Project Manual

Bid Package 02

(SITE DEMOLITION AND UTILITIES)



Cherokee Nation Replacement Hospital

Tahlequah, Oklahoma

Project Number 21-08.21 October 21, 2022



Tel: 479.783.2480

Fax: 479.783.4844

E-mail: breck@childersarchitect.com

Web: www.childersarchitect.com



Mr. Mathew Thomas James R. Childers, Architect, Inc.

Re: Cherokee Nation WW Hastings Replacement Hospital Addendum 1 Narrative

Dear Mr. Thomas,

Following is a list of revisions included in Addendum 1.

- C3-108 LREC relocation revised on the west end to occur within Owner's property. Cox fiber pull boxes added and the length of conduits shortened. Conduits added for power and data to future monument sign at Downing Street. Grass sod limits revised to show sod for detention pond and behind curbs.
- C3-109 LREC relocation revised on the west end to occur within Owner's property. Cox fiber pull boxes added and the length of conduits shortened. Grass sod limits revised to show sod for detention pond and behind curbs. Annotations on light poles corrected.
- C3-110 LREC relocation revised on the west end to occur within Owner's property. Cox fiber pull boxes added and the length of conduits shortened. Grass sod limits revised to show sod for detention pond and behind curbs. Annotations on light poles corrected.
- C3-111 Grass sod limits revised to show sod for detention pond and behind curbs. Annotations on light poles corrected.
- C3-112 Grass sod limits revised to show sod for detention pond and behind curbs. Annotations on light poles corrected.
- C3-109 Conduits added for power and data to future monument sign at Downing Street. Grass sod limits revised to show sod for detention pond and behind curbs. Annotations on light poles corrected.
- C9-201 Conduits added for power and data to future monument sign at Downing Street. Grass sod limits revised to show sod for detention pond and behind curbs. Annotations on detail callouts corrected.

Specification 32 9219 Seeding- Paragraph 3.5 Maintenance is revised to address separate requirements for inside and outside the fence.

Specification 32 9223 Sodding- Paragraph 3.5 Maintenance is revised to address separate requirements for inside and outside the fence.

Sincerely, PARKHILL

By

Corey Lipps, PE Senior Practice Leader



Date: 08-17-22

Project: WW Hastings replacement hospital. Bid Package 01 Add 01.

Subject: Change Control Narrative Add. 01

	REFE	RENCE IS MADE TO	THE DRAWINGS AS N	OTED
ITEM	SHEET NUMBER	SHEET NAME	ROOM/CAM NUMBER	DESCRIPTION
1.	TNS1.02	NETWORK SITE PLAN-NORTH PARKING & ACCESS	KEYNOTES	Changed keynote #5 to reflect 2" conduit rather than 1.25".
2.	TNS1.02	NETWORK SITE PLAN-NORTH PARKING & ACCESS	KEYNOTES	Added Keynote #7 to legend.
3.	TNS1.02	NETWORK SITE PLAN-NORTH PARKING & ACCESS	Sheet	Added conduit going North to sign on Downing street coming from the last light pole location.



November 18, 2022

Mr. Mathew Thomas James R. Childers, Architect, Inc.

Re: Cherokee Nation WW Hastings Replacement Hospital - Addendum 02 Narrative

Dear Mr. Thomas,

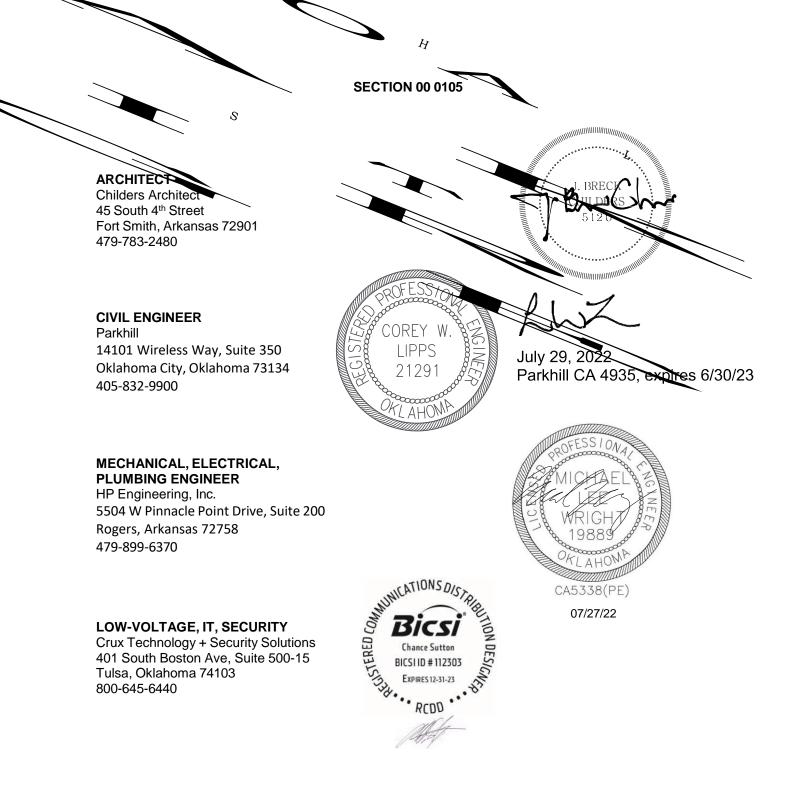
Following is a list of revisions included in Addendum 02.

- C0-101 Updated sheet list with new sheet C4-901.
- C4-101 Updated utility plan with grease trap location, new storm sewer inlet, and sanitary sewer manhole.
- C4-103 Updated utility plan with grease trap location, new storm sewer inlet, and sanitary sewer manhole.
- C4-901 New Sheet- Phase 1 Utility Plan.
- C6-101 Corrected grate elevation on STR9. Corrected STR22 to connect the existing storm sewer pipe to the manhole.
- C6-102 Added STR38 inlet north of the hospital. The flow lines of the pipes from STR28 to STR31 were lowered so that drainpipes on the upstream end can pass under the 16-in water line.
- C6-103 Revised pipe connections to storm sewer for the lower storm sewer.
- C6-203 Added label to STR18. Corrected STR22 to connect the existing storm sewer pipe to the manhole. Existing water line shown in profile ST5.
- C6-204 Added label to STR17 in ST6 profile. Added label to 45 deg bend in ST8 profile. Added profile for ST2 to provide a profile of the existing storm sewer to remove from under the Central Energy Plant. The storm sewer in ST7 profile was lowered so that drainpipes on the upstream end can pass under the 16-in water line. Added STR38 to ST7 profile. The pipe from STR33 to STR30 was lowered to pass under the 16-in water line.
- C?-206 Added storm sewer crossing pipes to the profile.
- C?-207 Revised the presentation of the water line in the profile.
- C?-210 Added label to the plan view. Revised profile on the east end to match the plan view.
- C?-212 Added the graphical presentation of the gate valve and fire hydrant to the profile view.
- C?-213 Added call-outs to the materials in the plan view of Water 8. Revised the profile view of Water 8 to match the plan. Added labels to the plan view of Water 13.
- C?-214 Added call-outs to the material in the plan view of Water 12.

Sincerely, PARKHILL

By

Corey Lipps, PE Senior Practice Leader



SECTION 00 31 00

AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: References other information relevant to the construction of this Project that is available project information.
- B. At the request of the Owner, the information identified below represents services that have been provided by others, not as an Architect's Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Architect and Architect's Consultants. Reference to such information herein is solely for the convenience of the Owner. Architect makes no representation, express or implied, as to the accuracy or validity of the information.
- C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.
- D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

1.2 GEOTECHNICAL REPORT

- A. Owner's Geotechnical Consultant has made subsurface borings at the Project site, has performed investigations of the geotechnical conditions, and has prepared reports of the investigation:
 - 1. North Parking Lot: Palmerton & Parrish, Inc., Project Number 281188, dated July 12, 2022.
- B. Information was obtained for use in preparing the foundation design, but is indicative only of the soil conditions where the borings are taken.
- C. Copies follow this Section.

1.3 ENVIRONMENTAL STUDY AND ASSESSMENT REPORT

- A. <u>The Owner's Environmental Consultant has assessed the impact on the surrounding</u> <u>environment, and has prepared a report that contains specific requirements of the Contractor.</u>
- B. <u>Copy of the document included after this Section for the convenience of the Owner.</u>
- C. <u>The Owner retained the following company:</u>

Eagle Environmental Consulting P. O. Box 335 Vinita, Oklahoma 74301 July 2022

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

GEOTECHNICAL ENGINEERING REPORT W.W. HASTINGS SURFACE PARKING TAHLEQUAH, OKLAHOMA

Prepared for:

CHILDERS ARCHITECT 142 Howell Street, Suite 170 Dallas, Texas 75207

Prepared by:



PPI PROJECT NUMBER: 281188

July 12, 2022



July 12, 2022 (Revised)

Childers Architect 142 Howell Street, Suite 170 Dallas, Texas 75207

- Attn: Mr. Matthew Thomas, Associate AIA Email: mthomas@childersarchitect.com
- RE: Geotechnical Engineering Report W.W. Hastings Replacement Surface Parking Tahlequah, Oklahoma PPI Project Number: 281188

Dear Mr. Thomas:

Attached, please find the report summarizing the results of the Geotechnical Investigation conducted for the above referenced project. We appreciate this opportunity to be of service and if you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC. By:

PALMERTON & PARRISH, INC. By:

Id Humber

R. Todd Hercules, P.E. Geotechnical Engineer

Submitted: One (1) Electronic .pdf Copy

BRP/SMR/RTH/cl

BRANDON OSS PARE Brandon R. Parrish, P.E.

Vice President



TABLE OF CONTENTS

EXECU	TIVE SUMMARY1, 2 8	k 3
2.0 P	ROJECT DESCRIPTION	. 5
	ITE DESCRIPTION	
4.0 S	UBSURFACE INVESTIGATION	
4.1	Subsurface Borings	. 6
4.2	Laboratory Testing	. 7
	ITE GEOLOGY	
	ENERAL SITE & SUBSURFACE CONDITIONS	. 8
6.1	Detention Basins	. 8
6.2	Groundwater	. 8
7.0 E	ARTHWORK	. 9
7.1	Site Preparation	. 9
7.2	Fill Material Types	
7.3	Compaction Requirements	
7.4	Landscaping & Site Drainage	
7.5	Earthwork Construction Considerations	12
7.6	Excavations	
7.7	Rippability	
8.0 F	OUNDATIONS	
8.1	Shallow Foundation Design Recommendations	
8.2	Uplift	
8.3	Construction Considerations for Shallow Foundations	
	EISMIC CONSIDERATIONS	
10.0 P	AVEMENT	
10.1	Flexible Pavement	15
10.2	Rigid Pavement	
10.3	Pavement Subgrade CBR	
10.4	Pavement Thickness	
	ONSTRUCTION OBSERVATION & TESTING	
12.0 R	EPORT LIMITATIONS	19

FIGURES

FIGURE 1 –	BOF	RING LOCATION PLAN
		APPENDICES
APPENDIX I	-	BORING LOGS & KEY TO SYMBOLS
APPENDIX II	-	GENERAL NOTES
APPENDIX III	-	GRAIN SIZE ANALYSIS RESULTS
APPENDIX IV	_	IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

EXECUTIVE SUMMARY

A Geotechnical Investigation was performed at the site planned for construction of the new Cherokee Nation W.W. Hastings Surface Parking located directly north of the recently constructed Cherokee Nation Outpatient Health Center in Tahlequah, Oklahoma. This project is anticipated to include construction of a new surface parking area, three (3) detention basins, and a bus shelter. The parking area will extend south of E. Downing Street to the existing Cherokee Nation Outpatient Health Center's existing parking area.

A total of twenty-five (25) geotechnical borings were drilled within the proposed development footprint. Twenty-one (21) borings were located within the proposed pavement area footprint, while four (4) borings were located within the proposed detention basins. Pavement borings were proposed to depths of 5 to 7.5 ft. below the ground surface, while the detention basin borings were to extend to proposed depths of 10 ft. All borings were extended to the depths specified above or auger refusal, whichever was shallower.

Based upon the information obtained from the borings and subsequent laboratory testing, the site is suitable for construction of the proposed new W.W. Surface Parking, detention basins, and bus shelter. Important geotechnical considerations for the project are summarized below. However, users of the information contained in the report must review the entire report for specific details pertinent to geotechnical design considerations.

- The project site primarily consists of grass-covered lawn or field with some areas of mature trees and existing structures. The existing structures are anticipated to be demolished prior to parking lot construction;
- A layer of topsoil (approximately 4 to 6 inches) was encountered within all borings. This material is not suitable in areas of new fill, pavement sections and building areas;

EXECUTIVE SUMMARY (CONTINUED)

- Existing structures including all building components, old pavements, and terminated utilities should be removed and replaced prior to the construction of pavements;
- Overburden soils generally consisted of clayey gravels and sands, gravelly clays, or lean clay with sand and gravel as is typical in the Tahlequah area. These soils were primarily logged as medium dense to very dense or stiff to very hard and sometimes exhibited significant drilling difficulty when using standard drilling methods;
- Foundation loads for the new bus shelter may be supported upon shallow foundations bearing upon stiff to very hard or medium dense to dense natural overburden soils, or controlled fill. Foundations bearing on native soils may be designed for an allowable bearing capacity of 3,500 psf for column footings and 3,000 psf for continuous footings. Foundations bearing on newly placed controlled fill may be designed for allowable bearing capacities of 2,500 psf for column footings and 2,000 psf for continuous footings;
- Due to the stiffness and density of the existing subgrade soils, sufficient support is anticipated to be provided for pavements if subgrades are prepared in accordance with <u>Section 7.0;</u>
- In order to provide temporary parking as well as a staging area for the upcoming Hospital project, the parking lot is understood to be initially asphalt paved, followed by a concrete overlay, i.e. white topping, once Hospital construction is complete. Refer to Section 10.0 for additional details regarding concrete white topping;
- The project site classifies as a Site Class C in accordance with Section 1613 of the 2018 International Building Code (IBC), as determined by on-site standard penetration resistance testing;

EXECUTIVE SUMMARY (CONTINUED)

- Excavation and mass earth moving at this project site is anticipated to generally be somewhat difficult and variable. Excavation difficulty and rippability of the existing overburden soils at the site is further discussed in <u>Section 7.7</u> of this report; and
- Palmerton & Parrish, Inc. should be retained for construction observation and construction materials testing. Close monitoring of subgrade preparation work is considered critical to achieve adequate foundation and subgrade performance.



GEOTECHNICAL ENGINEERING REPORT W.W. HASTINGS SURFACE PARKING TAHLEQUAH, OKLAHOMA

1.0 INTRODUCTION

This is the report of the Geotechnical Investigation performed at the site planned for construction of the new Cherokee Nation W.W. Hastings Surface Parking in Tahlequah, Oklahoma. This investigation was authorized by Mr. J. Breck Childers, Managing Principal, representing Childers Architect. The approximate site location is shown below for reference.



The purpose of the Geotechnical Investigation was to provide recommendations for foundation design and construction planning, and to aid in site development. Palmerton & Parrish Inc.'s (PPI) scope of services included field and laboratory investigation of the subsurface conditions in the vicinity of the proposed project site, engineering analysis of



the collected data, development of recommendations for foundation design and construction planning, and preparation of this engineering report.

2.0 PROJECT DESCRIPTION

ltem	Description		
Site Layout	See Figure 1: Boring Location Plan		
Pavements	The lot is anticipated to be asphalt paved initially and used for temporary parking and a construction staging area for the upcoming Hospital project. Once construction of the Hospital is complete, a concrete overlay, i.e. white topping, will be constructed for the final wearing surface.		
Detention Basins	A total of three (3) detention basins are planned at the project site on the west side of the proposed parking area.		
Retaining Walls	None anticipated.		
Foundation Loading	Light foundation loads for the bus shelter are anticipated.		
Existing Structure	Based on aerial imagery, the subject site contains an existing residential house and several shed buildings. Demolition of the existing structures is anticipated prior to project construction.		
Anticipated Grading	Site grading plans were not provided at the time of this report. It is PPI's understanding that approximately 2 to 3 feet of cut will be performed on the east side of the proposed new surface parking area and 1 to 2 feet of cut and/or fill will be performed across the remaining parking areas.		

3.0 SITE DESCRIPTION

ltem	Description
Township/Range/Section	T17N R22E S34
Location	The site is located in Cherokee County and will be located south of East Downing Street near its intersection with Old River Road in Tahlequah, Oklahoma.
Latitude:	35.913336°
Longitude:	-94.945408°
(± Center of Project Site)	
Available Historic Aerial Photography	Based on available historic aerial imagery from Google Earth Pro, the project site has not visibly been altered since the year 1985.
Current Ground Cover	The project site is primarily covered in grass covered topsoil with some trees and existing buildings/pavements on the north half of the subject site.
Existing Topography	The project site ranges in elevation from approximately 920 feet to 930 feet based on information from Google Earth Pro.
Drainage Characteristics	The project site drains to the northwest, with poor to moderate drainage.



4.0 SUBSURFACE INVESTIGATION

Subsurface conditions were investigated through completion of subsurface borings and subsequent laboratory testing.

4.1 Subsurface Borings

As requested by the Design Team, a total of twenty-five (25) borings were drilled at the project site. A site plan of the boring locations is attached as <u>Figure 1</u>: Boring Location Plan. Boring locations were selected by the Design Team and staked in the field by PPI. Boring identifications were assigned to the borings according to the table below:

Borings	Location	Proposed Boring Depths (ft)
DB1 thru DB4	Detention Basin	10
EP1 thru EP5	Eastern Parking	7.5
P1 thru P16	Primary Parking Area	5

Borings were discontinued in natural overburden soils or upon auger refusal at depths ranging from 3.8 ft. to 10 ft. below the existing ground surface. The Oklahoma One-Call System, as well as hospital maintenance personnel, were notified prior to the investigation to assist in locating buried public and private utilities, respectively. Logs of the borings showing descriptions of soil and rock units encountered, as well as results of field and laboratory tests and a "Key to Symbols" are presented in <u>Appendix I</u>.

Borings were drilled between June 8 and 10, 2022 using 4.5-inch outside diameter (O.D.) continuous flight augers (CFA) or a 3-inch O.D. carbide tricone with wash rotary methods. Boring DB2 encountered a chert layer that was not penetrable with CFA's; however, drilling was continued using a 3-inch O.D. carbide tricone.

All borings were advanced utilizing a track-mounted Dietrich D-50 drill-rig. Soil samples were collected at 2.5 ft. centers during drilling using a split spoon sampler while performing the Standard Penetration Test (SPT) in general accordance with ASTM D1586.



Auger refusal occurred in Borings DB1, DB2, DB3, EP1, EP2, EP5, P1, P2, P6, P11, P13, P15, and P16. The refusal was either a result of the auger itself or the split spoon sampler failing to penetrate the chert-laden soils.

4.2 Laboratory Testing

Collected samples from the borings were sealed and transported to the laboratory for further evaluation and visual examination. Laboratory soil testing included the following:

- Atterberg Limits (ASTM D4318);
- Grain Size (ASTM D6913);
- Moisture Content (ASTM D2216); and
- Pocket Penetrometer Strength.

Laboratory soil test results are shown on each boring log in Appendix I and are summarized in the following table. Grain size analysis results are attached as <u>Appendix III</u>.

Soil Labo	Soil Laboratory Testing Results						
Boring	Depth (ft.)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (Pl)	Moisture Content (%)	USCS Symbol	% Passing No. 200 Sieve
DB2	8.5	22	14	8	11.0	SC	-
DB3	6.0	-	-	-	11.3	SC	38
EP2	3.5	33	18	15	13.5	GC	-
EP5	6.0	-	-	-	10.3	SC	33
P3	1.0	26	17	9	18.5	CL	-
P3	3.5	-	-	-	11.3	GC	28
P9	1.0	33	16	17	17.1	CL	-
P16	1.0	33	20	13	21.2	CL	-

5.0 SITE GEOLOGY

According to the United States Geologic Survey's Geological Map of Oklahoma, the general site is underlain at depth by the Keokuk and Reeds Spring formation and the St. Joe Group. Within the site area, the primary rock type is chert with other rock types consisting of limestone, shale, and marlstone. Overburden soils at the site are typically



residual having developed through chemical and physical weathering of the underlying parent bedrock, consisting primarily of chert fragments, boulders and clay layers. The boundary between overburden soils and relatively unweathered limestone is usually abrupt.

6.0 GENERAL SITE & SUBSURFACE CONDITIONS

Based upon subsurface conditions encountered within the borings drilled at the project site, generalized subsurface conditions are fairly consistent across the project site, and similar to typical overburden soils found within the Tahlequah area. Surficial materials primarily consist of topsoil, overlying lean clays with varying amounts of gravel and sand or clayey gravels/sands. Gravels and sands were generally noted to consist of chert. Zones of relatively chert free lean clays were sometimes encountered and were generally noted to be within the upper 3 feet were present in isolated areas.

These conditions are presented on each boring log attached in <u>Appendix I</u>. Soil stratification lines on the boring logs indicate approximate boundary lines between different types of soil units based upon observations made during drilling. In-situ transitions between soil and some rock types are typically gradual.

6.1 Detention Basins

The overburden soils encountered within Borings DB1, DB2, DB3, and DB4 were consistent with soils containing large amounts of chert gravels. Chert cobbles and boulders may also be found within this material that are not distinguishable with a 2-inch split-spoon sampler. Therefore, special attention must be made to the rippability of the soils in the detention basin areas, as explained in <u>Section 7.7</u>.

6.2 Groundwater

Shallow groundwater was not observed within the borings on the date drilled, except within Boring EP1. Perched groundwater was encountered within Boring EP1 at a depth of 1 ft. It is anticipated that perched water had collected over a relatively impermeable layer of fat clay, causing the water to be locally isolated within the



boring location. The free-water encountered within this boring is <u>not</u> anticipated to reflect the depth of a more stable layer of groundwater at the subject site.

It should be noted that water-based drilling fluid was used during field drilling in Boring DB2. As a result, obtaining groundwater levels was not possible once tricone rotary methods were initiated. Based upon previous borings drilled within the general site area, groundwater is not anticipated to be encountered. It should be noted that during wet periods, perched groundwater may be encountered at the limestone/shale/chert and overburden soil contact, if present. Groundwater levels should be expected to fluctuate with changes in site grading, precipitation, and regional groundwater levels. Groundwater may be encountered at shallower depths during wetter periods.

7.0 EARTHWORK

7.1 Site Preparation

The initial phase of site preparation should include the following:

- Topsoil and all vegetative matter including trees/root bulbs should be removed from all pavement locations, building locations, and areas scheduled to receive new fill. Removal should include tree roots of 6-inches or greater; and
- Areas scheduled to receive <u>controlled</u> fill should be proof-rolled and <u>approved</u> in accordance with the following section of this report.

After the initial phase is complete, it is recommended that all building, pavement and undercut bottoms be proof-rolled to assure a stable subgrade. Proof-rolling consists essentially of rolling the ground surface with a loaded tandem axle dump truck or similar heavy rubber-tired construction equipment and noting any areas which rut or deflect during rolling. All soft subgrade areas, if any, identified during proof-rolling should be undercut and replaced with compacted fill as outlined below. Proof-rolling, undercutting, and replacement should be monitored by a representative of PPI. **The depth and areal extent of undercutting soft subgrade areas will be largely**



dependent upon the time of year and related soil moisture conditions. If construction is initiated during or immediately following wetter months, the requirement for undercutting areas of isolated soft surficial soils below planned cut depths should be anticipated and reflected in the contract documents, but anticipated to be minimal.

After evaluation by proof-rolling and approval, the subgrade should be scarified to a depth of at least 8 inches, adjusted to within the optimum moisture content ranges and compacted to specified density, provided below (See <u>Section 7.3</u>). Placement of controlled fill may then proceed.

7.2 Fill Material Types

Fill Type ¹	USCS Classification	Acceptable Location for Placement	
On-Site Soils / Imported Fill	GC, SC, SW or GW	Acceptable for all areas/elevations.	
Low Volume Change (LVC) Engineered Fill & Onsite Soils ²	CL, GC, or SC (LL < 50)	Acceptable for all areas/elevations; however, CL soils containing less than 30 percent gravels may be difficult to establish proper compaction with and it may be advisable to limit these materials to non- pavement and building areas.	
Non-LVC Imported Fill	CH with less than 30% gravel content	Should not be placed within the upper 2 ft. beneath foundations and pavements.	

Controlled, compacted fill should consist of approved materials that are free of organic matter and debris and contain maximum rock size of 12 inches, or the lift thickness, whichever is less. Frozen material should not be used and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to its use.

^{2.} Low plasticity cohesive soil or granular soil having a liquid limit of less than 50%, containing at least 15% fines retained on the No. 200 sieve, and preapproved by the Geotechnical Engineer.



7.3 Compaction Requirements

Item	Description		
Subgrade Scarification Depth	At least 8 inches		
Fill Lift Thickness	8-inch (loose)		
Compaction Requirements ¹	 <u>Coarse Grained Material:</u> 70% Relative Density, or compacted by a minimum of three (3) passes of a large diameter self-propelled vibratory compactor. <u>Fine Grained Material:</u> 95% Standard Proctor Density (ASTM D-698) 		
Moisture Content	 ± 2% optimum moisture for CL, SC, or GC soil types; or 0 to 4% above optimum for CL-CH or CH soil types. 		
 One (1) Field Density (compaction) test for each 2,500 sq. ft. of fill within bus shelter areas; One (1) Field Density (compaction) test for each 5,000 sq. ft. of fill within paving areas; and A minimum of three (3) tests per lift. 			
We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented			

We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

7.4 Landscaping & Site Drainage

Discharge from roof downspouts, if any, should be collected and diverted well away from the parking area perimeter and incorporated into the design plans. Rapid, efficient runoff away from the project site should also be provided.

In addition, provisions should be implemented to reduce the potential for large fluctuations in moisture within the subgrade soils adjacent to the structure. Ponding of surface water immediately adjacent to the structures and pavements can significantly increase subgrade moisture and may result in undesirable subgrade movement. As previously mentioned, careful consideration should be given to the landscaping and drainage elements to be installed at the project site adjacent to bus shelter and pavement areas. Trees and some large bushes can draw significant moisture from the subgrade soils, resulting in shrinkage and subsequent foundation/pavement movement.



7.5 Earthwork Construction Considerations

Once grading and filling operations have been completed, the moisture within the subgrade should be maintained, and soils not be allowed to dry and desiccate prior to construction of footings. Grading of the site should be performed in such a manner so that ponding of surface water on prepared subgrade or in excavations is avoided. During construction, if the prepared subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be scarified or removed, moisture conditioned, and recompacted prior to construction.

7.6 Excavations

Based upon the subsurface conditions encountered during this investigation, the onsite soils typically classify as Type B in accordance with OSHA regulations. Temporary excavations in soils classifying as Type B with a total height of less than 20 ft. should be cut no steeper than 1H:1V in accordance with OSHA guidelines. **Confirmation of soil classification during construction, as well as construction safety (including shoring, if required), is the responsibility of the contractor.**

7.7 Rippability

As mentioned throughout this report, the overburden soils at the project site primarily consist of dense to very dense clayey gravels with possible chert cobbles and boulders. Sometimes significant difficulty was experienced when drilling the geotechnical borings within this chert-laden material. Based upon this information, the overburden soils are anticipated to be rippable with dozers, but with difficulty. In addition, areas resistant to ripping consisting of large chert boulders, requiring other removal methods (pneumatic breakers or blasting, if allowed) should be anticipated. The Earthwork Contractor should review the attached boring logs when assessing excavation difficulty at this site. Mass grading at this site is anticipated to occur at a slower rate as compared to sites where overburden soils are primarily fine grained (silts and clays).



8.0 FOUNDATIONS

8.1 Shallow Foundation Design Recommendations

The table below contains recommendations regarding shallow foundations for the bus shelter structure.

Description	Column (Spread Footing)	Wall (Continuous Footing)	
Net allowable bearing pressure ¹	Native Soil: 3,500 psfControlled Fill: 2,500 psf	Native Soil: 3,000 psfControlled Fill: 2,000 psf	
Minimum dimensions	2.5 feet	1.5 feet	
Minimum embedment below finished grade for frost protection and variation in soil moisture ² (footings on soil)	2 feet	2 feet	
Estimated total settlement ³	1 inch or less	1 inch or less	
Allowable passive pressure ⁴	600 psf	600 psf	
Coefficient of sliding friction ⁵	0.4 (natural soils/controlled fill)	0.4 (natural soils/controlled fill)	

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed. A factor of safety value of 3 has been applied to these values.

- 2. For perimeter footings and footings beneath unheated areas.
- 3. The foundation movement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations.
- 4. Allowable passive pressure value considers a factor of safety of about 2. Passive pressure value applies to undisturbed native clay or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density. Passive resistance should be neglected for the upper 2.5 feet of the soil below the final adjacent grade due to strength loss from freeze/thaw and shrink/swell.
- 5. Coefficient of friction value is an ultimate value and does not contain a factor of safety.

8.2 Uplift

Resistance of shallow spread footings to uplift (Up) may be based upon the dead weight of the concrete footing structure (Wc) and the weight of soil backfill contained in an inverted cone or pyramid directly above the footings (W_S). The following parameters may be used in design:

Description	Weights		
Weight of Concrete (Wc)	150 pcf		
Weight of Soil Resistance (Ws)	100 pcf		
Weight for on-site soils placed in accordance with Section 7.0			

The base of the cone or pyramid should be the top of the footing and the pyramid or cone sides should form an angle of 30 degrees with the vertical. Allowable uplift capacity (U_p) should be computed as the lesser of the two (2) equations listed below:

 $U_P = (W_S/2.0) + (W_C/1.25) \text{ or } U_P = (W_S + W_C)/1.5$

8.3 Construction Considerations for Shallow Foundations

It is essential that footing bottoms should not be allowed to become dry and desiccate prior to concrete placement to help reduce the potential for shrink/swell behavior. Footings should be clean and free of standing water, debris, and loose soil at the time of concrete placement. Footing/mat excavations should be observed by a representative of PPI prior to placement of reinforcing steel and concrete placement.

9.0 SEISMIC CONSIDERATIONS

Code Used	Site Classification		
2018 International Building Code (IBC) ¹	С		
1. In general accordance with the 2018 International Building Code, Section 1613			

10.0 PAVEMENT

The parking lot is anticipated to be asphalt paved initially and used for temporary parking and a construction staging area for the upcoming Hospital project. Once construction of the Hospital is complete, a concrete overlay, i.e. white topping, will be constructed for the final wearing surface. Prior to initial asphalt pavement placement, preparation of the pavement subgrade should be performed in accordance with <u>Section</u> <u>7.0</u> of this report.



10.1 Flexible Pavement

As mentioned above, asphalt is anticipated to be placed as the temporary driving surface to be used for parking and a construction staging area. Below the asphaltic paving, the aggregate base may be a granular compacted crushed limestone with a gradation and quality conforming to the requirements of the Oklahoma Department of Transportation (ODOT), Standard Specification 703.01 for Type A aggregate. The maximum lift thickness for the granular base is 4 in. Granular base thicknesses in excess of 4 inches should be placed in multiple lifts with each lift being of approximately equal thickness. The granular base should be compacted to at least 100% of Standard Proctor Compaction (ASTM D-698).

Asphaltic concrete, both base and surface, should conform to the applicable requirements of ODOT Standard Specification 708. Asphaltic concrete should be compacted to 92 to 96% of Maximum Theoretical Specific Gravity (ASTM D-2041). Substitution of an appropriate Superpave Mix Design, SP 190C or SP 250C, can be used in place of the bituminous base. SP 190C or SP 125C may be used for the surface. All bituminous mix designs should have been prepared or verified within 6 months of the date of placement on the project.

10.2 Concrete White Topping

Following temporary use of the asphalt driving surface, it is understood that a thin concrete white topping will be placed on top of the asphalt as the final driving surface. A bonded overlay is considered the most appropriate overlay due to the anticipated relatively good condition of the previously placed asphalt. In a bonded overlay, preparation of the underlying asphalt is key to the satisfactory performance of the white topping. A bonded white topping is <u>not</u> recommended to be placed over new asphalt. However, the asphalt is anticipated to be in place at least 1 year prior to white topping placement. The following steps should be performed prior to white topping placement:



- Mill asphalt surface 0.5-inch, minimum, maintaining at least a 4-inch underlying asphalt thickness to promote satisfactory bonding;
- Mill deeper, or completely remove, where the asphalt is heavily damaged, if any by construction equipment; and
- The milled asphalt surface should be swept multiple times, air blasted to remove remaining debris and dust and wetted prior to concrete placement.

Following surface asphalt preparation, installation of the concrete white topping is anticipated. Construction of a concrete white topping is similar to standard concrete pavement, although it does require some additional requirements, including:

- Concrete panel size of 6-ft by 6-ft. to aid in concrete crack control;
- Joints sawed as soon as concrete has gained sufficient strength to allow sawing without raveling;
- Due to the increased number of saw joints, a gang of concrete saws spaced along a guide bar is often used for the longitudinal joints, with the transverse joints sawed first. Regardless, the paving contractor should have sufficient equipment and manpower available for the saw jointing process, as this requirement is greater than conventional concrete pavement jointing and curing occurs at a faster pace due to the thinner concrete section. If jointing is not performed in a timely manner, undesirable cracking may occur; and
- Refer to "Tech Brief, Thin Concrete Overlays, FHWA-HIF-17-012, October 2017" found at <u>https://www.fhwa.dot.gov/pavement/pubs/hif17012.pdf</u> for additional information.

The Portland Cement Concrete (PCC) mix should have a minimum 28-day compressive strength of 4000 pounds per square inch (psi). Concrete should be placed at a low slump (1 to 3 inches) and have an entrained air content of 5 to 7%. If an increased slump is desired, use of Super Plasticizer is recommended.



10.3 Pavement Subgrade CBR

Based upon relatively high SPT-N values obtained during drilling, the natural soil deposits should exhibit stiff to hard subgrades for pavement construction. A CBR value equal to 5.0 for the <u>natural</u> subgrade soils or <u>natural</u> overburden soils that have been properly recompacted is recommended to be used in pavement design.

10.4 Pavement Thickness

Typical pavement design for this type of development would generally generate a Structural Number of 3.0 to 3.5 within heavy duty areas and 2.4 to 2.6 within light duty areas, depending on the subgrade conditions. The lower table presents corresponding typical flexible and rigid pavement thickness using the general Structural Numbers where conventional pavement placement is anticipated, i.e. standard thickness concrete <u>or</u> asphalt only. However, the upper table below presents recommended thickness if a temporary asphalt layer is placed, utilized during hospital construction, followed by placement of a concrete white topping once Hospital construction is complete.

Recommended Temporary Asphalt Placement Followed by Concrete White Topping Thicknesses (If utilized)						
Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)	
Initial Flexible (Asphalt) Pavement Layer	Medium Duty	*2.0	3.0	-	6.0	
Concrete White Topping	Medium Duty	-	-	5.0	N/A	
*This layer will be milled 0.5-inches and thoroughly cleaned prior to concrete white topping placement, and repaired (if required) in areas where construction traffic damages the asphalt pavement.						



Conventional Pavement Thicknesses (If utilized)						
Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)	
Flexible Pavement	Heavy Duty	3.0	4.0	-	6.0	
	Medium Duty	2.0	3.0	-	6.0	
	Light Duty	2.0	2.0	-	6.0	
Rigid Pavement	Heavy Duty	-	-	7.0	4.0	
	Medium Duty	-	-	6.0	4.0	
	Light Duty	-	-	5.0	4.0	

11.0 CONSTRUCTION OBSERVATION & TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Since geotechnical engineering is influenced by variable depositional and weathering processes and because we sample only a small portion of the soils affecting the performance of the proposed structures, unanticipated or changed conditions can be disclosed during grading. Proper geotechnical observation and testing during construction is imperative to allow the Geotechnical Engineer the opportunity to evaluate assumptions made during the design process. Therefore, we recommend that PPI be kept apprised of design modifications and construction schedule of the proposed project to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study. We recommend that during construction all earthwork be monitored by a representative of PPI, including site preparation, placement of all engineered fill and trench backfill, and all foundation excavations as outlined below.

- An experienced Geotechnical Engineer or Engineering Technician of PPI should observe the subgrade throughout the proposed project site immediately following stripping to evaluate the native clay, identify areas requiring additional undercutting, and evaluate the suitability of the exposed surface for fill placement;
- An experienced Engineering Technician of PPI should monitor and test all fill placed within the building and pavement areas to determine whether the type of



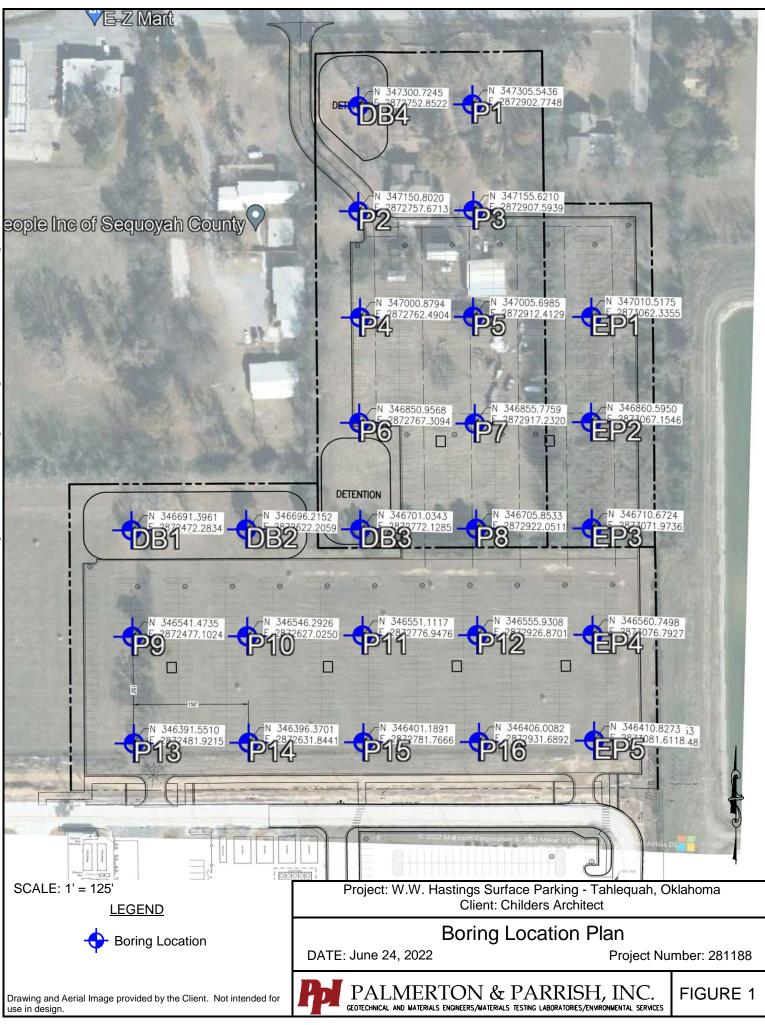
material, moisture content, and degree of compaction are within recommended limits. Refer to <u>Section 7.3</u> for recommendations regarding Field Density (compaction) testing frequency;

- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays; and
- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays.

12.0 **REPORT LIMITATIONS**

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. Palmerton & Parrish's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.

FIGURES



APPENDIX I

BORING LOGS & KEY TO SYMBOLS

4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

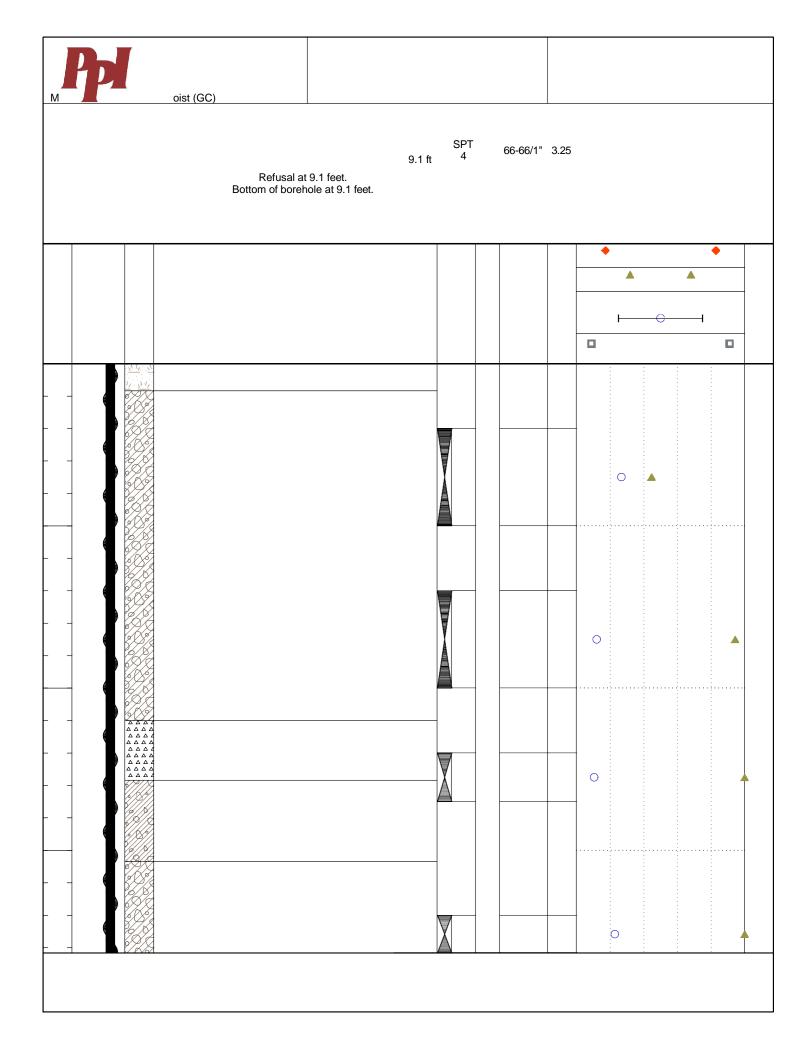
GEOTECHNICAL **BORING LOG**

BORING NUMBER

PAGE 1 OF 1

CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/9/22 COMPLETED 6/9/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS _____ HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [´]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö SAMPLE TYPE NUMBER RECOVERY % (RQD %) STRATA SYMBOL POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 80 20 40 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft CLAYEY GRAVEL, With Sand, Reddish Brown to Red, Dense to Very Dense, Moist (GC) SPT 5-21-24 0 1 (45) 2.5 CFA - 4.5" O.D. ²⁸⁻⁴⁸⁻⁴⁶ 1.75 SPT 2 (94) 5.0 5.5 ft CHERT LAYER 6.4 ft SPT 59-66/3" 1.75 3 GRAVELLY LEAN CLAY, With Sand, Red, Very Hard, Moist (CL) 7.7 ft 7.5

CLAYEY GRAVEL, With Sand, Red, Very Dense,



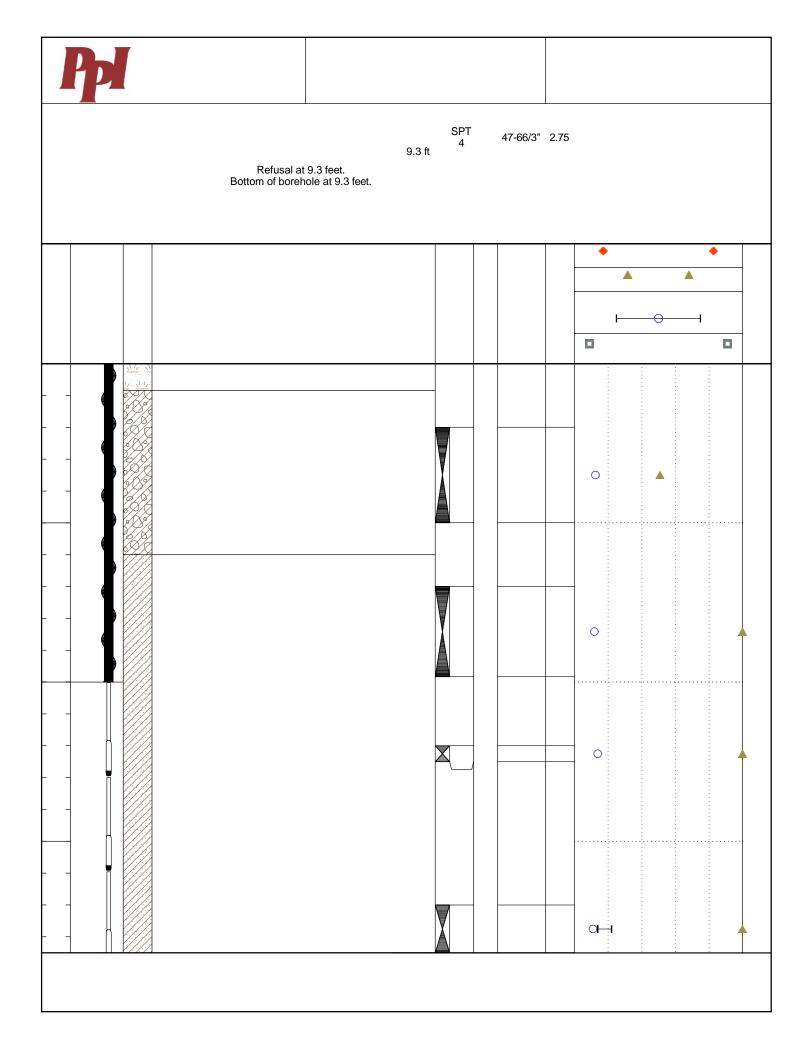
4168 W. Kearney Springfield, Missouri 65803 Telephone: (417) 864-6000 Fax: (417) 864-6004

GEOTECHNICAL BORING LOG

BORING NUMBER

D	B2
---	-----------

PAGE 1 OF 1 CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/9/22 COMPLETED 6/9/22 SURFACE ELEVATION BENCHMARK EL. DRILL RIG Dietrich D-50 GROUND WATER LEVELS DRILLER SP _____ HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [′]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ff) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION ŧ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft CLAYEY GRAVEL, With Sand, Brown, Very Dense, Moist (GC) SPT 12-21-30 0 1 (51) CFA - 4.5" O.D. 2.5 3.0 ft CLAYEY SAND, With Gravel, Red, Very Dense, Moist (SC) SPT 20-52 2.75 2 66/5" 5.0 SPT 66/3" 0.75 3 ROTARY - 3" O.D. 7.5



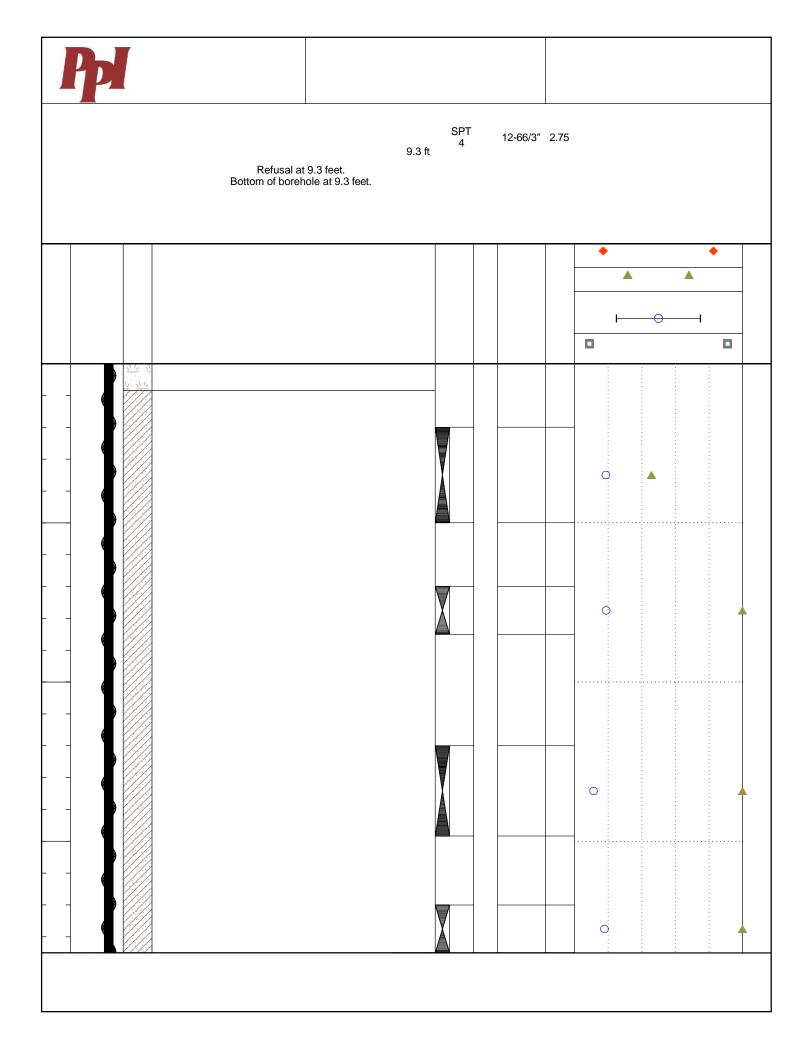
NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

GEOTECHNICAL BORING LOG

BORING NUMBER

DB3

PAGE 1 OF 1 PROJECT NAME WW Hastings Surface Parking CLIENT Childers Architect PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/9/22 COMPLETED 6/9/22 SURFACE ELEVATION _____ BENCHMARK EL. _____ DRILLER SP DRILL RIG _Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [′]100 20 60 8Ö CORRECTED BLOW COUNTS (N VALUE) 40 STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 20 40 80 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft CLAYEY SAND, With Gravel, Red With Gray, Dense to Very Dense, Moist (SC) SPT 5-17-29 1.5 1 (46) 2.5 CFA - 4.5" O.D. SPT 21-66/3" 2.25 2 5.0 SPT 30-63-2.25 3 66/5" 7.5

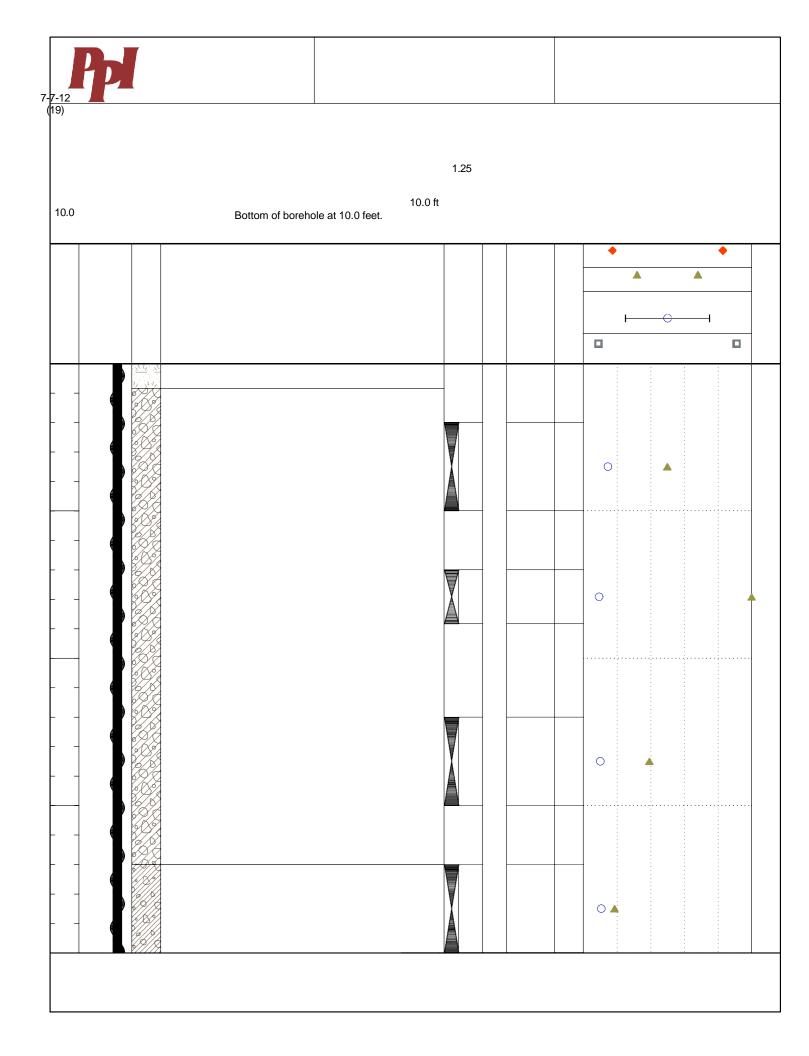


GEOTECHNICAL BORING LOG

BORING NUMBER

|--|

PAGE 1 OF 1 CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/10/22 COMPLETED 6/10/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS _____ HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [′]100 60 8Ö CORRECTED BLOW COUNTS (N VALUE) 20 40 STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft CLAYEY GRAVEL, With Sand, Red to Brown, Dense to Very Dense, Moist (GC) SPT 5-13-37 1.5 1 (50) 2.5 CFA - 4.5" O.D. SPT 66-66/5" 3.5 2 5.0 20-22-17 1.75 SPT 3 (39) 7.5 SPT 4 8.5 ft GRAVELLY LEAN CLAY, With Sand, Red, Very Stiff, Moist (CL)



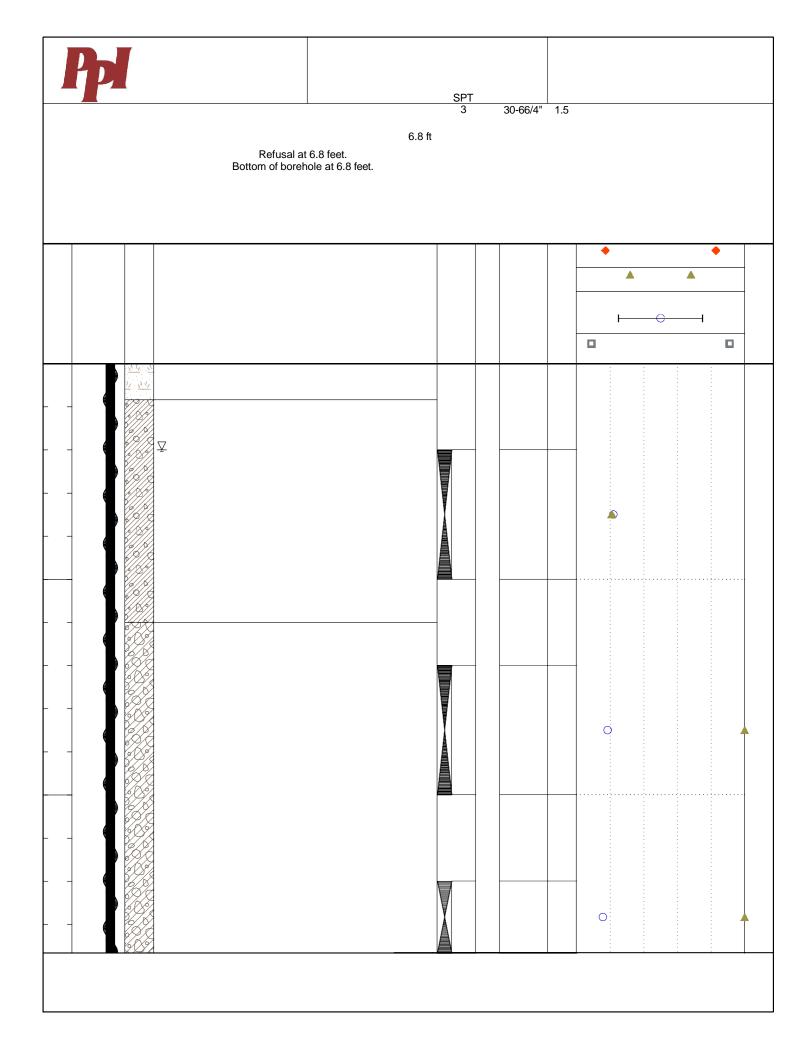
NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

GEOTECHNICAL BORING LOG

BORING NUMBER

PAGE 1 OF 1

CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/10/22 COMPLETED 6/10/22 SURFACE ELEVATION _____ BENCHMARK EL. _____ DRILLER SP DRILL RIG _Dietrich D-50 GROUND WATER LEVELS AT TIME OF DRILLING <u>1 ft</u> HAMMER TYPE Auto LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [´]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft GRAVELLY LEAN CLAY, With Sand, Red to Brown, Very Stiff, Moist (CL) SPT 1-4-17 0.75 (21) 1 CFA - 4.5" O.D. 2.5 3.0 ft CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC) SPT 39-66-59 0.5 2 (125)5.0



NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

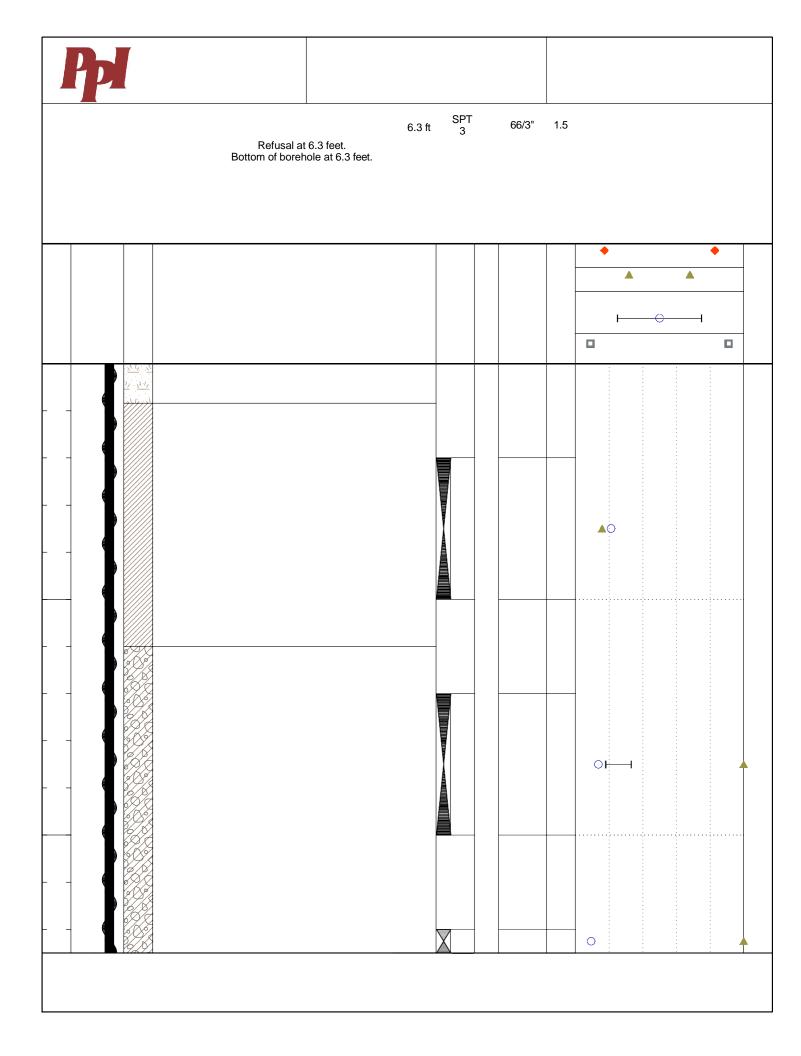
GEOTECHNICAL BORING LOG

BORING NUMBER

EF	22
----	----

PAGE 1 OF 1

CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/10/22 COMPLETED 6/10/22 SURFACE ELEVATION BENCHMARK EL. DRILL RIG Dietrich D-50 GROUND WATER LEVELS DRILLER SP HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [´]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ff) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft LEAN CLAY, With Gravel and Sand, Red to Brown, Very Stiff, Moist (CL) SPT 1-3-13 0.5 (16) 1 CFA - 4.5" O.D. 2.5 3.0 ft CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC) SPT 24-45-64 1.5 (109) 2 5.0



NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

GEOTECHNICAL **BORING LOG**

BORING NUMBER

EP3	
-----	--

PAGE 1 OF 1

CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/8/22 COMPLETED 6/8/22 SURFACE ELEVATION BENCHMARK EL. DRILL RIG Dietrich D-50 GROUND WATER LEVELS DRILLER SP _____ HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [´]100 20 40 60 8Ö CORRECTED BLOW COUNTS (N VALUE) STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft LEAN CLAY, Trace Sand & Gravel, Red to Brown, Stiff, Moist (CL) SPT 3-4-5 0.75 (9) 1 2.5 CFA - 4.5" O.D. - With Gravel, Red, Very Stiff Below 3.5' SPT 5-7-9 2 2 (16)5.0 5.5 ft CLAYEY GRAVEL, With Sand, Red, Dense, Moist (GC) 16-29-16 3.25

SPT 3

(45)

.5		Bottom of bore	ehole at 7.5 feet.	7.5 ft						
						•			•	•
							├	-0		
	$\frac{\sqrt{1/2}}{\sqrt{1-\frac{1}{2}}}$									
-						-		-	-	
-						-		-		
-							~	-		
-							0	-		
_					 	 		- - - - - - - - - - - - - - - - - - -		
_						-		-		
						-		-		
						-		-		
						▲(C	-		
-						-		-		
-						 				
_						-		-		
_						 -		-		
						-		-	-	
						Ċ)	A	-	
						-		-		

GEOTECHNICAL BORING LOG

BORING NUMBER

P4
. –

PAGE 1 OF 1 CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED <u>6/8/22</u> COMPLETED <u>6/8/22</u> SURFACE ELEVATION _____ BENCHMARK EL. ____ DRILL RIG Dietrich D-50 GROUND WATER LEVELS DRILLER SP _____ HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. GDT - 6/24/22 09:36 - Si_MASTER PROJECT FILE'2022/OK/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [´]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft LEAN CLAY, With Sand and Gravel, Red to Brown, Stiff, Moist (CL) SPT 4-7-7 1.5 (14) 1 2.5 CFA - 4.5" O.D. 3.0 ft CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC) 25-62-64 3.75 SPT 2 (126)5.0 - Wet Below 6' SPT 34-45-52 0.5 3 (97)

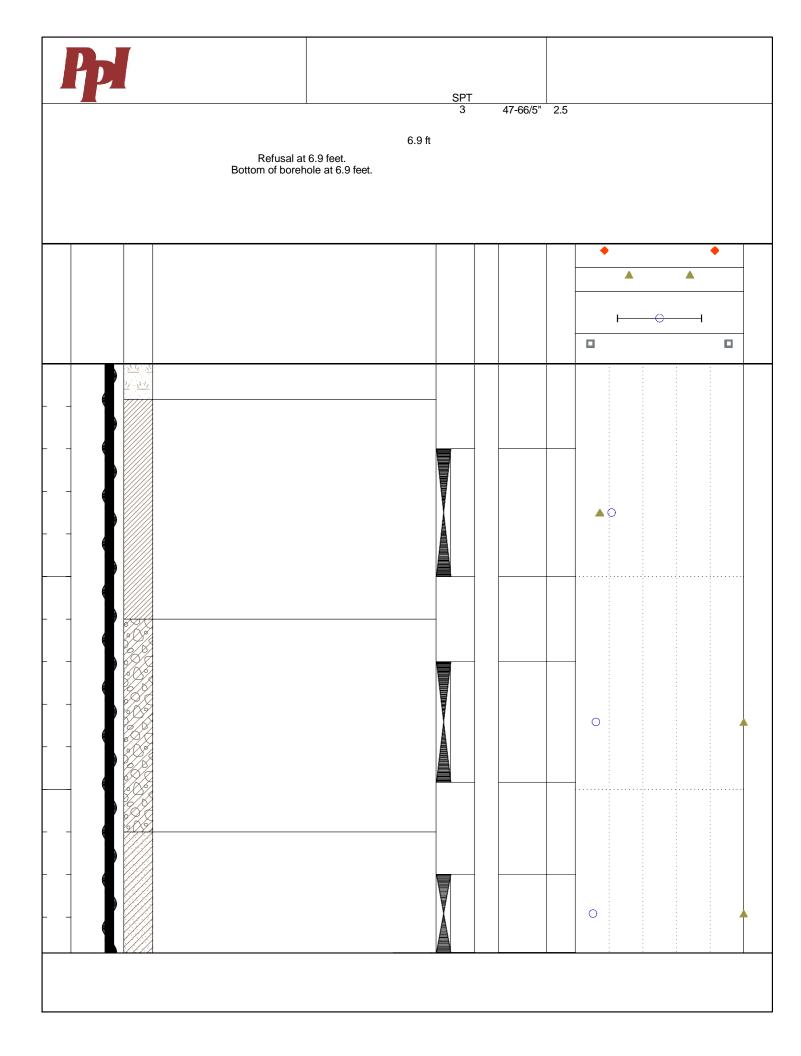
	Р					
7.5		Bottom of boreh	7.5 ft oole at 7.5 feet.			
					▲ O	
					0	
					0	

GEOTECHNICAL BORING LOG

BORING NUMBER

EP5

PAGE 1 OF 1 CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/8/22 COMPLETED 6/8/22 SURFACE ELEVATION _____ BENCHMARK EL. _____ DRILL RIG Dietrich D-50 GROUND WATER LEVELS DRILLER SP HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [´]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0.0 TOPSOIL (5") 0.4 ft LEAN CLAY, Trace Gravel, Gray to Brown, Stiff, Moist (CL) SPT 3-4-10 2.5 (14) 1 CFA - 4.5" O.D. 2.5 3.0 ft CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC) SPT 39-47-2.25 66/5" 2 5.0 5.5 ft CLAYEY SAND, With Gravel, Red, Very Dense, Moist (SC)

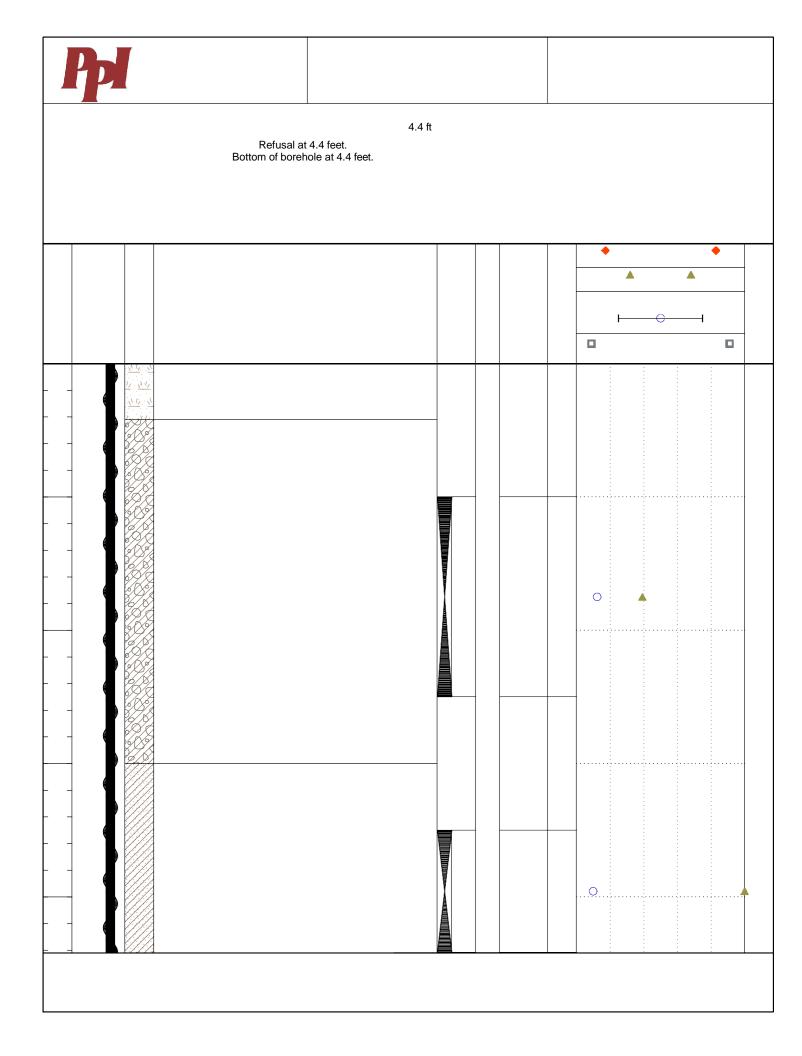


GEOTECHNICAL BORING LOG

BORING NUMBER

P1

	NT <u>Childe</u> JECT NO.				PROJECT NAME WW Hastings Surface Parking PROJECT LOCATION Tahlequah, OK								
DATE	DATE STARTED 6/9/22		2	COMPLETED 6/9/22	SURF	ACE ELI	EVATI	ON	BENCHMARK EL				
	DRILLER <u>SP</u> DF		DRILL RIG Dietrich D-50	GROU									
HAM	HAMMER TYPE <u>Auto</u>					AT TIME	E OF D	RILLING	None				
NOT				CHECKED BY CL			AT END OF DRILLING						
DEPTH (ff)	DRILLING	STRATA SYMBOL	U	MATERIAL DESCRIPTION nified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)		
0			TOPSOIL (5")									
1			CLAYEY G (GC)	RAVEL, With Sand, Brown, Dens	0.4 f e, Moist	ı							
2	CFA - 4.5" O.D.					SPT 1	-	7-16-24 (40)	1.5				
3			CLAYEY S/ (SC)	AND, With Gravel, Red, Very Den	3.0 f se, Moist	t							
4						SP1 2	Г	35-66/5"	1.5				

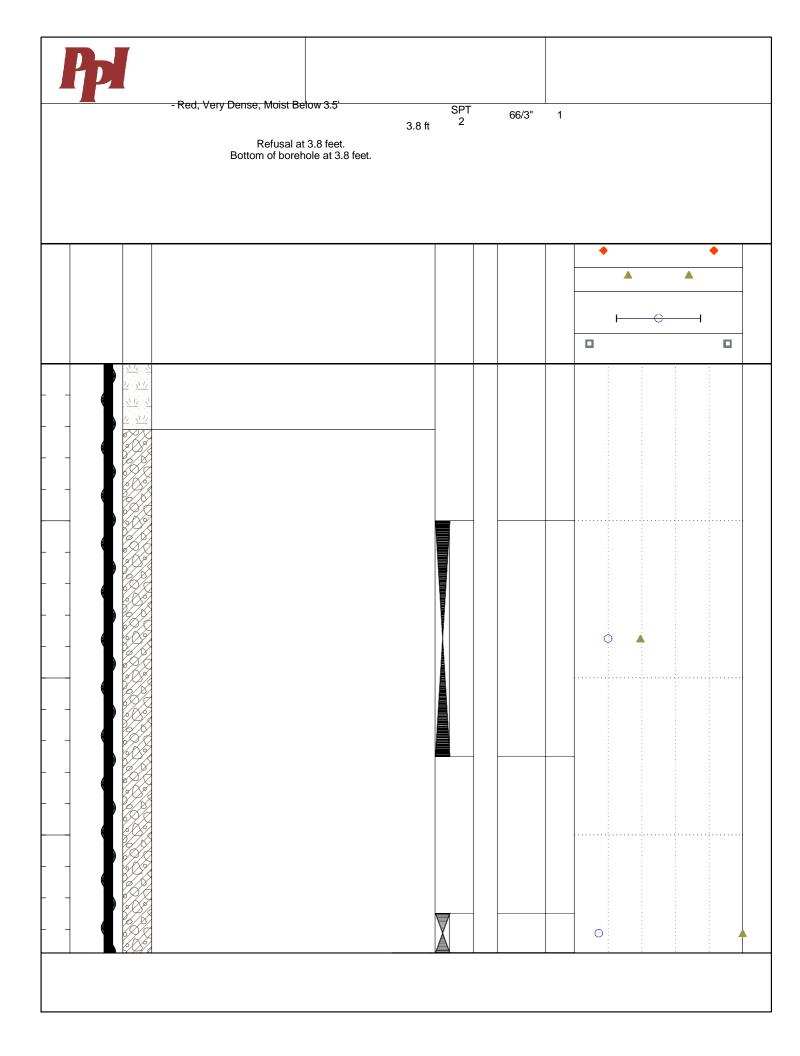


GEOTECHNICAL BORING LOG

BORING NUMBER

P2

			x: (417) 864-6004		PAGE 1 OF 1
	NT Childe		ect		
PRO	JECT NO.	281188		PROJECT LOCATION Tahlequah, C	Ж
DATE	E STARTE	D <u>6/10/22</u>	2 COMPLETED <u>6/10/22</u>	SURFACE ELEVATION	BENCHMARK EL.
	LER <u>SP</u>		DRILL RIG _Dietrich D-50		
		A) /			
	LOGGED BY <u>MV</u> CHE NOTES			AT END OF DRILLING	
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER RECOVERY % (RQD %) CORRECTED BLOW COUNTS (N VALUE) POCKET PEN. (tst)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)
0			TOPSOIL (5")		1 2 3 4
	CFA - 4.5" O.D.		CLAYEY GRAVEL, Wtih Sand, Brown, Dens (GC)	e, Wet SPT 5-10-29 1 1 (39) 1	



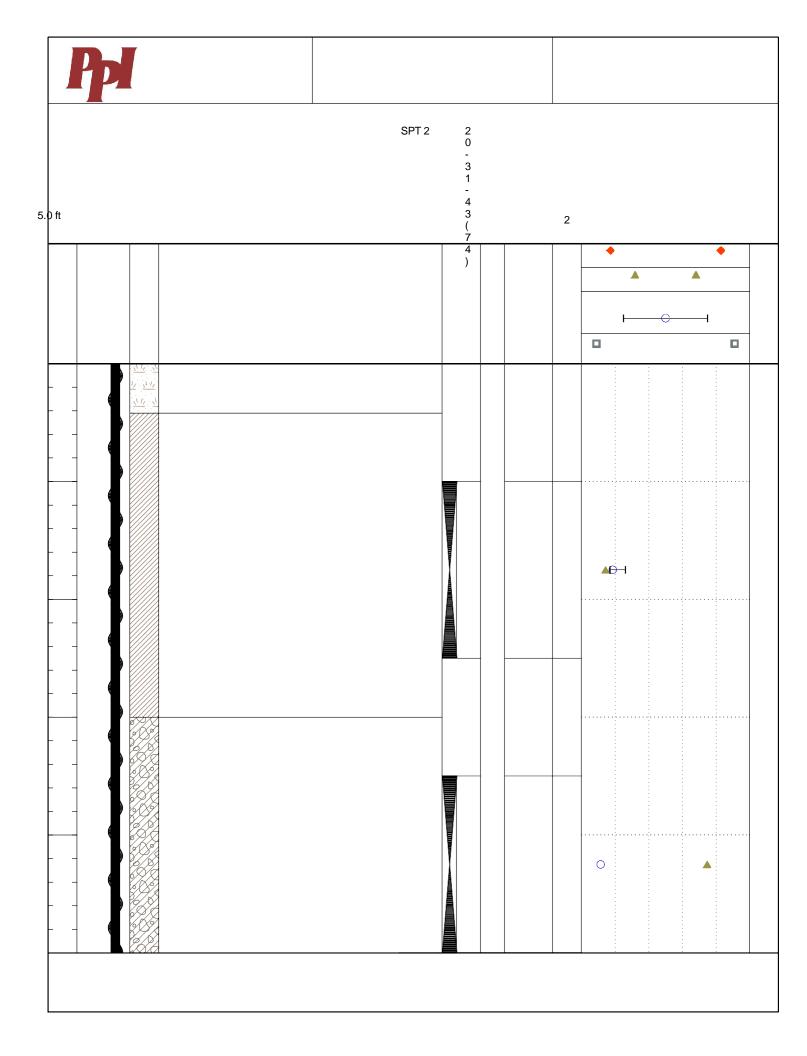
GEOTECHNICAL **BORING LOG**

BORING NUMBER

P 3
P3

PAGE 1 OF 1 CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/9/22 COMPLETED 6/9/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG _Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [′]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ff) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0 TOPSOIL (5") 0.4 ft LEAN CLAY, With Sand & Gravel, Red to Brown, Stiff, Moist (CL) 1 SPT 3-3-12 0 1 (15) CFA - 4.5" O.D. 2 3.0 ft 3 CLAYEY GRAVEL, With Sand, Red to Brown, Very Dense, Moist (GC) ole at 5.0 feet. 0 m 4 5 0 f В b 0 0 r t t е

h

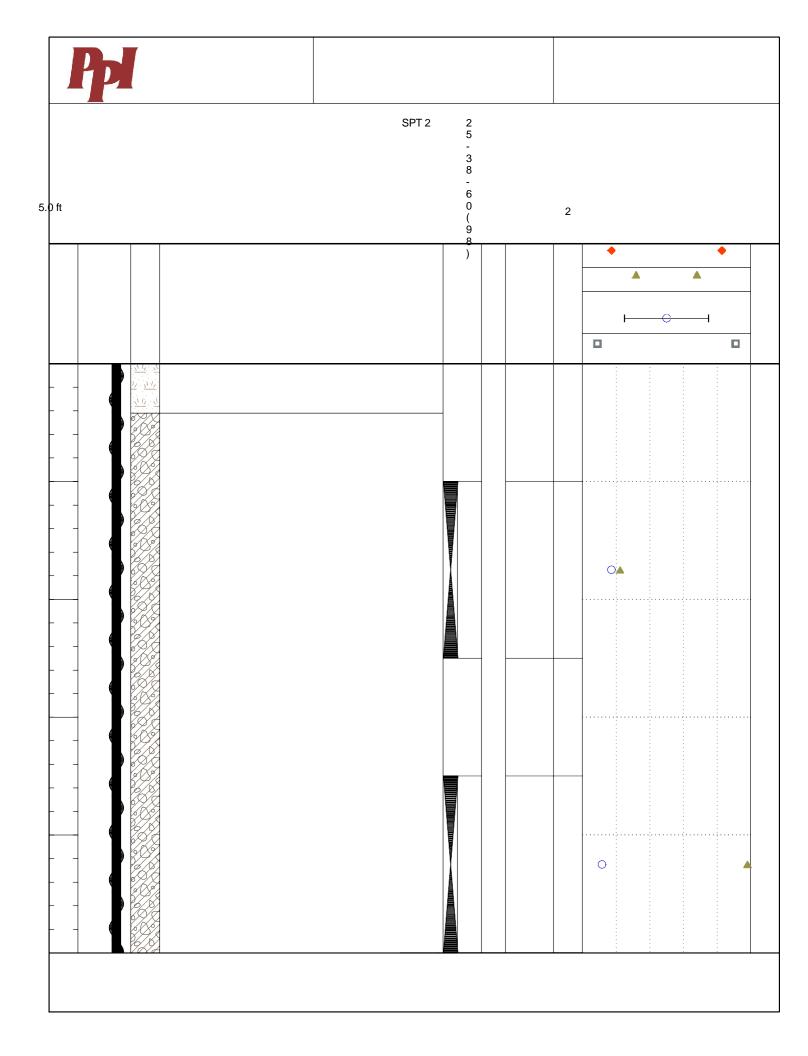


GEOTECHNICAL BORING LOG

BORING NUMBER

P4

CLIENT Childers Architect PROJECT NO. 281188						PROJECT NAME _WW Hastings Surface Parking						
DATE STARTED 6/10/22 COM			22	COMPLETED 6/10/22	SURI	SURFACE ELEVATION			BENCHMARK EL			
DRILLER <u>SP</u> HAMMER TYPE <u>Auto</u>				DRILL RIG _Dietrich D-50	GRO							
						AT TIME OF DRILLING <u>None</u>						
				CHECKED BY <u>CL</u>								
O DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	U TOPSOIL (MATERIAL DESCRIPTION nified Soil Classification Syste	em	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4		
1	CFA - 4.5" O.D.		CLAYEY G Moist (GC)	RAVEL, With Sand, Red, Me	ouni Dense,	SP1 1	r	3-9-13 (22)	1.75			
3			- Very Dens	se Below 3.5'								
4						5 B o	t t o m o f b	ore	hole at 5	0.0 feet.		



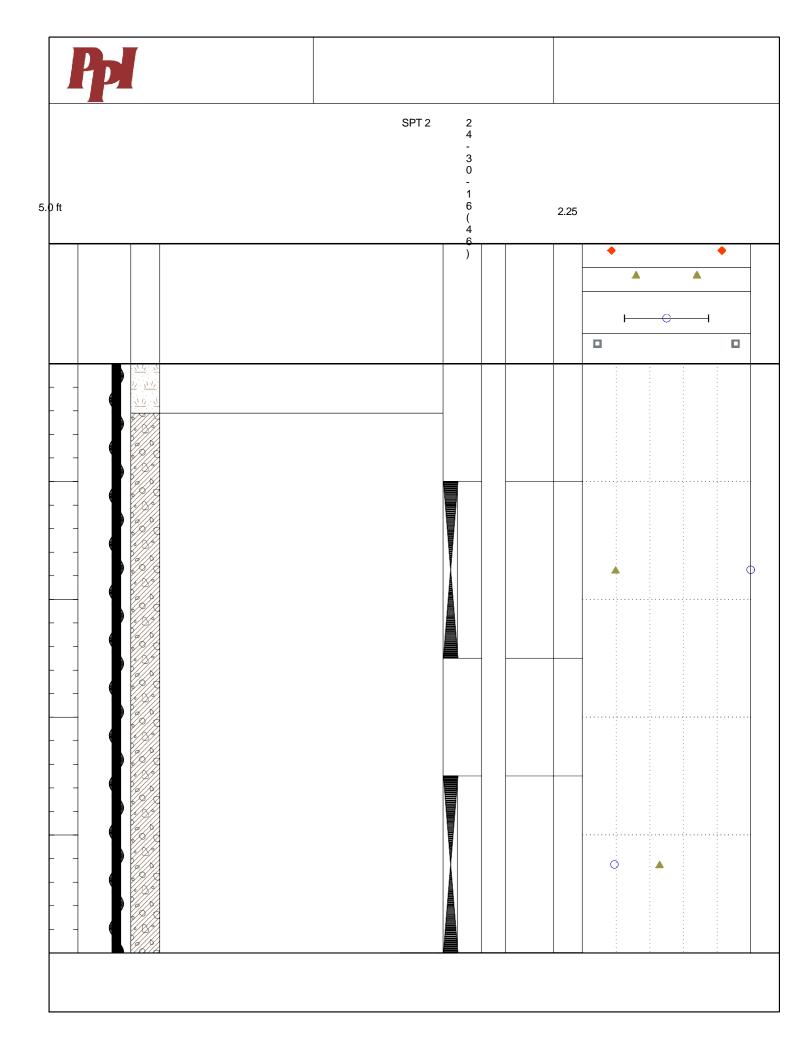
GEOTECHNICAL BORING LOG

BORING NUMBER

	P 5
--	------------

PAGE 1 OF 1

CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/10/22 COMPLETED 6/10/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG _Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [′]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 20 40 80 60 SHEAR STRENGTH (ksf) 1 2 3 4 0 TOPSOIL (5") 0.4 ft GRAVELLY LEAN CLAY, Red to Brown, Very Stiff, Moist (CL) 1 SPT 1-3-17 1.25 1483.7 (20)1 CFA - 4.5" O.D. 2 3 - Hard Below 3.5' t orehole at 5.0 feet. 4 t 0 5 m 0 В f b 0



GEOTECHNICAL BORING LOG

BORING NUMBER

PAGE 1 OF 1 PROJECT NAME WW Hastings Surface Parking CLIENT Childers Architect PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/10/22 COMPLETED 6/10/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CL AT END OF DRILLING NOTES NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ DRY UNIT WT (pcf) [′]100 60 8Ö CORRECTED BLOW COUNTS (N VALUE) 20 40 STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 20 40 80 60 SHEAR STRENGTH (ksf) 1 2 3 4 0 TOPSOIL (5") 0.4 ft CLAYEY GRAVEL, Wtih Sand, Red to Brown, Dense, Moist (GC) 1 SPT 7-8-35 1 (43) 1 CFA - 4.5" O.D. 2 3 - Red, Very Dense Below 3.5' SPT 4 33-55 1.5 2 66/2"

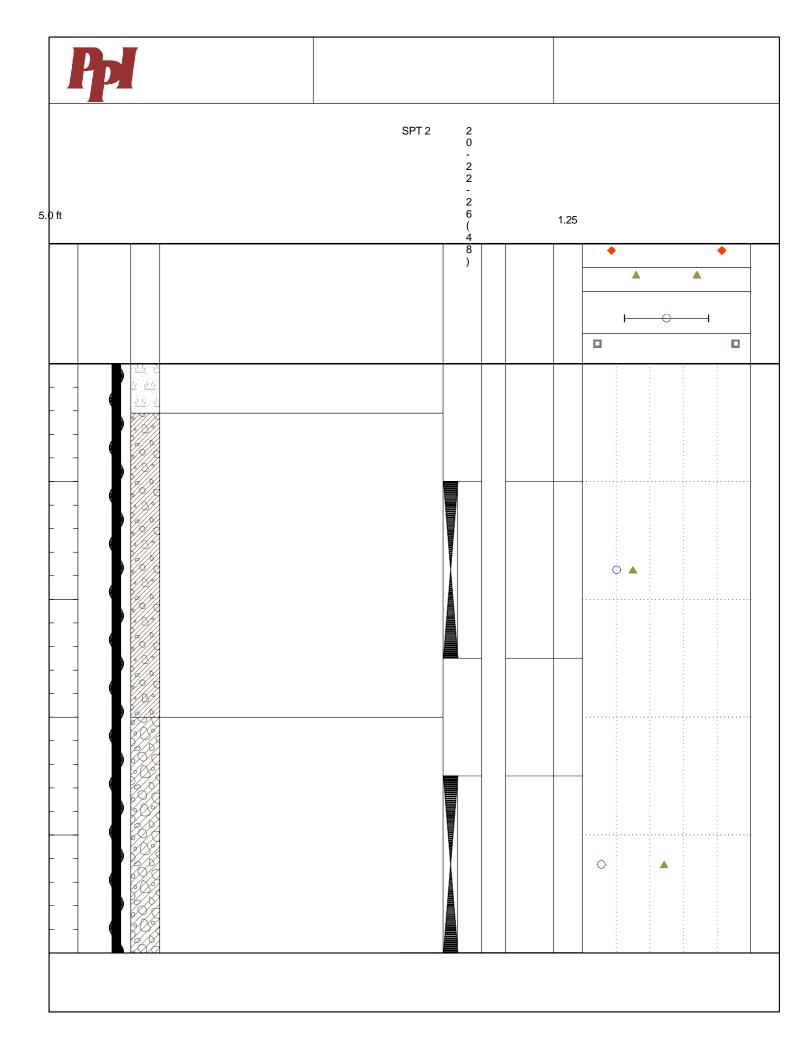
Ppl		
4.7 Refusal at 4.7 feet. Bottom of borehole at 4.7 feet.	rπ	
		0
		0

GEOTECHNICAL BORING LOG

BORING NUMBER

P7

	NT <u>Childer</u>		ect	PROJECT NAME <u>WW Hastings Surface Parking</u> PROJECT LOCATION <u>Tahlequah</u> , OK					
DATE STARTED <u>6/10/22</u>			2 COMPLETED <u>6/10/22</u>	SURFACE ELEVATION BENCHMARK EL					
			DRILL RIG Dietrich D-50	GROUND WATER LEVELS					
НАМ	MER TYPE	Auto		AT TIME OF DRILLING None					
LOGGED BY MV			CHECKED BY CL	AT END OF DRILLING					
DEPTH (ft)	es Drilling Method	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 N VALUE 20 40 60 80 N VALUE 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4	ELEVATION (ft)				
0			TOPSOIL (5")						
1			GRAVELLY LEAN CLAY, Red to Brown, Ve Moist (CL)	0.4 ft y Stiff, SPT 4-13-17 1 1 (30) 1					
2	CFA - 4.5" O.D.								
3			CLAYEY GRAVEL, With Sand, Red to Brov Moist (GC)	3.0 ft n, Dense,					
4				o ole at 5.0 feet. m 5 o f B b o o t r t e h					

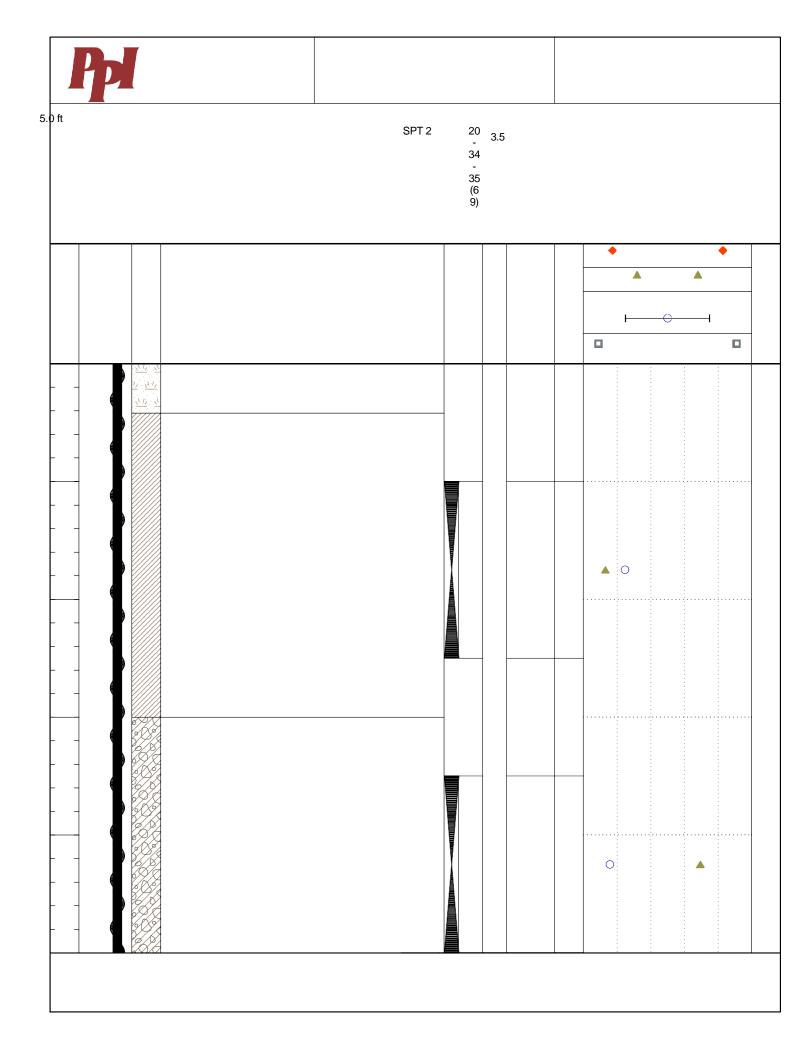


GEOTECHNICAL BORING LOG

BORING NUMBER

P8

	INT <u>Childers</u>		ect	PROJECT NAME WW Hastings Surface Parking PROJECT LOCATION Tahlequah, OK				
DATE STARTED <u>6/8/22</u>		6/8/22	COMPLETED <u>6/8/22</u>	SURFACE ELEVATION BENCHMARK EL				
			DRILL RIG Dietrich D-50					
	IMER TYPE			AT TIME OF DRILLING None				
NOT			CHECKED BY CL	AT END OF DRILLING				
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 NOINBEL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4				
0			TOPSOIL (5")					
NOT HLd=0 0 1 2 3 4	O.D.		LEAN CLAY, Trace Sand & Gravel, Red to (Moist (CL)	0.4 ft aray, Stiff, SPT 3-5-8 1 1 (13) 1				
2	CFA - 4.5"							
3			CLAYEY GRAVEL, With Sand, Red to Brow Dense, Moist (GC)	3.0 ft n, Very				
4				o ole m at 5 o 5.0 f fee B b t. o o t r t e h				

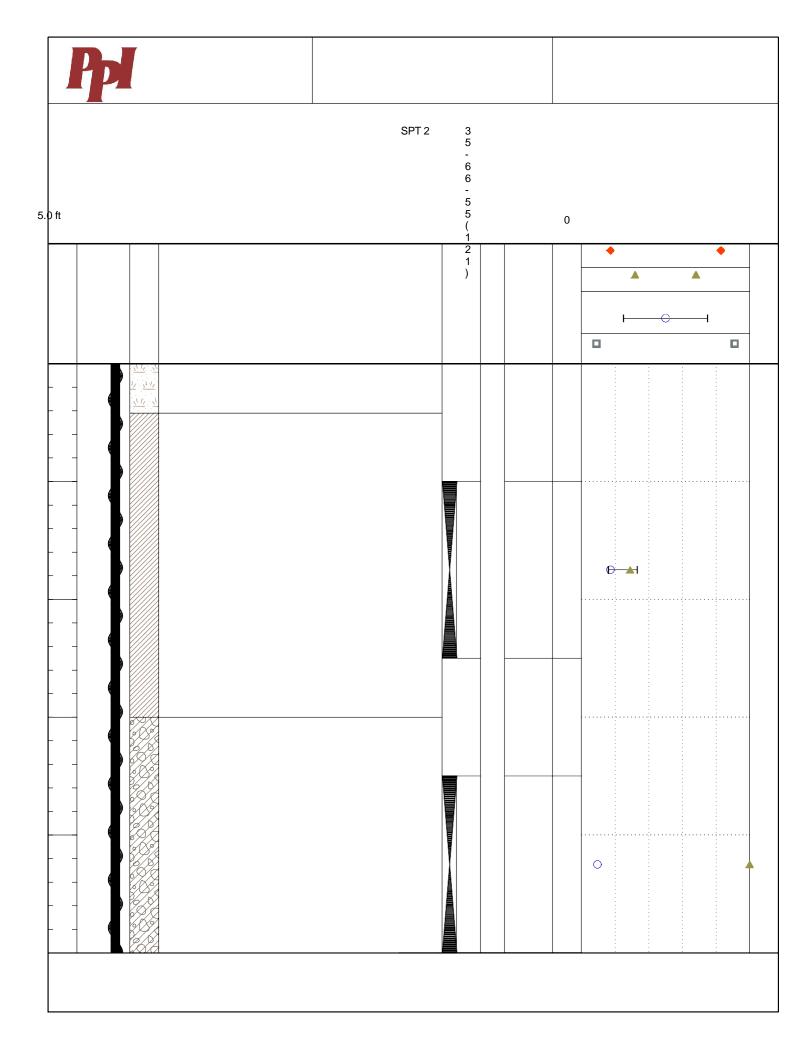


GEOTECHNICAL BORING LOG

BORING NUMBER

P9

		Fa	ax: (417) 864-6004	PAGE 1	OF 1				
CLI	ENT Childe	ers Archite	ect	PROJECT NAME WW Hastings Surface Parking					
PRO	DJECT NO. <u>281188</u>			PROJECT LOCATION Tahlequah, OK					
DA	TE STARTE	D <u>6/9/22</u>	COMPLETED 6/9/22	SURFACE ELEVATION BENCHMARK EL					
DRI	LLER <u>SP</u>		DRILL RIG _ Dietrich D-50	GROUND WATER LEVELS					
HAN	MMER TYP	E <u>Auto</u>		AT TIME OF DRILLING None					
LOC	GGED BY	MV	CHECKED BY CL	AT END OF DRILLING					
B/BORING LOGS/281188 - GINT.GPJ DEPTH OK (ff)	DD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 N VALUE 20 40 60 80 STUD STUD SOCKET BEN (st) 20 40 60 80 20 40 60 80 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION (ft)				
KING-SU			TOPSOIL (5")	1 2 3 4					
ING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:_MASTER PROJECT FILE'2022/OKIC/CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT.GPJ	CFA - 4.5" O.D.		LEAN CLAY, With Sand & Gravel, Red to Bro Stiff, Moist (CL)	0.4 ft own, Very SPT 3-7-22 3 1 (29) 3					
NGLOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:_MASTER F \$			CLAYEY GRAVEL, With Sand, Red to Brown Dense, Moist (GC)	3.0 ft n, Very o ole at 5.0 feet. m 5 o f B b o o t r t e h					

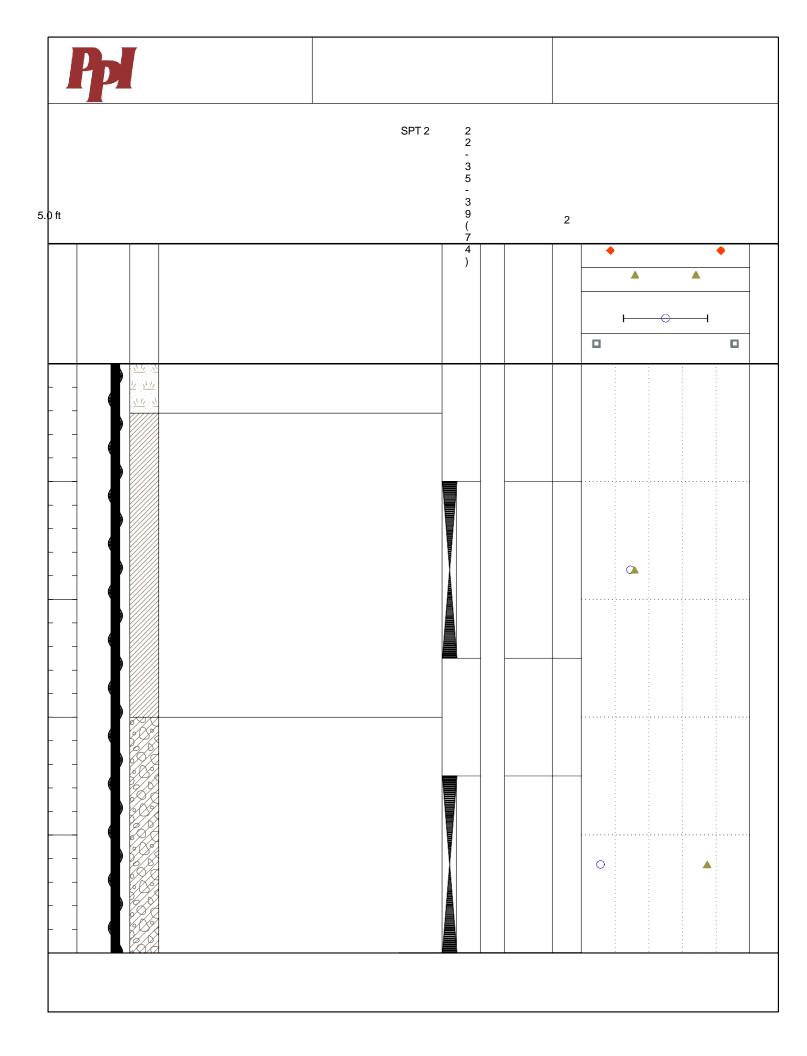


GEOTECHNICAL BORING LOG

BORING NUMBER

P1	0
-----------	---

		ilders Archi 1 0. <u>281188</u>		PROJECT NAME WW Hastings Surface Parking PROJECT LOCATION Tahlequah, OK					
				SURFACE ELEVATION	_ BENCHMARK EL.				
			DRILL RIG _Dietrich D-50	_ GROUND WATER LEVELS AT TIME OF DRILLING <u>None</u>					
LC	GGED B	Y _MV	CHECKED BY CL	AT END OF DRILLING					
	DES	gor	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER RECOVERY % (RQD %) CORRECTED RLOW COUNTS (N VALUE) POCKET PEN. (tst)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4				
22/OK/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE C	4.5" O.D.		LEAN CLAY, With Sand, Trace Gravel, Red to Hard, Moist (CL)	0.4 ft 9 Brown, SPT 3-4-28 1.25 1 (32) 1.25					
NG LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S._MASTER PROJECT FILE/2022/OKIC/CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUB/BORING LOGS/281188 - GINT.GPJ	CFA -		CLAYEY GRAVEL, With Sand, Red to Brown, Dense, Moist (GC)	3.0 ft Very t ehole at 5.0 f 0 m 5 0 f B b 0 0 t r	eet.				



NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

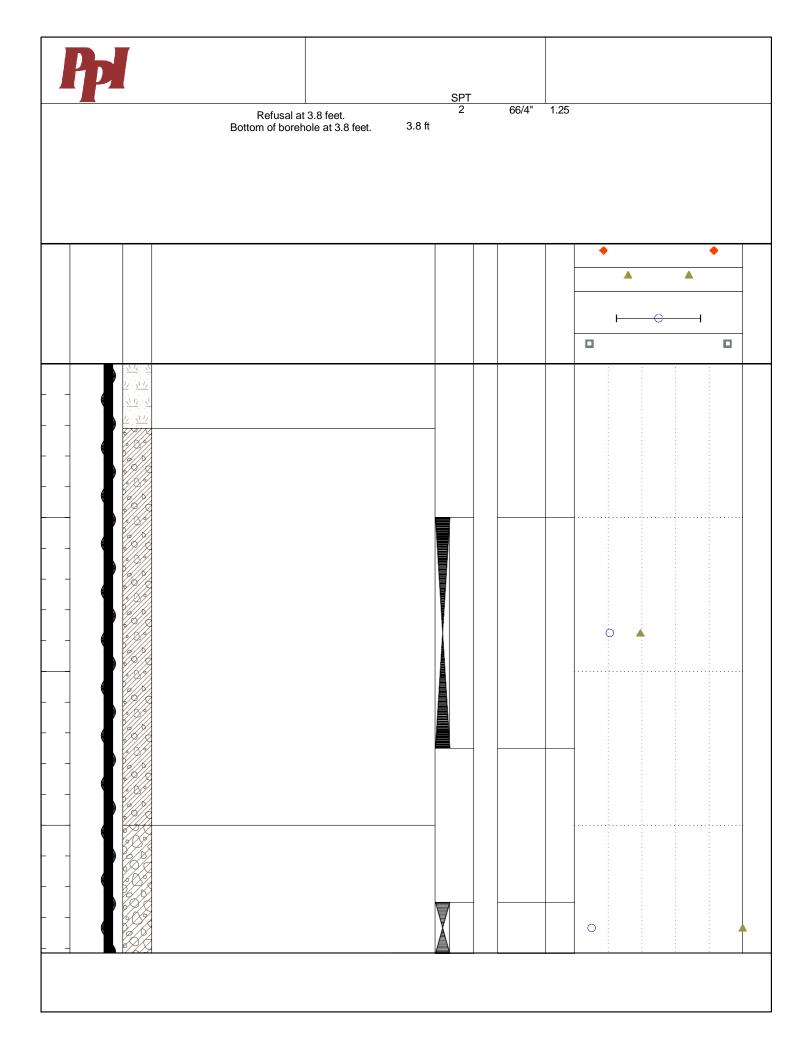
GEOTECHNICAL BORING LOG

BORING NUMBER

ELEVATION (ft)

PAGE 1 OF 1

CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/9/22 COMPLETED 6/9/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS _____ HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [′]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE DRILLING METHOD 80 20 40 60 DEPTH MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 0 TOPSOIL (5") 0.4 ft GRAVELLY LEAN CLAY, Red to Brown, Hard, Moist (CL) 1 CFA - 4.5" O.D. SPT 1-12-28 2 (40) 1 2 3.0 ft 3 CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC)



NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

DEPTH

0

1

2

3

4

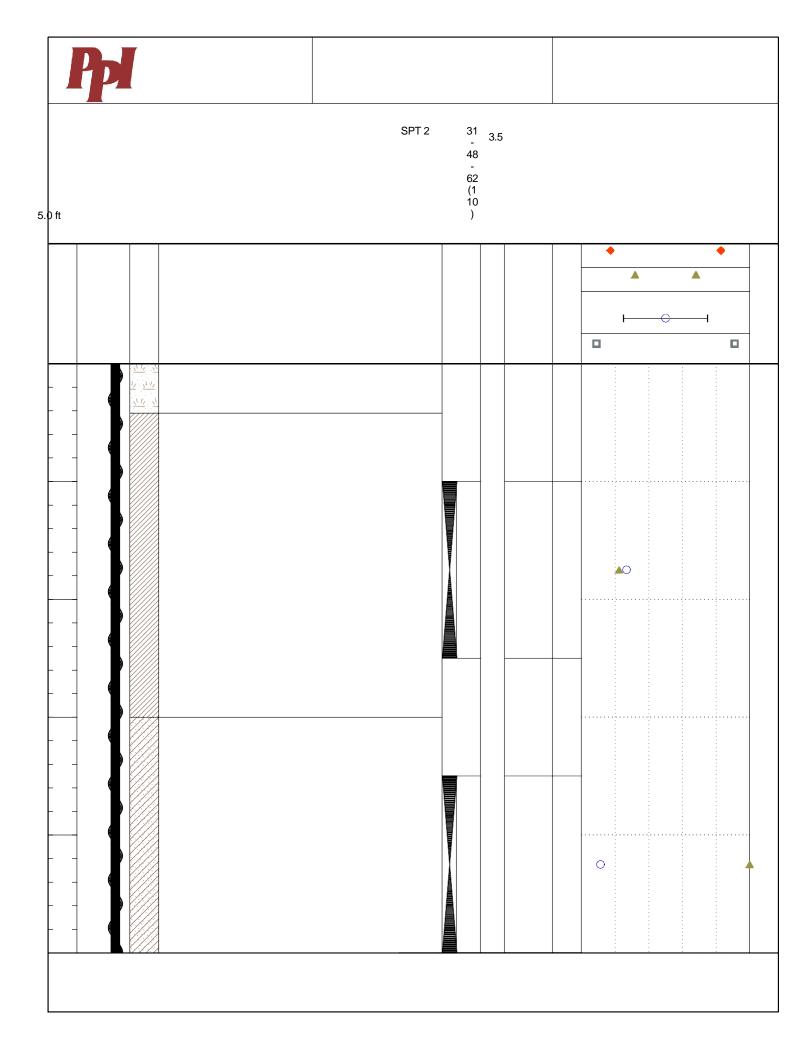
GEOTECHNICAL **BORING LOG**

BORING NUMBER

ELEVATION (ft)

PAGE 1 OF 1

CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/8/22 COMPLETED 6/8/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [′]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE DRILLING METHOD 80 20 40 60 MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 TOPSOIL (5") 0.4 ft LEAN CLAY, With Sand & Gravel, Red to Brown, Very Stiff, Moist (CL) SPT 3-5-17 1 1 (22) CFA - 4.5" O.D. 3.0 ft CLAYEY SAND, With Gravel, Red to Tan, Very Dense, Moist (SC) bo t. 0 t re hol t 0 е 5 m at 5.0 0 f fee В



NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY. MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

DEPTH

0

1

2

3

4

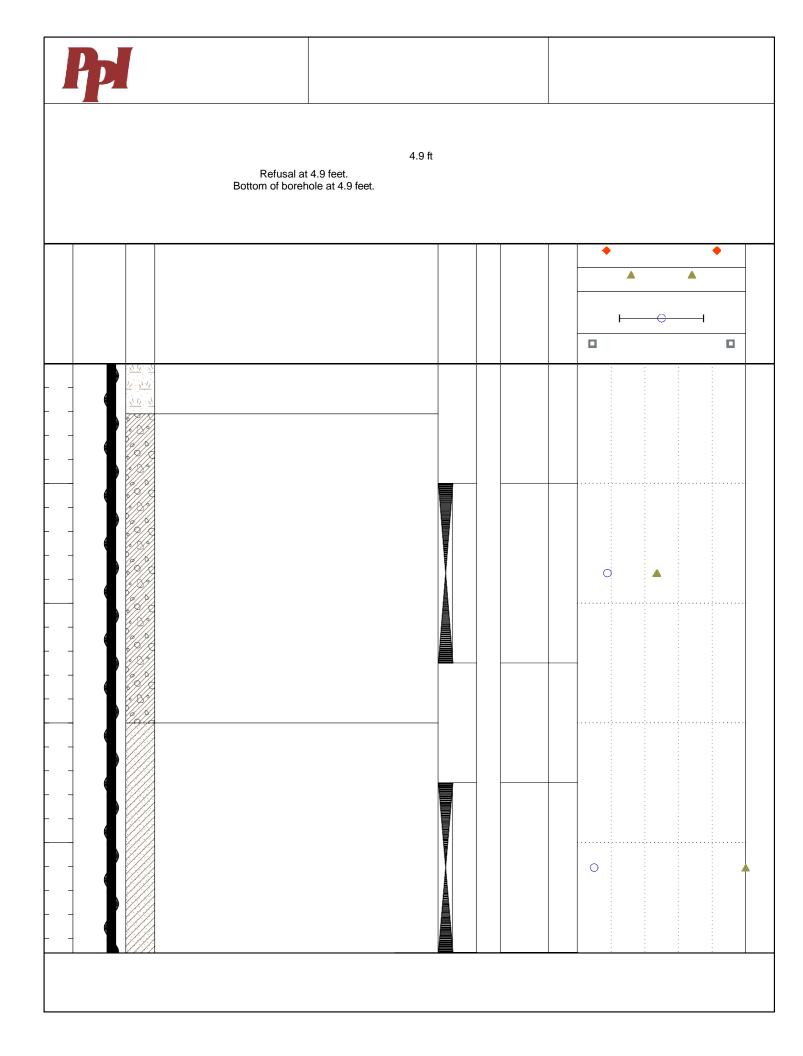
GEOTECHNICAL **BORING LOG**

BORING NUMBER

ELEVATION (ft)

PAGE 1 OF 1

PROJECT NAME WW Hastings Surface Parking CLIENT Childers Architect PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/9/22 COMPLETED 6/9/22 SURFACE ELEVATION _____ BENCHMARK EL. _____ DRILLER SP DRILL RIG _Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [′]100 40 60 8Ö CORRECTED BLOW COUNTS (N VALUE) 20 STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE DRILLING METHOD 80 20 40 60 MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 20 40 80 60 SHEAR STRENGTH (ksf) 1 2 3 4 TOPSOIL (5") 0.4 ft GRAVELLY LEAN CLAY, With Sand, Red to Brown, Hard, Moist (CL) SPT 5-17-30 2.25 1 (47) CFA - 4.5" O.D. 3.0 ft CLAYEY SAND, With Gravel, Red to Tan, Very Dense, Moist (SC) SPT 41-64 2.75 2 66/5"



NOTES

DEPTH

0

1

CFA - 4.5" O.D. 2

3

4

£

NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY. MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

GEOTECHNICAL **BORING LOG**

BORING NUMBER

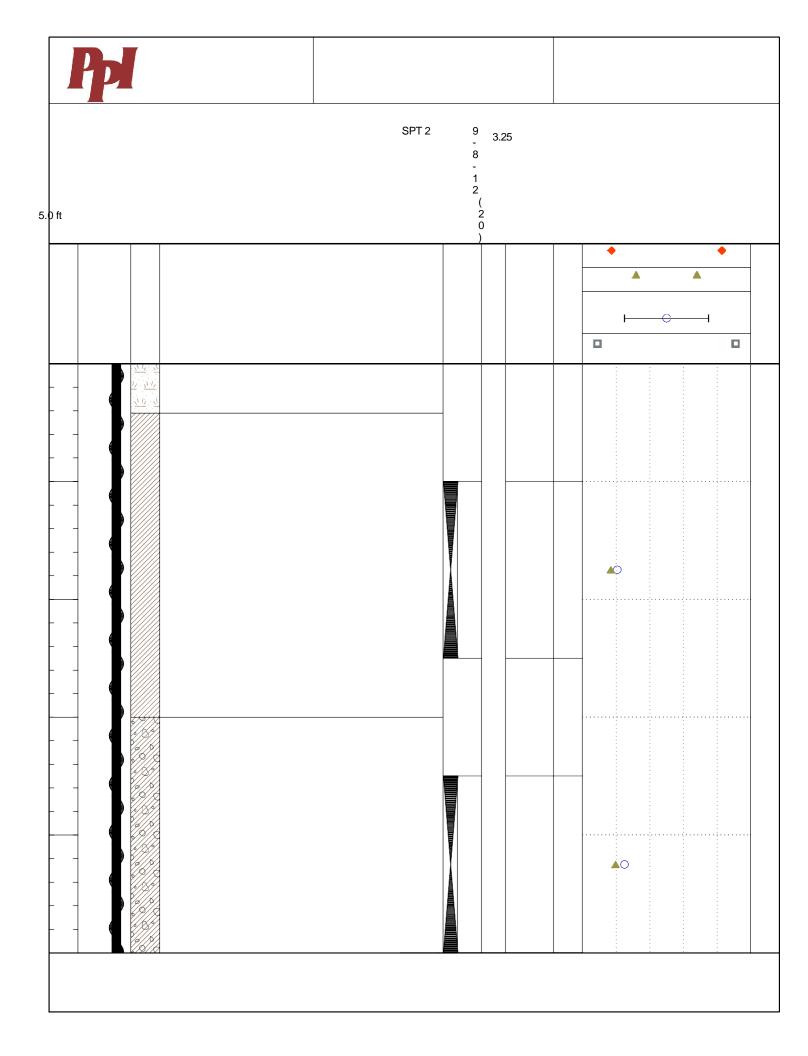
ELEVATION (ft)

PAGE 1 OF 1 CLIENT Childers Architect PROJECT NAME WW Hastings Surface Parking PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/8/22 COMPLETED 6/8/22 SURFACE ELEVATION _____ BENCHMARK EL. _____ DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING DRY UNIT WT (pcf) [´]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE DRILLING METHOD 80 20 40 60 MATERIAL DESCRIPTION PL MC LL Unified Soil Classification System 40 80 20 60 SHEAR STRENGTH (ksf) 1 2 3 4 TOPSOIL (5") 0.4 ft LEAN CLAY, With Sand & Gravel, Red to Brown, Very Stiff, Moist (CL) SPT 1-5-12 1.25 1 (17)3.0 ft GRAVELLY LEAN CLAY, With Sand, Red, Very Stiff, Moist (CL) t е et. h 0 m ol 5 е 0 f at 5. В b 0 0 0

fe

r

t



NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

DEPTH

0

1

2

3

4

GEOTECHNICAL **BORING LOG**

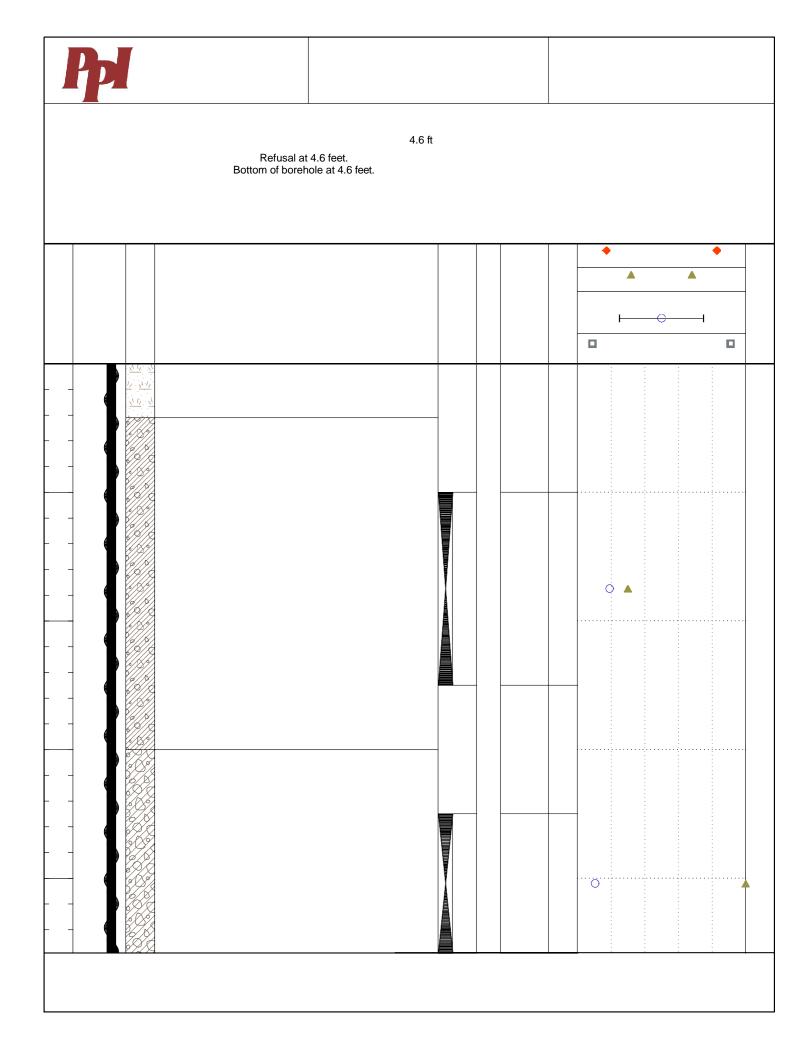
BORING NUMBER

P1	5
-----------	---

ELEVATION (ft)

PAGE 1 OF 1

PROJECT NAME WW Hastings Surface Parking CLIENT Childers Architect PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/8/22 COMPLETED 6/8/22 SURFACE ELEVATION _____ BENCHMARK EL. _____ DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING NOTES DRY UNIT WT (pcf) [′]100 20 60 8Ö CORRECTED BLOW COUNTS (N VALUE) 40 STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE DRILLING METHOD 80 20 40 60 MATERIAL DESCRIPTION £ PL MC LL Unified Soil Classification System 20 40 80 60 SHEAR STRENGTH (ksf) 1 2 3 4 TOPSOIL (5") 0.4 ft GRAVELLY LEAN CLAY, With Sand, Red to Brown, Very Stiff, Moist (CL) SPT 3-10-20 1.25 (30) CFA - 4.5" O.D. 1 3.0 ft CLAYEY GRAVEL, Wtih Sand, Red, Very Dense, Moist (GC) SPT 43-66-0.75 2 66/1"



NOTES

DEPTH

0

£

DRILLING METHOD

NG LOG - PPI - PPI STD TEMPLATE. 6DT - 6/24/22 09:36 - SY, MASTER PROJECT FILE/2022/0K/C/HILDERS ARCHITECT - 281188-WW HASTINGS SURFACE PARKING-SUBIBORING LOGS/281188 - GINT. GPJ

1

2

3

CFA - 4.5" O.D.

GEOTECHNICAL **BORING LOG**

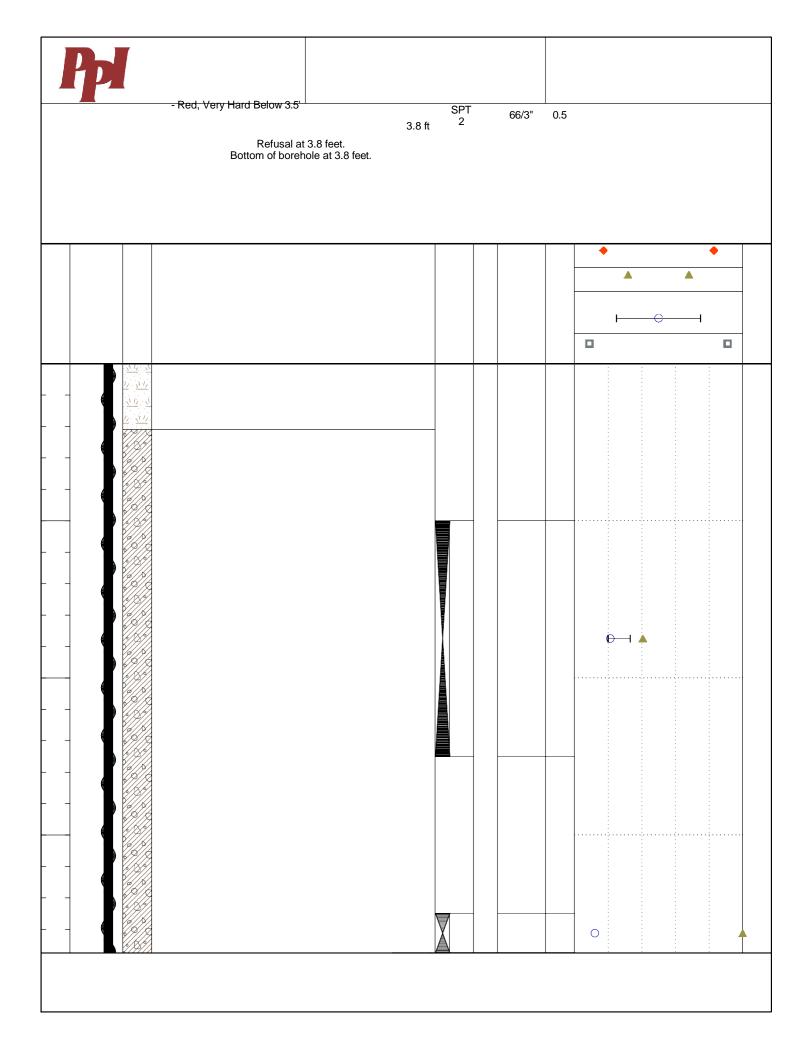
BORING NUMBER

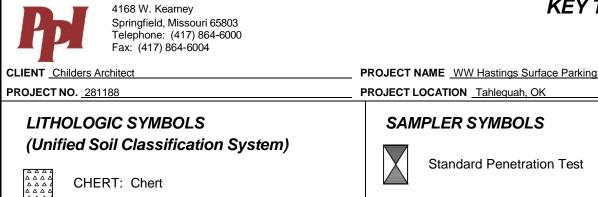
P1	6
-----------	---

ELEVATION (ft)

PAGE 1 OF 1

PROJECT NAME WW Hastings Surface Parking CLIENT Childers Architect PROJECT NO. 281188 PROJECT LOCATION Tahlequah, OK DATE STARTED 6/8/22 COMPLETED 6/8/22 SURFACE ELEVATION BENCHMARK EL. DRILLER SP DRILL RIG Dietrich D-50 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None LOGGED BY MV CHECKED BY CL AT END OF DRILLING DRY UNIT WT (pcf) [′]100 CORRECTED BLOW COUNTS (N VALUE) 20 40 60 8Ö STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE 80 20 40 60 MATERIAL DESCRIPTION PL MC LL Unified Soil Classification System 20 40 80 60 SHEAR STRENGTH (ksf) 1 2 3 4 TOPSOIL (5") 0.4 ft GRAVELLY LEAN CLAY, With Sand, Red to Brown, Hard, Moist (CL) SPT 3-13-28 2 (41) 1





KEY TO SYMBOLS

JECT	NO. <u>281188</u>	PROJECT I	LOCATION Tahlequah, OK
	OLOGIC SYMBOLS fied Soil Classification System)	SAN	MPLER SYMBOLS
	CHERT: Chert		Standard Penetration Test
	CL: USCS Low Plasticity Clay		
	CLG: USCS Low Plasticity Gravelly Clay		
	GC: USCS Clayey Gravel		
	SC: USCS Clayey Sand		
$\left(\frac{\overline{r_{f,1}}}{\overline{r_{f,1}}} - \overline{r_{f,1}} \right)$	TOPSOIL: Topsoil		
		WE	LL CONSTRUCTION SYMBOLS
PI W DD NP	ABB - LIQUID LIMIT (%) - PLASTIC INDEX (%) - MOISTURE CONTENT (%) - DRY DENSITY (PCF) - NON PLASTIC - PERCENT PASSING NO. 200 SIEVE - POCKET PENETROMETER (TSF)	BREVIATIO	VS TV - TORVANE PID - PHOTOIONIZATION DETECTOR UC - UNCONFINED COMPRESSION ppm - PARTS PER MILLION Water Level at Time ✓ Drilling, or as Shown Water Level at End of Drilling, or as Shown Water Level After 24 Hours, or as Shown

APPENDIX II

GENERAL NOTES

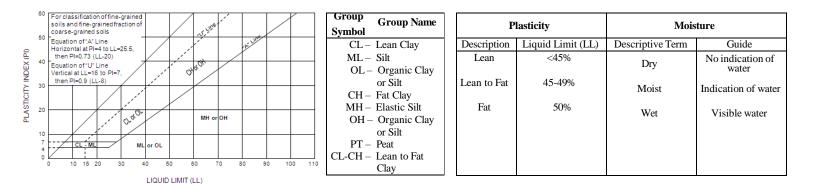


GENERAL NOTES

SOIL PROPERTIES & DESCRIPTIONS

COHESIVE	SOILS
	BOILD

	0	COMESTVE SOLLS				
Consistency	Unconfined Compressive Strength (Qu)	Pocket Penetrometer Strength	N-Value			
	(psf)	(tsf)	(blows/ft)			
Very Soft	<500	<0.25	0-1			
Soft	500-1000	0.25-0.50	2-4			
Medium Stiff	1001-2000	0.50-1.00	5-8			
Stiff	2001-4000	1.00-2.00	9-15			
Very Stiff	4001-8000	2.00-4.00	16-30			
Hard	>8000	>4.00	31-60			
Verv Hard			>60			



Fine Grained Soil Subclassification	Percent (by weight) of Total Sample
Terms: SILT, LEAN CLAY, FAT CLAY, ELASTIC SILT	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]
with sand, with gravel, with cobbles, with boulders scattered sand, scattered gravel, scattered cobbles, scattered boulders a trace sand, a trace gravel, a few cobbles, a few boulders	>15-30] – secondary coarse grained constituents 5-15] <5]
The relationship of clay and silt constituents is based on plasticity and not based on Atterberg Limits tests and the Plasticity Chart.	mally determined by performing index tests. Refined classifications are

NON-COHESIVE (GRANULAR) SOILS

				**GRAIN SIZE IDENTIFICATION		TION
				Name	Size Limits	Familiar Example
RELATIVE DENSITY	N-VALUE		JRE CONDITION	Boulder Cobbles Coarse Gravel	12 in. or more 3 in. to 12 in. 3/-in. to 3 in.	Larger than basketball Grapefruit Orange or lemon
		Descriptive Term	Guide	Fine Gravel	No. 4 sieve to $\frac{3}{4}$ -in.	Grape or pea
Very Loose	0-4	Dry	No indication of water	Coarse Sand	No. 10 sieve to No. 4 sieve	Rock salt
Loose	5-10	Moist	Damp but no visible water	Medium Sand	No. 40 sieve to No. 10 sieve	Sugar, table salt
Medium Dense	11-24	Wet	Visible free water, usually	Fine Sand*	No. 200 sieve to No. 40 sieve	Powdered sugar
Dense	25-50		soil is below water table.	Fines	Less than No. 200 sieve	r o waerea bagar
Very Dense	51			T mes	Less multito. 200 sieve	
				*Particles finer t a distance of 8 ir	han fine sand cannot be discerned	with the naked eye at

Coarse Grained Soil Subclassification	Percent (by weight) of Total Sample			
Terms: GRAVEL, SAND, COBBLES, BOULDERS	PRIMARY CONSTITUENT			
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]			
with gravel, with sand, with cobbles, with boulders	>15-30] - secondary coarse grained constituents			
scattered gravel, scattered sand, scattered cobbles, scattered boulders	5-15]			
a trace gravel, a trace sand, a few cobbles, a few boulders	<5]			
Silty (MH & ML)*, clayey (CL & CH)*	<15]			
(with silt, with clay)*	5-15] – secondary fine grained constituents			
(trace silt, trace clay)*	<5]			
*Index tests and/or plasticity tests are performed to determine whether the term "silt" or "clay" is used.				

GENERAL NOTES



ROCK QUALITY DESIGNATION (RQD)		
Description of Rock Quality	<u>*RQD (%)</u>	
Very Poor	< 25	
Poor	25-50	
Fair	50-75	
Good	75-90	
Excellent	90-100	
*RQD is defined as the total length of sound core		
pieces 4 in. or greater in length, expressed as a		

pieces 4 in. or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

Term	Approx. Unconfined Compressive Strength (tsf)	
Extremely Soft	Can be indented by thumbnail	2.6-10
Very Soft	10-50	
Soft	50-260	
Medium Hard	Can be grooved 2 mm deep by firm pressure of knife	260-520
Moderately Hard	Requires one hammer blow to fracture	520-1040
Hard	Can be scratched with knife or pick only with difficulty	1040-2610
Very Hard	>2610	

	DEGREE OF WEATHERING				
Slightly Weathered	Rock generally fresh, joints stained and discoloration extends into rock up to 25mm (1 in), open joints may contain clay, core rings under hammer impact.				
Weathered	Rock mass is decomposed 50% or less, significant portions of rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.				
Highly Weathered	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.				

VOIDS			
Pit	Voids barely seen with naked eye to 6mm (1/4-in)		
Vug	Voids 6 to 50mm (¹ / ₄ to 2 in) in diameter		
Cavity	50 to 6000mm (2 to 24 in) in diameter		
Cave	>600mm		

GRAIN SIZE (TYPICALLY FOR SEDIMENTARY ROCKS)							
Description	Field Identification						
Very Coarse Grained	>4.76						
Coarse Grained	2.0-4.76	Individual grains can easily be distinguished by eye.					
Medium Grained	0.42-2.0	Individual grains can be distinguished by eye.					
Fine Grained	0.074-0.42	Individual grains can be distinguished by eye with difficulty.					
Very Fine Grained	<0.074	Individual grains cannot be distinguished by unaided eye.					

BEDDING THICKNESS

Very Thick Bedded	> 3' thick						
Thick Bedded	1' to 3' thick						
Medium Bedded	4" to 1' thick						
Thin Bedded	11/4" to 4" thick						
Very Thin Bedded	$\frac{1}{2}$ " to $1\frac{1}{4}$ " thick						
Thickly Laminated	1/2" to 1/2" thick						
Thinly Laminated	¹ / ₂ " or less (paper thin)						

DRILLING NOTES

Drilling and Sampling Symbols

NQ - Rock Core (2-in. diameter)

- HQ Rock Core (3 in. diameter)
- HSA Hollow Stem Auger

CFA – Continuous Flight (Solid Stem) Auger SS – Split Spoon Sampler WB – Wash Bore or Mud Rotary TP – Test-Pit

HA- Hand Auger

Soil Sample Types

ST - Shelby Tube

Shelby Tube Samples: Relatively undisturbed soil samples were obtained from the borings using thin wall (Shelby) tube samplers pushed hydraulically into the soil in advance of drilling. This sampling, which is considered to be undisturbed, was performed in accordance with the requirements of ASTM D 1587. This type of sample is considered best for the testing of "in-situ" soil properties such as natural density and strength characteristics. The use of this sampling method is basically restricted to soil containing little to no chert fragments and to softer shale deposits.

Split Spoon Samples: The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot of an 18-in. long, 2-in. O.D. split-barrel sampler with a 140 lb. hammer falling a distance of 30 in. The Standard Penetration Test is carried out according to ASTM D-1586.

Water Level Measurements

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, shallow groundwater may indicate a perched condition. Caution is merited when interpreting short-term water level readings from open bore holes. Accurate water levels are best determined from piezometers.

Automatic Hammer

Palmerton and Parrish's CME's are equipped with automatic hammers. The conventional method used to obtain disturbed soil samples used a safety hammer operated by company personnel with a cat head and rope. However, use of an automatic hammer allows a greater mechanical efficiency to be achieved in the field while performing a Standard Penetration resistance test based upon automatic hammer efficiencies calibrated using dynamic testing techniques.



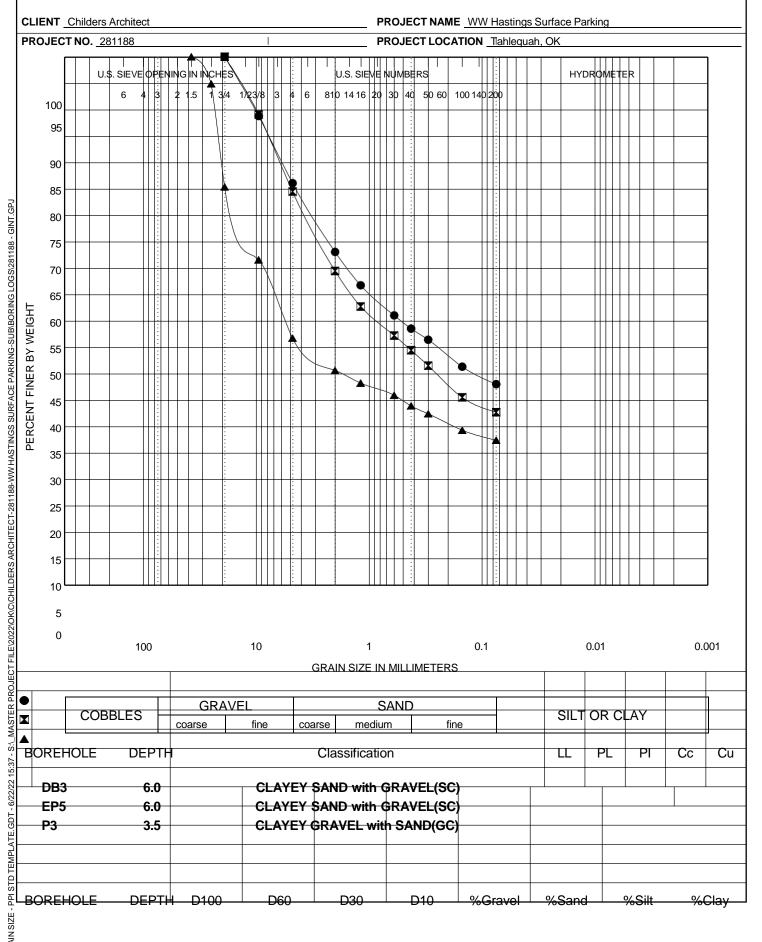
APPENDIX III

GRAIN SIZE ANALYSIS RESULTS



4168 W Kearney St. Springfield, MO 65803 Telephone: 417-864-6000

GRAIN SIZE DISTRIBUTION



DB3	6.0	19	1.548		23.9	38.0	38.1
EP5	6.0	19	2.059		25.5	41.7	32.8
P3	3.5	37.5	8.814	0.172	53.2	19.3	27.5

APPENDIX IV

IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you - assumedly a client representative - interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated*.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnicalengineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full*.

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnicalengineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.* Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists.*



Telephone: 301/565-2733 e-mail: info@geoprofessional.org www.geoprofessional.org

Copyright 2016 by Geoprofessional Business Association (GBA). Duplication, reproduction, or copying of this document, in whole or in part, by any means whatsoever, is strictly prohibited, except with GBA's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of GBA, and only for purposes of scholarly research or book review. Only members of GBA may use this document or its wording as a complement to or as an element of a report of any kind. Any other firm, individual, or other entity that so uses this document without being a GBA member could be committing negligent



Cherokee Nation Tahlequah Hospital Development Tahlequah, Cherokee County, Oklahoma



Prepared for:



Cherokee Nation 206 East Allen Road Tahlequah, OK 74464

CHILDERS AR CHITECT

and

Childers Architect 45 South 4th Street Fort Smith, AR 72901

Prepared by:



P.O. Box 335 Vinita, Oklahoma 74301 918-272-7656 P.O. Box 5446 Fort Smith, Arkansas 72913 918-244-9595

July 2022

tun

Steven R. Votaw

President

TABLE OF CONTENTS

1.0	INTR	ODUCTION	1
	1.1	Project Scoping	1
	1.2	Project Purpose and Need	1
2.0	ALTE	RNATIVES CONSIDERED	1
	2.1	Proposed Action Alternative	1
	2.1.1	Considered Action Alternative	2
	2.2	No-Action Alternative	2
3.0	AFFE	CTED ENVIRONMENT	
	3.1	Existing Environment	2
	3.2	Social and Economic Conditions	3
	3.3	Environmental Justice	5
	3.4	Protection of Children	5
	3.5	Natural Resources	5
	3.6	Water Resources	7
	3.7	Floodplains	8
	3.8	Wetlands	8
	3.9	Fish and Wildlife	9
	3.10	Threatened and Endangered Species1	0
	3.11	Cultural Resources	2
	3.12	Tribal Consultation	2
	3.13	Air Quality	3
	3.14	Hazardous Materials	4
	3.15	Climate Change	5
	3.16	Community Services	5
	3.17	Transportation and Parking10	6
	3.18	Utilities	6
	3.19	Potential for Generating Substantial Controversy1	7
	3.20	Cumulative Effects	7
	3.21	Impact Summary1'	7
4.0	MANA	AGEMENT AND MITIGATION MEASURES	9
5.0		CY AND TRIBAL COORDINATION	
6.0	APPL	ICABLE FEDERAL LAWS AND REGULATIONS2	1

7.0	LIST OF PREPARERS	22
8.0	REFERENCES	23

LIST OF TABLES

Table 1	Cherokee County, Oklahoma Demographics	4
Table 2	Identified Aquatic Resources	7
Table 3	Species Conclusion Table	11
Table 4	National Ambient Air Quality Standards	13
Table 5	Impact Summary Matrix	
Table 6	Applicable Federal Environment Laws and Regulations	21

LIST OF APPENDICES

Appendix	Α	Proposed Action Maps and Representative Photographs
Appendix	B	Agency and Tribal Coordination
Appendix	С	Wetlands and Waterway Delineation Report of Survey
Appendix	D	Biological Assessment
Appendix	E	Phase I Environmental Site Assessment

Cherokee Nation Hospital Project Cherokee County, Oklahoma

1.0 INTRODUCTION

The Cherokee Nation (CN) proposes to construct a new hospital in Tahleguah, Cherokee County, Oklahoma. The proposed project would involve constructing a new 401,000 square foot, seven-story high-rise hospital and a two-story 12,800 square foot freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and 0.5 mile of proposed waterline would also be constructed to service the new facility. The proposed action area encompasses approximately 13 acres. The disturbance area associated with the hospital and adjacent parking areas encompasses approximately 1.04 acres. The utility line corridors to be temporarily disturbed would be 1.32 miles within a 25-foot-wide corridor encompassing approximately 4 acres. The utility lines would be offset from the existing infrastructure lines within the previously disturbed corridors. The utility line corridors would transition along existing utility line corridor easements which have also been previously cleared and are maintained on a generally routine basis. Eagle Environmental Consulting, Inc. (EEC) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] § § 4321-4347) and the President's Council on Environmental Quality (CEQ) NEPA Implementing Regulations (Title 40 of the Code of Federal Regulations [CFR] § § 1500-1508) Guidance. This EA incorporates the environmental public interest review factors as outlined by NEPA and has been prepared for the CN. Appendix A contains the proposed action maps, exhibits, and graphics for reference. Figure 1 provides graphical depiction of the action area location. *Figure 2* presents a Considered Action Alternative (CAA) design exhibit on aerial imagery. Figure 3 provides the Proposed Action Alternative (PAA) design plan exhibiton aerial imagery. Figure 4 contains representation of proposed hospital floorplans. Figure 5 depicts the PAA relative to the 100-year floodplain (maximum flood pool area). Visual reference of action area characteristics is provided through representative photographs also located in *Appendix A*.

1.1 **Project Scoping**

Project scoping letters requesting comments from the relevant county, state, and federal regulatory/resource agencies as well as Native American tribes having potential interest in the project area, relative to environmental and socioeconomic issues that should be considered as part of this assessment are provided in **Appendix B** along with any and all response letters. Only the Proposed Action and No Action Alternatives are evaluated and discussed herein. One other action alternative was identified by the project proponent which would meet the project purpose and need and is discussed in Section 2.1.1.

1.2 Project Purpose and Need

The project purpose is to improve medical care to tribal citizens by constructing a new, state-of-the-art facility that can accommodate increased numbers of patients and allow for better access to healthcare services. The project need is to construct a new hospital and attendant parking area. The energy plant and utility lines are needed to support the new hospital infrastructure.

2.0 ALTERNATIVES CONSIDERED

2.1 **Proposed Action Alternative**

The Proposed Action Alternative would involve constructing a new 401,000 square foot, seven-story high-rise hospital with an adjacent parking lot and a two-story 12,800 square foot freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. The hospital and parking area encompasses approximately 13 acres. The disturbance area associated with the hospital and adjacent parking areas encompasses approximately 1.04 acres. The utility line corridors to be temporarily disturbed would be 1.32

Cherokee Nation Hospital Project Cherokee County, Oklahoma

miles within a 25-foot-wide corridor encompassing approximately 4 acres. The utility lines would be offset from the existing infrastructure lines within the previously disturbed corridors. No trees are proposed to be removed during construction. All areas of soil disturbance will be restored to original contour, elevation, and grade. No trees are proposed to be removed as part of this project. The hospital and parking area has been previously disturbed. The utility line corridors would transition along existing utility line corridor easements which have also been previously cleared and are maintained on a generally routine basis.

2.1.1 Considered Action Alternative

The CAA was very similar in all design aspects to the PAA except that it included plans for a parking garage. Upon review of the CAA, the Cherokee Nation determined that this portion of the project was "within very close proximity to culturally sensitive resources" and recommended that this location be avoided. Therefore, this action alternative was not considered viable and evaluation thereof will not be carried forward in this EA.

2.2 No-Action Alternative

The National Environmental Policy Act (NEPA) and the (CEQ) provided regulations on the implementation of NEPA and require consideration and analysis of the No Action Alternative. The No-Action alternative would not meet the purpose or need for proposed lease expansion. None of the proposed public use facilities or features would be installed or developed. Although the No-Action would not satisfy the purpose or and need for the proposed action, this alternative is included in the assessment to provide a comparative and reference baseline relative to the potential effects of the proposed action. The No-Action is synonymous with no change to the existing environment.

3.0 AFFECTED ENVIRONMENT and ENVIRONMENTAL CONSEQUENCES

This section presents the general description of the existing conditions and resources within the proposed action area relevant to evaluated public interest review factors. Analysis of the potential environmental consequences under the NAA and PAA are also incorporated for evaluation purposes.

3.1 Existing Environment

Land use refers to the purpose and current usage activity a given parcel provides or supports whether undeveloped, residential, commercial, recreational, industrial, agricultural, or no obvious utilization. The following provides perspective on the natural features associated with the general project area and is used as a comparative basis to describe the current conditions/features of the action area.

Ecoregion

The surveyed area is located in the Ozark Highlands Dissected Springfield Plateau–Elk River Hills ecoregion. The area is comprised of narrow ridgetops and intervening, steep V-shaped valleys. Carbonate rocks, along with associated karst features, are characteristic. Springs abound in valleys and contribute cool water to perennial streams. Cherty limestone of the Mississippian Boone Formation is extensive, but older shales, limestone, and dolomite are also exposed in valley bottoms. The region is considered rugged and wooded and upland natural vegetation is oak–hickory and oak–hickory–pine forests and associated woodlands. Livestock and poultry farming, woodland grazing, logging, recreation, and quarrying are the main land uses.

Physiography

The PAA is located on approximately 13 acres of formerly disturbed/developed areas. Topography of the general area has been graded/modified and consists mainly of minor undulation with infrequently occurring

Cherokee Nation Hospital Project Cherokee County, Oklahoma

streams. Utility corridors transition through previously developed and residential areas.

Geology

The PAA is located in Cherokee County, which lies within the Dissected Springfield Plateau—Elk River Hills region of the Ozark Highlands. It is mantled by Quaternary cherty clay solution residuum and underlain by Mississippian-age limestone and interbedded chert. Rock outcrops are common in the region.

Vegetation

The natural vegetation of the region consists mostly of oak-hickory forest and some oak-hickory-pine forest. Mixed deciduous forest containing black oak, white oak, blackjack oak, winged elm, hickories, and mixed deciduous-shortleaf pine forest can be found on uplands. Species native to floodplains and low terraces include willow, maples, hickories, birch, American elm, and sycamore. The dominant vegetation of the PAA consists of Bermuda grass henbit, aster, plantain, and other forbs. The observed trees were scattered in a park like setting and consisted of post oak, black oak, black hickory, American elm, and eastern red cedar. Neither the mid-story or understory vegetation was essentially present. The portions of the assessment area not covered by impervious surfaces and described as a mowed and maintained park-like setting.

Land Cover and Land Use

Land use and land cover in this ecoregion consists mostly of woodland or forest. Primary land uses are livestock and poultry farming, woodland grazing, logging, recreation, and quarrying. Numerous high-quality streams occur. The project area is described a predominantly cleared/modified area associated with previously developed health care campus situated on CN property.

Action Area Land Use and Condition

The action area is situated on CN property adjacent to the W.W. Hastings Hospital and is designated for health care use. The project area is described a predominantly cleared/modified area associated with previously developed health care campus situated on CN property. Visual perspectives of the PAA are provided by photographs located at *Appendix A*.

Environmental Consequences

The PAA would result in minor impacts to the overall action area physiography/landscape resulting from clearing, grubbing and site preparation in advance of proposed hospital and utility line construction. All temporarily disturbed soils will be restored to pre-construction contour to the extent practicable and revegetated using native vegetation. Land use is not anticipated to change. No appreciable tangential impacts to these public interest review factors are anticipated aside from installation/development of the permanent health care facility features. Maintenance, herbicide application, and/or mowing is expected to continue. Since no other development tangential to the PAA are anticipated, no cumulative impact to aquatic resources, terrestrial habitats, topography, physiography, geological features, or soils are anticipated.

The NAA would result in no change in condition or use of CN property. None of the features/development contemplated under PAA would occur. The existing environment or physical features would remain unchanged or continue to develop naturally.

3.2 Social and Economic Conditions

The U.S. Census Bureau Website was used to identify the social and economic characteristics at the county level. *Table 1* summarizes the 2021 census estimates for socioeconomic information for Cherokee County,

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Oklahoma.

Table 1. Cherokee County, Oklahoma Demographics				
Population				
Population estimates, July 1, 2021, (V2021)	47,627			
Age				
Persons under 5 years, percent	5.6%			
Persons under 18 years, percent	21.7%			
Persons 65 years and over percent	17.0%			
Race and Hispanic Origin				
White alone, percent	51.5%			
Black or African American alone, percent	1.4%			
American Indian and Alaska Native alone, percent	36.4%			
Asian alone, percent	1.0%			
Native Hawaiian and Other Pacific Islander alone, percent	0.1%			
Two or More Races, percent	9.6%			
Hispanic or Latino, percent	7.3%			
White alone, not Hispanic or Latino, percent	47.1%			
Housing				
Housing units, July 1, 2021, (V2021)	22,245			
Owner-occupied housing unit rate, 2016-2020	67.3%			
Median value of owner-occupied housing units, 2016-2020	\$126,400			
Median gross rent, 2016-2020	\$679			
Families & Living Arrangements				
Households, 2016-2020	17,364			
Persons per household, 2016-2020	2.71			
Education				
High school graduate or higher, percent of persons age 25 years+, 2016-2020	87.5%			
Bachelor's degree or higher, percent of persons age 25 years+, 2016-2020	27.5%			
Economy				
In civilian labor force, total, percent of population age 16 years+, 2016-2020	55.2%			
Total accommodation and food services sales, 2017 (\$1,000)	58,797			
Income & Poverty				
Median household income (in 2020 dollars), 2016-2020	\$43,378			
Per capita income in past 12 months (in 2020 dollars), 2016-2020	\$22,617			
Persons in poverty, percent	19.6%			

Environmental Consequences

The PAA is associated with a previously developed health care campus situated on CN property and may have short- and/or long-term impacts on the socioeconomics of the surrounding areas. In the short term, the PAA may provide a temporary benefit to the contractor or contractors selected to construct the proposed hospital and utility line construction. The project proponent would expect to realize increased capacity for patient care. Workforce expansion in the Tahlequah area may also increase slightly associated with the need for additional hospital staff. Local businesses may experience increased sales opportunities tangential to installation, operation, and maintenance of the improved health care facility. Possible adverse impacts may include increased noise from the operation of construction equipment, though this is expected to be

Cherokee Nation Hospital Project Cherokee County, Oklahoma

temporary. Lighting installed outside the facility or in parking lot may also contribute to light pollution.

The NAA would result in no change to the current conditions of this review factor. The PAA would not be completed and socio-economic conditions would remain unchanged.

3.3 Environmental Justice

Executive Order (EO) 12898 "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations" (February 11, 1994) states that if possible, no federal actions should place any adverse environmental, economic, social, or health effects on minority or low-income groups. According to the poverty guidelines published by the US Department of Health and Human Services (HHS), the 2019 HHS poverty guidelines for a family of four with an annual household income of \$25,750 is considered to be the poverty level. An annual income of \$12,490 is considered to be the poverty level for an individual. The HHS Poverty Guidelines are published annually and reflect the poverty conditions for the previous year (Federal Register, 2019).

Environmental Consequences

The PAA would be located on previously disturbed CN hospital property and does not have any residential development. The PAA would not directly impact any homes; therefore, no minority group or low- income families would be disproportionately affected.

The NAA would not result in any disproportionate negative impacts on minority or low-income populations.

3.4 Protection of Children

Executive Order 13045 pertains to "Protection of Children for Environmental Health and Safety Risks", April 21, 1997. This mandate requires federal agencies to identify and assess environmental health and safety risks that may affect children. The project is located in a rural area on USACE property no homes present.

Environmental Consequences

The PAA will not affect the safety or health of children and will be in full compliance with Executive Order 13045.

The NAA would not result in changes to the existing conditions.

3.5 Natural Resources

<u>Soils</u>

The Natural Resources Conservation Service (NRCS) Web Soil Survey was used to identify soil units within the study area (NRCS 2021). Multiple soil units are present within the proposed project area including: Captina silt loam, 1 to 3 percent slopes; Clarksville very gravelly silt loam, 1 to 8 percent slopes; Clarksville very gravelly silt loam, 20 to 50 percent slopes, stony; Tonti gravelly silt loam, 1 to 3 percent slopes; Britwater silt loam, 1 to 3 percent slopes; and Britwater gravelly silt loam, 3 to 8 percent slopes.

Environmental Consequences

The PAA would temporarily disturb approximately 4 acres of soil associated with clearing and grubbing of

Cherokee Nation Hospital Project Cherokee County, Oklahoma

vegetation as part of site preparations, site grading, and conversion to impervious surfaces relative to the hospital, parking area, and access roads. The area of temporary disturbance is estimated to be 1 acre associated with staging areas and/or operational area for sanitary and waterline installation. Both corridors will be restored upon project completion with no permanent impacts. All temporarily disturbed soils within the construction corridor will be restored to pre-construction contour to the extent practicable and revegetated using native vegetation. Herbicide application and/or mowing is expected to continue in restored herbaceous areas adjacent to the hospital and parking areas. The utility line corridors will likely not be mowed or maintained on a regular basis upon project completion. No prime farmland or sensitive soils were identified within the PAA.

The NAA would not cause impacts to the existing soils.

Farmland Soils

The Natural Resource (NRCS) administers the Farmland Protection Policy Act (FPPA 1981) to ensure that federal programs minimize unnecessary and irreversible conversion of farmland soils to nonagricultural uses. The response from the NCRS is provided in *Appendix B*.

Environmental Consequences

NRCS reviewed the subject project information and determined that the proposed project will not impact any easements, watersheds, or prime farmland soils as defined by the Farmland Protection Policy Act. Prime farmland is not present and no other easements relative to the Farm Protection Policy Act have been identified. Therefore, the FPPA does not apply.

The NAA would not impact any soils protected under the FPPA.

Wild and Scenic Rivers

The National Park Service Website was used to identify any wild and scenic rivers within or near the proposed action (National Park Service, 2012).

Environmental Consequences

No waterways classified as wild and scenic pursuant to the Federal Wild and Scenic Rivers Act Public Law 90-542 are located within the proposed action.

The NAA would not affect any wild or scenic rivers.

Vegetation

Executive Order 13112, signed by President Clinton on February 3, 1999, requires that a Council of Departments dealing with invasive species be created to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive could potentially cause or create. Invasive species are plants that grow and have a relatively higher probability of growing in areas of soil disturbance. The aggressive spread of these species can interfere with growth of native species. The PAA proposes development activities on the existing health care campus area. The overall acreage of the PAA would be approximately 13 acres.

Environmental Consequences

No invasive species were identified within the PAA during onsite field surveys. Removal of woody and herbaceous vegetation would result from the construction of the PAA; however, all temporarily disturbed vegetation within the utility line construction corridors will be restored to pre-construction contour to the

Cherokee Nation Hospital Project Cherokee County, Oklahoma

extent practicable and revegetated using native herbaceous vegetation. Corridor mowing or herbicide application may occur on an infrequent basis after project completion.

The NAA would allow vegetative species to persist in or flourish from their current to climax state. Therefore, no negative impacts are expected.

3.6 Water Resources

Surface Water

The Tahlequah USGS 7.5-minute topographic map indicated one ephemeral waterway was present within the PAA. This aquatic resource was confirmed during onsite surveys. One additional waterway and one detention pond were also identified within the PAA. The Waters of the United States (WOUS) delineation reports of survey provides the descriptions, characteristics, and photographs of the identified aquatic resources observed within the PAA and is provided at *Appendix C*.

Environmental Consequences

EEC conducted a Waters of the United States and wetland delineation survey associated with the proposed development project to identify and demarcate potentially jurisdictional waterways and/or wetlands within the project area. Two waterways and one detention pond were identified during the field survey. *Table 2* provides a summary of the feature type, linear footage, acreage, centroid location coordinates, and USACE jurisdictional status of identified sites.

Table 2. Identified Aquatic Resources								
Site Number	Feature Type	Feet	Acres	Latitude	Longitude	Jurisdictional?		
FS-1	Detention Pond		0.43	35.9105	-94.9448	No		
FS-2	Waterway	205		35.9108	-94.9531	Likely Yes		
FS-3 Waterway		50		35.9132	-94.9569	Yes		
T	255	0.43						

No impacts are anticipated to surface water resources. The proposed project design plan was situated within the project area to avoid impacts to waters of the US. Due to the expected minor impact to potential sanitary line crossing of the two identified waterways (less than 1/10 acre each), compensatory mitigation would not be required as part of the received Nationwide Permit for Utility Lines (NWP 12, Appendix B).

The NAA would not affect any surface water resources.

Groundwater

The Oklahoma Water Resources Board website was used to broadly assess groundwater resources beneath the land within the PAA. The action area is underlain by the Roubidoux major aquifer and the Boone minor aquifer (USGS). The Boone and Roubidoux aquifers are located in northeastern Oklahoma and underlie about 3,100 square miles and 4,600 square miles, respectively, in Adair, Cherokee, Craig, Delaware, Le Flore, Mayes, McIntosh, Muskogee, Nowata, Ottawa, Rogers, Sequoyah, and Wagoner counties. The Roubidoux aquifer is considered a major aquifer by the Oklahoma Water Resources Board (having an average well yield of at least 50 gallons per minute) and supplies groundwater for public water uses, commerce, industry, and rural water districts. The Boone aquifer is considered a minor aquifer by the Oklahoma Water Resources Board (having an average well yield of less than 50 gallons per minute) and supplies groundwater for domestic purposes, with some agricultural, commercial, and public water uses.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Environmental Consequences

Based on the proposed construction, evaluation of groundwater resources, aquifer locations, and characteristics, the PAA would not affect groundwater resources.

No subsurface water resources would be affected resultant from the NAA.

Public Water Supplies

The Oklahoma Department of Environmental Quality's Data Viewer was used to broadly assess the presence of public water supplies wells, public water supply intakes, and wellhead protection areas that may be affected by the proposed action. No public water supplies within or near the action area were identified.

Environmental Consequences

No public water supply systems would be affected by the PAA.

The NAA would not affect public water supply systems. Therefore, there would be no negative impacts relative to this public interest review factor.

Sole Source Aquifers

The United States Environmental Protection Agency's website was used to identify the location of any sole source aquifers. No sole source aquifers are located within or near the PAA.

Environmental Consequences

No impacts to sole source aquifers would occur as a result of the PAA. The NAA would not affect this resource.

3.7 Floodplains

The protection of floodplains and floodways is required by Executive Order 11988 to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains to avoid direct or indirect support of floodplain development. Coordination with the Oklahoma Water Resources Board determined that Cherokee County participates in the National Flood Insurance Program (NFIP). The Federal Emergency Management Agency's (FEMA) website was used to determine whether any floodplains were located within the PAA.

Environmental Consequences

The PAA will not disturb or be situated in any portion of a mapped 100-year floodplain. All work associated with the PAA would conform to USACE and applicable federal, state, or local floodplain protection regulations as required. The PAA would not result in the displacement of flood water storage.

The NAA would not impact any mapped floodplain areas.

3.8 Wetlands

The United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (USACE 2010) were referenced in concert to identify wetlands. The Waters of the US Delineation was performed within the action area. The report of survey detailing the onsite evaluation is provided in *Appendix C*.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Environmental Consequences

No wetland areas were identified during the field survey. The PAA will not impact any wetland areas.

There would be no impacts to wetlands under the NAA.

3.9 Fish and Wildlife

The action area includes both mature and sub-mature upland forested areas associated with ridges and hillsides. A biological assessment (BA) was prepared to identify and address the potential impacts to fish and wildlife as well as threatened and endangered species and is located at *Appendix D*.

Environmental Consequences

Direct effects within the action area would consist of temporary impacts associated with utility line installation associated with soil disturbance during trench excavation. Temporary impacts are anticipated adjacent to the trench corridor where excavated soils would be side-cast. Utility lines would be installed within the open trench and then backfilled. The disturbed corridor would be restored to pre-disturbance elevation, grade, and contour to the extent practical. The area of temporary disturbance would be 4 acres. The hospital and parking areas were previously disturbed and covered with impervious surfaces. No trees would be removed. Herbaceous vegetation would be re-established on disturbed soils upon project completion. Corridor mowing or herbicide application may occur on an infrequent basis after project completion. Water quality impacts will be avoided to the extent possible and terrestrial erosion/sedimentation control measures will be employed as required. Specific surveys for the federally listed T&E species were not conducted as part of this assessment. Private and governmental property or right of way maintenance, herbicide application, and/or mowing is expected to continue in restored herbaceous areas as well as along the completed trackage areas. Potential suitable habitat for the ABB was identified beyond the disturbance zones of the proposed action. The action area has been previously disturbed, potentially suitable habitat was not present, and the project area is wholly located outside the established designated ABB location lands; therefore, based on the location outside a conservation area and applicability of the 4(d) Rule determination key, no ABB surveys appear required. No suitable habitats for the remaining federally-listed species was identified within or adjacent to the assessment area. No speciesspecific presence/absence surveys have been performed relative to the project. Animal species and their respective uses are expected to be varied, opportunistic, and relative to the preferred or utilized habitats for each. Based on the observed habitat characteristics, the most predominant species expected to be present or utilize the proposed action would consist of small mammals and birds. The diversity of bird species varies between summer and winter migrants; however, no nests were observed. Predatory or omnivorous animals such as coyote, skunk, raccoon, and snakes are expected to utilize both terrestrial and aquatic areas primarily during foraging. The habitat quality relative to the action area is described as good to excellent. Permanent displacement and temporary disturbances to exhibiting habitats result from the PAA. Temporary impacts would be associated with infrastructure installation after which the disturbed areas would be restored. Mammalian, amphibian, reptilian, and avian use of the specific construction areas would be required to vacate said areas. Wildlife species would no longer be able to use permanently converted habitat areas but should be able to utilize the temporarily affected habitats upon site or corridor restoration. Wildlife use of areas associated with construction of permanent structures will be precluded. Activity within the PAA is expected to increase after completion. Human and vehicle presence may result in short term wildlife presence and/or patterns. The majority of the species traditionally present within the PAA prior to lease expansion are expected to remain adjacent to the proposed development areas. Ground nesting birds were not observed and are not expected in any consistent appreciable extent or numbers based on the vegetation types and habitat structure. Ground-dwelling rodents and their evidence were observed within the action area. Suitable forage and cover for both birds and small mammals are provided by seed producing

Cherokee Nation Hospital Project Cherokee County, Oklahoma

herbaceous vegetation. Herpetofauna are expected to continue utilization of the PAA; however, their patterns may be altered to avoid areas of increase human presence. The available habitats for these species would include herbaceous edges areas/borders and deadfall. The area immediately adjacent thereto provides the same habitat structure availability and should provide ample refuge for escaping species. Based on this assessment, the overall impacts to terrestrial species are expected to be minor and relatively short term. The majority of the terrestrial species should be able to flee the proposed work areas during construction. Based on the avoidance and minimization of habitat impacts to be employed as part of the proposed construction plan, limited and minor amounts structural habitats should be removed or displaced. Based on onsite survey observations, more than sufficient suitable and equally preferred habitat is available in very close proximity to the proposed development areas for terrestrial species to utilize for cover, nesting, denning, and/or foraging.

Under the No-Action Alternative, terrestrial and aquatic species would not be affected.

3.10 Threatened and Endangered Species

In accordance with the Endangered Species Act of 1973, Federally-listed threatened and endangered species were identified for the proposed action area. EEC conducted field surveys to evaluate the existing habitats and determine the potential for species presence. The prepared BA identifies the life cycle and habitat requirements for each species, discusses the anticipated impacts, and includes effect determinations *(Appendix D)*.

Environmental Consequences

Direct effects within the action area would consist of temporary impacts associated with utility line installation associated with soil disturbance during trench excavation. Temporary impacts are anticipated adjacent to the trench corridor where excavated soils would be side-cast. Utility lines would be installed within the open trench and then backfilled. The disturbed corridors would be restored to pre-disturbance elevation, grade, and contour to the extent practical. The hospital and parking areas were previously disturbed and covered with impervious surfaces. No trees would be removed. Herbaceous vegetation would be re-established on disturbed soils upon project completion. Water quality impacts will be avoided to the extent possible and terrestrial erosion/sedimentation control measures will be employed as required. Specific surveys for the federally listed T&E species were not conducted as part of this assessment. The herbaceous habitats to be affected did not exhibit suitable habitat for any of the listed species. No caves are known to be located within or adjacent to the project area. Potential impacts to the ABB are possible; however, based on the location outside a conservation area and applicability of the 4(d) Rule determination key, no ABB surveys appear required. No suitable habitats for the remaining federally-listed species was identified within or adjacent to the assessment area. No species-specific presence/absence surveys have been performed relative to the project. No other development associated with the proposed project is expected. No uses or projects are anticipated that would be tangential to the proposed project. Provided no additional habitat disturbances are undertaken, the proposed project should have no indirect effects on the listed species other than described.

Northern long-eared bat - No Effect. No suitable roost trees are present within the action area. Limited foraging (forested areas) are present alongside but not within the utility corridors. Further, this species should or will have migrated to winter hibernacula during the fall/winter periods of proposed clearing and grubbing activities.

Gray bat - No Effect. No habitats for this species would be affected, and no known caves are present within action area. The project would also employ the USFWS protective measures and standard best management

Cherokee Nation Hospital Project Cherokee County, Oklahoma

practices would be employed during utility line installation near or at aquatic resources. BMP's include minimization of aquatic resource disturbance, avoid or minimize removal of riparian zone vegetation, and deploy erosion/sediment control measures adjacent to aquatic resources to minimize impacts to water quality.

Ozark big-eared bat - No Effect. No known caves harboring this species are present within or near the project area. Suitable foraging habitat for this species is not present.

American Burying Beetle - Potential suitable habitat for the ABB was identified beyond the disturbance zones of the proposed action. The action area has been previously disturbed, potentially suitable habitat was not present, and the project area is wholly located outside the established designated location lands. Therefore, the Section 4(d) rule appears to be applicable. The ABB Section 4(d) Rule determination key is located in *Appendix A* of the attached Biological Assessment.

Neosho Mucket, Rabbitsfoot Mussel, Piping Plover, Red Knot, and Monarch Butterfly – No Effect. Suitable habitat not present. No individuals observed.

Species occurrence records were requested from the ONHI regarding the federal, state, and/or species of concern within or near the project area. Occurrence records were received for the American Burying Beetle near but not within the action area. Presence of this species is possible. The Species Conclusion Table (*Table 3*) below provides the potential affect determination to each of the federally-listed species:

Table 3 - Species Conclusion Table			
Species	Habitat Evaluation	USFWS	ESA
		Consultation	Determination
Northern Long-eared Bat	Roost trees and foraging habitat not present within or adjacent to action area.	Not Required	No Effect
Gray Bat	No caves present. Potentially suitable foraging habitat not present. Stormwater and water quality measures to minimize impacts will be employed during utility construction.	Not Required	No Effect
Piping Plover	No suitable habitat observed. No individuals observed.	Not Required	No Effect
Red Knot	No suitable habitat was observed. No individuals observed.	Not Required	No Effect
Ozark Big-eared Bat	No suitable habitat present.	Not Required	No Effect
Neosho Mucket	No suitable habitat. No presence records.	Not Required	No Effect
Rabbitsfoot Mussel	No suitable habitat. No presence records.	Not Required	No Effect
American Burying Beetle	Suitable habitat not present in action area. Surveys not required.	Not Required	No Effect
Monarch Butterfly	Suitable foraging habitat not present. No host plant species observed. No individuals observed.	Not Required	No Effect

The NAA would not affect any federally-listed threatened or endangered species.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Bald Eagle

Although the Bald Eagle (*Haliaeetus leucocephalus*) has been removed from the threatened and endangered species list, the eagle continues to be protected by the Bald and Golden Eagle Protection Act. Bald eagles are rather large raptorial birds measuring 3 feet in height with a 7-foot wingspan. The bald eagle prefers large trees or high cliffs along large waterways for perching and nesting purposes. Fish is the preferred diet of eagles, but they also eat small mammals, waterfowl, turtles and dead animals. Preferred foraging areas include quiet coastal areas, rivers, or lakeshores with large tall trees.

Environmental Consequences

No potential or suitable habitat was identified within the action area for the bald eagle. No bald eagles or nests were observed during the site visit. This project is not expected to impact the bald eagle.

The NAA would not affect the Bald Eagle.

Migratory Birds

Executive Order 13186 refers to the responsibility of federal agencies to protect migratory birds. Migratory bird species are protected under the Migratory Bird Treaty Act (MBTA) as amended. The MBTA prohibits the take of any migratory bird without authorization for the USFWS.

Environmental Consequences

Suitable nesting habitat is present within and/or adjacent to the utility line corridors. However, no bird nests were observed within the area planned for the proposed action. No active swallow nests were observed within the action area. Construction is encouraged to occur between August 15 and March 31 to avoid the nesting season to avoid potential impact to migratory birds. Suitable habitat for non-migratory ground nesting birds is also present and construction is encouraged to occur during the same time frame. Provided construction can be conducted within the non-nesting season, no adverse effects are anticipated to non-migratory birds.

The NAA would not affect migratory birds.

3.11 Cultural Resources

Section 106 of the National Historic Preservation Act of 1966, as amended, protects those properties that are listed or eligible for listing in the National Register of Historic Places (NRHP). The CN archeologist also reviewed the proposed action areas relative to potential impacts to cultural resources and determined no predisturbance cultural resource surveys would be required for the PAA.

Environmental Consequences

No cultural resource surveys were required by the State Archeologist. Known sensitive sites will be avoided. No resource impacts are anticipated. *Section 4.0* provides coordination protocols for inadvertent discoveries of such resources.

The NAA would not impact cultural resources. Natural processes including erosion would continue to affect the general area.

3.12 Tribal Consultation

Under 36CFR Part 800.3, Native American tribes were identified that could have concerns regarding the proposed action. EEC provided notice of the proposed project to Native American tribal nations having potential interest in the PAA. The tribal scoping and response letters are provided in *Appendix B*.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Environmental Consequences

Multiple tribal nations were provided scoping letters requesting their comments or concerns relative to the project area. One response letter was received from the Cherokee Nation whereby they reported that sensitive areas were located in close proximity to the originally proposed project (CAA). The CN modified the originally proposed project design to avoid the known resources. Once the project design was modified to omit the proposed parking garage facet, no resources should be affected by the PAA. Inadvertent discoveries of historically-important tribal resources may occur during construction. If any such resources are encountered during construction, the project proponent will cease construction activities and notify the CN, Oklahoma Archeological Survey, and tribal nations.

The NAA is not expected to result in adverse impacts to tribal resources.

3.13 Air Quality

The Clean Air Act (CAA) requires the USEPA to identify National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. Ambient air quality monitoring stations exist at various locations throughout Oklahoma. The NAAQS were established for ozone (O3), carbon monoxide (CO), nitrogen dioxide (NOx), sulfur dioxide (SOx), and particulate matter (PM10) and (PM 2.5). Areas that meet the national standards for the criteria air pollutants are in attainment. Areas that exceed the national standards are in nonattainment. Under the CAA, the EPA has classified air basins as being in attainment or nonattainment for each of the criteria pollutants and whether or not the standards have been achieved. Air quality in Oklahoma is measured and regulated by the Oklahoma Department of Environmental Quality, Air Quality Division (*Table 4*). Currently, Cherokee County, Oklahoma is in attainment in regard to the NAAQS with respect to the criteria pollutants CO, SO2, O3, NO2.5, PM10, and lead (Pb).

Table 4 - National Ambient Air Quality Standards						
Pollutant		Primary/Secondary	Averaging Time	Level		
Carbon Dio	xide	Primary	8-hour 1-hour	9 ppm 35 ppm		
Lead		Primary and Secondary	Rolling 3- month average	0.15µg/m ^{3 (1)}		
Nitrogen Di	oxide	Primary	1-hour	100 ppb		
		Primary and Secondary	Annual	53 ppb ⁽²⁾		
Ozone		Primary and Secondary	8-hour	0.075 ppm (3)		
Particulate	PM	Primary	Annual	12 μg/m³		
Pollution	2.5	Secondary	Annual	15 μg/m³		
		Primary and Secondary	24-hour	35 µg/m3		
	PM 10	Primary and Secondary	24-hour	150 μg/m³		

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Table 4 - National Ambient Air Quality Standards					
Pollutant	Primary/Secondary	Averaging	Level		
		Time			
Sulfur Dioxide	Primary	1-hour	0.075 ppb ⁽⁴⁾		
	Secondary	3-hour	0.5 ppm		

Environmental Consequences

The PAA is located in Cherokee County, which is classified as **in attainment** with regard to the NAAQS pollutants. Therefore, the construction of the PPA would have minimal to no effect on air quality.

Construction Related Emissions

The proposed project would generate local temporary short-term direct impacts on air quality during construction. Sources of dust will be generated from vehicular traffic and construction-related equipment (trucks, scrapers, and excavators). The emission levels of the anticipated construction equipment are expected to be minimal based on the relatively few numbers of construction equipment needed to accomplish the construction process. The following are recommendations to implement regarding the construction period of the project:

- Use ultra-low sulfur fuel (< 15 ppm) in all diesel engines.
- Use add-on controls such as catalysts and particulate traps where suitable.
- Minimize engine idling (e.g., 5-10 minutes/hour).
- Use equipment that runs on clean, alternative fuels as much as possible.
- Use updated construction equipment that was either manufactured after 1996 or retrofit to meet the 1996 emissions standards.
- Prohibit engine tampering and require continuing adherence to manufacturers' recommendations.
- Maintain engines in top running condition tuned to manufacturers' specifications.
- Phase project construction to minimize exposed surface areas.
- Reduce speeds to 10 and 15 mph in construction zones.
- Conduct unannounced site inspections to ensure compliance.
- Locate haul truck routes and staging areas away from sensitive population centers.

The project proponent or their selected contractors will implement dust control measures that will effectively eliminate and or minimize dust during construction activities. No long term or adverse impacts are anticipated.

Operational Related Emission

Criteria emission sources during operation of the proposed project will occur. Minor increases may result during times of increased traffic within the PAA; however, these periods are expected to be brief and intermittent enough to allow sufficient time for atmospheric assimilation. No adverse impacts area anticipated as a result of the PAA.

Under the NAA, no earth disturbing activities would occur and no emissions would result which would affect air quality, increase emissions, or climatological patterns.

3.14 Hazardous Materials

EEC performed a Hazardous Materials Assessment (HMA) within the proposed action area for recognized environmental conditions on March 16, 2022. The term recognized environmental conditions means the

Cherokee Nation Hospital Project Cherokee County, Oklahoma

presence or likely presence of any hazardous substances or petroleum products in, on, or at a property due to any release to the environment under conditions indicative of a release to the environment or under conditions that pose a material threat of a future release to the environment.

Environmental Consequences

No Recognized Environmental Conditions were reported or observed at the target property. The area is described as previously developed and consists of health facility buildings, parking areas, and roads. No issues were identified at the target property in the environmental database records/research that required further investigation. The Phase I Environmental Site Assessment report is provided at *Appendix E*.

The No-Action Alternative would not create or affect hazardous waste or materials.

3.15 Climate Change

Climate change is an important national and global concern. There is general agreement that the earth's climate is currently changing and anthropogenic (human-caused) greenhouse gas (GHG) emissions have been documented as contributing to this change. Carbon dioxide (CO2) makes up the largest anthropogenic component of these GHG emissions. However, there is no scientific methodology for attributing specific climatological changes to a particular project's emissions. The CEQ GHG emissions guidance requires action agencies to consider: (1) The potential effects of a proposed action on climate change as indicated by assessing GHG emissions (e.g., to include, where applicable, carbon sequestration); and (2) The effects of climate change on a proposed action and its environmental impacts.

This guidance recommends agencies quantify a proposed agency action's projected direct and indirect GHG emissions; use projected GHG emissions (to include, where applicable, carbon sequestration implications associated with the proposed agency action) as a proxy for assessing potential climate change effects; recommends agencies include a qualitative analysis and explain the basis for determining that quantification is not reasonably available because tools, methodologies, or data inputs are not reasonably available to support calculations for a quantitative analysis; discusses methods to appropriately analyze reasonably foreseeable direct, indirect, and cumulative GHG emissions and climate effects; considers reasonable alternatives for short- and long-term effects and benefits in the alternatives and mitigation analysis; advises agencies to use available information rather than undertaking new research, and provides examples of existing sources of scientific information; recommends using information developed during the NEPA review to consider alternatives that would make the actions and affected communities more resilient to the effects of a changing climate; outlines special considerations for agencies analyzing biogenic carbon dioxide sources and carbon stocks associated with land and resource management actions under NEPA; and using the agencies expertise and experience to consider an environmental effect and prepare an analysis based on the available information.

Environmental Consequences

Greenhouse gas emissions from construction of the PAA would be minor and similar to other small construction projects. Operation of the proposed PAA facilities are anticipated to result in a net decrease on greenhouse gas emissions, since the new facilities/structures would utilize the most modern, technologically advanced, and efficient systems. Therefore, no emissions significantly contributing to climate change would occur. Ecological changes in Oklahoma due to climate change are predicted to include warming temperatures and increased severity of both floods and drought over the next several decades. These changes are not expected to affect the need for, viability of, or environmental impacts of the PAA.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Under the NAA, no greenhouse gas emissions or impacts to or from climate change would occur.

3.16 Community Services

Community services are identified as providers of fire, police, and medical emergency services having jurisdiction within or surrounding the PAA property. Potential impacts could include disruption of service, site access prevention, and/or creating situations where traditional transportation routes or increased response times could occur – temporary or permanent. Impacts to said services could also result from the PAA by placing a greater burden on service providers directly attributed to response needs for which the providers are not currently staffed at sufficient levels to serve the PAA.

Environmental Consequences

The PAA is situated on previously developed and access-improved areas on CN property. No service disruptions, access restrictions, transportation route modifications to the PAA or surrounding community(ies) or changes which would alter emergency service response times beyond the PAA are expected to occur as a result of the PAA. Increased burden on law enforcement and/or fire services are not anticipated based on their current force sizes relative to the community demands and coverage. No adverse impacts to community services are expected to occur as a result of the PAA.

The NAA would not alter the currently-provided community services.

3.17 Transportation and Parking

The PAA would result in development of a new parking lot adjacent to the new health care facility. Impacts to existing transportation and parking facilities could result from the PAA through increased traffic volumes or service loads on the existing roadways and/or parking areas.

Environmental Consequences

The PAA is situated within an existing health care campus on CN property. Ample parking associated with the PAA has been incorporated into the overall facility design to accommodate expected transportation and parking needs. No public parking areas are located within or near the PAA. Increases in traffic on the local area streets may occur resulting from increased member use of the new facility, however traffic and vehicle noise levels are expected to be very minor and similar to those currently experienced from the larger overall medical campus. No negative impacts relative to these public interest review factors are expected to result from the PAA.

The NAA would not affect current transportation or parking patterns.

3.18 Utilities

Evaluation of this public interest review factor is traditionally associated with determining if any impacts would be expected to existing infrastructure as well as considering the potential impacts of the PAA that could occur as a result of establishing new utility infrastructure. Utilities required to support the PAA would include water, sewer, natural gas, electricity, and/or telecommunications services.

Environmental Consequences

Based on the engineering design, survey information, and adjacent residences/businesses requiring the same utilities, all services are currently available adjacent to the PAA. Connection to said utilities, other than the new sanitary and waterlines, to support the PAA would be available without additional construction activities to bring services to the PAA. Services are located adjacent to the PAA within the existing rights

Cherokee Nation Hospital Project Cherokee County, Oklahoma

of way and/or easements along the adjacent arterial streets. No existing system upgrades have been identified as necessary to support the PAA. No adverse impacts are expected to occur relative to this public interest review factor.

The NAA would not cause impacts on existing utility systems.

3.19 Potential for Generating Substantial Controversy

Controversy or opposition to a proposed action can typically include but not necessarily be limited to actions that may have; the potential to disrupt natural scenic vistas, sensitive areas, conflict with established zoning requirements, disturb local communities, result in decreased local business revenues, remove or change, historic public recreation opportunities, situate highway facilities in locations where not previously constructed, and/or result in the eminent domain 'take' of private property. The PAA is associated with a new medical facility to address the needs of the CN and tribal members. The PAA is located on previously developed CN property.

Environmental Consequences

Intermittent, limited, and short-term potential for noise level increases may be possible from facility construction but are not anticipated to result in adverse effects to other adjacent properties within and/or associated with a developed health care campus. The PAA would result in expansion of the existing medical facility on CN property. Private residences are located adjacent to or near the action area No concerns were expressed by the commenting agencies or tribal nations or have been identified by the CN or through preparation of this EA. Based on this rationale, the potential for substantial controversy is not expected.

The NAA would not result in substantial controversy.

3.20 Cumulative Effects

Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (CFR 40 § 1508.7). The cumulative impacts that result from an action may be undetectable but can add to other disturbances and eventually lead to a measurable environmental change. For any given resource, a cumulative impact would only potentially exist if the resource were also directly impacted by the proposed action.

3.21 Impact Summary

Only those resources or public interest review factors which have been identified as having potential adverse impacts and for which mitigation measures will be employed are described below. Public interest review factors evaluated which would not be potentially affected are not discussed. *Table 5* below identifies all public interest review factors considered as well as the anticipated impact relative thereto.

Soils

The PAA would modify the topographic setting of the action area through grading, site preparation, and conversion of existing soils to impervious surfaces. Implementation of the PAA should not result in cumulatively considerable adverse effects to soils. All temporarily disturbed soils will be restored upon completion to restore site coverage to reduce or prevent soil erosion or sedimentation. No adverse impacts were identified by NRCS.

Vegetation

Vegetation, primarily herbaceous, will be affected by the PAA. All disturbed soils will be restored upon site grading or facility completion to restore site coverage to reduce or prevent soil erosion or sedimentation.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Native herbaceous species will be used to revegetate disturbed areas not designated for impervious surfaces.

Biological Resources (Fish and Wildlife Resources and Threatened/Endangered Species)

The project area does not contain any unique or sensitive ecosystems or biological communities. Terrestrial species would be able to move to adjacent areas with unrestricted access. Some terrestrial habitat would be removed but the activities should not result in adverse cumulative effects to any aquatic or terrestrial species. Avoidance and minimization of habitat impacts were implemented during site design and facility orientation also served as mitigation measures. No further mitigation relative to fish and wildlife resources are proposed.

Cumulative Effects

Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (CFR 40 § 1508.7). The cumulative impacts that result from an action may be undetectable but can add to other disturbances and eventually lead to a measurable environmental change. For any given resource, a cumulative impact would only potentially exist if the resource were also directly impacted by the proposed action.

Table 5 – Impact Summary Matrix						
Public Interest Factor	Beneficial Impact	No Impact	Minimal Adverse Impact	Adverse Impact	Significant Adverse Impact	Mitigation/ Avoidance MeasuresProposed
Land Use	•					
Social Environment	•					
Economic Environment	•					
Aesthetics			•			•
Environmental Justice		•				
Protection of Children		•				
Soils			•			•
Farmland		•				
Floodplains		•				
Wetlands		•				
Surface Water (Water Quality)		•				
Groundwater		•				
Vegetation			•			•
Biological Resources			•			•
Threatened/ Endangered Spp.		•				
Cultural Resources		•				

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Air Quality		•		
Hazardous Material		•		
Geology		•		
Community Services	•			
Transportation & Parking		•		
Utilities		•		
Potential for Controversy		•		
Cumulative Impacts		•		

4.0 MANAGEMENT AND MITIGATION MEASURES

Mitigation is defined by CFR 1508.20 as:

- (a) Avoiding the impact altogether by not undertaking a certain action or parts of an action.
- (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- (e) Compensating for the impact by replacing or providing substitute resources or environments. Mitigation measures to be implemented during construction of the PAA are summarized below.

<u>Soils</u>

All disturbed soils will be restored/repaired as close to the original condition as practicable and stabilized with vegetation and/or erosion control measures.

Water Quality

Mitigation measures will be implemented as part of the design and construction of the PAA to reduce impacts resulting from erosion or stormwater runoff. The project proponent will comply with all requirements of the Clean Water Act as required by the state Water Quality Certification (Section 401), the National Pollutant Discharge Elimination System (NPDES) as required by Section 402, and point source impacts to waters of the US through Section 404 of the Clean Water Act permit issuance and condition compliance.

Vegetation

Mitigation measures will be implemented to restore any affected environment to its original or natural state to the extent practicable. The identified BMP's will be employed during all project phases. Vegetation removal would be required to construct the proposed action. Replacement of the affected vegetation is proposed and would be accomplished through installation of native herbaceous species providing the most benefit for wildlife, habitat, and aesthetics. A suggested planting ratio of native grass species to forbs should be 70% grasses and 30% forbs. The planting (seeding) rate would be determined based on the selected species and required aerial coverage. Depending on the seasonal timing of seeding, planting area slope, and topography, a light straw mulching (or mulch blankets) may be utilized to increase germination rates and

Cherokee Nation Hospital Project Cherokee County, Oklahoma

restored/repaired soil stability. Additional compensatory mitigation measures are proposed to offset the expected temporary and/or permanent adverse impacts to fish, wildlife, and their habitat include:

- 1) Revegetation of exposed soil areas using native herbaceous species;
- 2) Placement of silt fences, if practicable.

During eroded area repair activities, Best Management Practices (BMPs) would be followed to ensure sediment control. The intent would be to prevent accelerated erosion to the extent practicable. The BMPs would be designed specific to the site and maintained during the operational/repair activities. The temporary control devices will be removed after vegetation is established.

Biological Resources

Implementation of the following mitigation measure would ensure that the proposed action would avoid or minimize potential adverse effects to migratory birds and other birds of prey protected under the Migratory Bird Treaty Act (MBTA):

If the project begins during the nesting season for birds of prey and migratory birds (between February 1 and October 1), a preconstruction bird survey for nesting sites will be conducted within the project site no more than 14 days prior to commencement with construction activities. The qualified biologist will document and submit the results of the preconstruction survey in a letter to the CN within 30 days following the survey. If no active nests or roosts are identified during the preconstruction survey, then no further mitigation is required. If any active nests are identified during the preconstruction survey within the project site, a buffer zone will be established around the nests. A qualified biologist will monitor nests weekly during construction to evaluate potential nesting disturbance by construction activities. The biologist will demarcate the buffer zone with construction tape or pin flags within 100 feet of the active nest and maintain the buffer zone until the end of the breeding season or until the young have fledged. Guidance from the CN will be requested if establishing a 100-foot buffer zone is impractical if the nestlings within the active nest appear disturbed. Tree removal activities are proposed to be conducted within the fall/winter/early spring time periods to avoid impacts to bat species and/or their habitats when said species are present.

Cultural Resources

In the event of an inadvertent discovery of archaeological resources shall be subject to Section 106 of the National Historic Preservation Act as amended (36 CFR 800), the Native American Graves Protection and Repatriation Act (NAGPRA)(25 USC 3001 et seq.), and the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-mm). Specifically, procedures for post review discoveries without prior planning pursuant to 36 CFR 800.13 shall be followed. The purpose of the following mitigation measures is to minimize the potential adverse effect of construction activities to previously unknown archaeological or paleontological resources in the case of inadvertent discovery:

- All work shall be halted until a professional archaeologist, or paleontologist if the find is of a paleontological nature, can assess the significance of the find.
- If any archaeological find is determined to be significant by the archaeologist, or paleontologist as appropriate, then representatives of the Tribe shall meet with the archaeologist, or paleontologist, to determine the appropriate course of action, including the development of a Treatment Plan, if necessary.
- All significant cultural or paleontological materials recovered shall be subject to scientific analysis, professional curation, and a report prepared by the professional archaeologist, or paleontologist, according to current professional standards.
- If human remains are discovered during ground-disturbing activities, pursuant to NAGPRA, the

Cherokee Nation Hospital Project Cherokee County, Oklahoma

Tribal Official and CN representative shall be contacted immediately. No further disturbance shall occur until the Tribal Official and agency representative have made the necessary findings as to the origin and disposition.

 If the remains are determined to be of Native American origin, the CN representative shall notify a Most Likely Descendant (MLD). The MLD is responsible for recommending the appropriate disposition of the remains and any grave goods.

Hazardous Materials

The project proponent will require all contractors or operators to report such accidental spills immediately upon notice of occurrence. The operator will be made responsible for cleanup and/or removal of such spillage as well as contaminated soils, as deemed necessary by the project proponent.

5.0 AGENCY AND TRIBAL COORDINATION

Appropriate federal, county, and state resource agencies and tribal nations were contacted to solicit views and provide input on the proposed project resources. Scoping letters requesting comments or pertinent information relative to the proposed project were sent to multiple regulatory and resource agencies as well as Native American tribes having potential interest in the proposed project. Scoping letters and received responses from agencies and tribes are included as representative responses in *Appendix B*.

6.0 APPLICABLE FEDERAL LAWS AND REGULATIONS

APPLICABLE FEDERAL ENVIRONMEN	TAL LAWS AND REGULATIONS
Archeological and Historical Preservation Act	1974, 16 U.S.C. 469, <u>et seq</u>
Clean Air Act, as amended	1990, 42 U.S.C. 7609, <u>et seq</u>
Clean Water Act, as amended	1977, U.S.C. 1251, <u>et seq</u>
Council on Environmental Quality	2020, 40 CFR Parts 1500-1508
Endangered Species Act, as amended	1973, 16 U.S.C. 1531, <u>et seq</u>
Federal Water Project Recreation Act, as amended	1965, 16 U.S.C. 460-1-12, et seq
Fish and Wildlife Coordination Act, as amended	1934, 16 U.S.C. 661, <u>et seq</u>
Land and Water Conservation Fund Act, as amended	1965, 16 U.S.C. 661, et seq
National Historic Preservation Act, as amended	1966, 16 U.S.C. 470a, et seq
National Environmental Policy Act, as amended	1969, 42 U.S.C. 4321, et seq
Native American Graves Protection & Repatriation Act	1990, 25 U.S.C. 3001-13, et seq
Rivers and Harbors Act	1899, 33 U.S.C. 401, et seq
Watershed Protection and Flood Prevention Act	1954, 16 U.S.C. 1001, et seq
Floodplain Management	1977, Executive Order 11988
Protection of Wetlands	1977, Executive Order 11990
Environmental Justice	1994, Executive Order 12898
Environmental Health and Safety Risks	1997, Executive Order 13045
Federal Facilities on Historic Properties	1996, Executive Order 13006
Accommodation of Native American Sacred Sites	1996, Executive Order 13007
Farmland Protection Policy Act	1981, 7 U.S.C. 4201, <u>et seq</u>
National Invasive Species Act	1966, 16 U.S.C. 4701, et seq (E.O 13112)
Aquatic Nuisance Species Prevention and Control Act	1990, 16 U.S.C. 4701, et seq
Water Resources Planning Act	1965
Recreational Fisheries	Executive Order 12962
Protection of Migratory Birds	Executive Order 13186
USACE Procedures for Implementing NEPA	33 CFR Part 230

Cherokee Nation Hospital Project Cherokee County, Oklahoma

7.0 LIST OF PREPARERS



Steven Votaw, President. Steve has 34 years of experience in biological and ecological studies. Mr. Votaw is the President of Eagle Environmental Consulting, Inc. (20+ years) and has been the Project Manager on various environmental impact statements, environmental site assessments, biological resource evaluations, wetland delineations, and threatened and endangered species surveys. Mr. Votaw was previously a Senior Regulatory Project Manager (10 years) with the U.S. Army Corps of Engineers and Fisheries Technician with the Oklahoma Department of Wildlife Conservation (2 years). Mr. Votaw received a Bachelor of Science degree in Fisheries Management and Wildlife Biology from Northeastern Oklahoma State University with post-graduate work in environmental science.

Jeff London, **National Resource and Sr. GIS Analyst**. Jeff has years of experience in the environmental field. Mr. London was previously a Lake and Project Manager for the U.S. Army Corps of Engineers (35 years). Mr. London was responsible for managing the O&M, recreation, and natural resource programs. He also served as an outdoor recreation planner and project manager for District- wide recreation, environmental and interagency support programs. Additionally, he uses Geographic Information System (GIS) and CAD technology to analyze and display environmental features in support of biological and ecological studies and NEPA documentation. Mr. London received a Bachelor of Science degree in forestry from Oklahoma State University with postgraduate work in GIS.

Sean Votaw, Field Biologist and GIS Specialist. Sean has 6 years of experience in biological and ecological surveys as well as wetland and waterway delineations and Phase I environmental site assessments. Mr. Votaw received a Bachelor of Science degree in Fish and Wildlife Biology from Northeastern Oklahoma State University.

Jessica Darnell, Technical Document Manager. Jessica has 7 years of experience composing and editing NEPA documents and technical scientific reports including biological and ecological assessments, Waters of the United States Delineations, and Phase I environmental site assessments. Ms. Darnell holds a bachelor's degree from the University of Central Oklahoma where she graduated with Summa Cum Laude honors.

8.0 **REFERENCES**

Council on Environmental Quality. 2022. Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act.

Curtis N.M. and W.E. Ham. 1979. Geomorphic Provinces of Oklahoma. In: Geology and Earth Resources

Cherokee Nation Hospital Project Cherokee County, Oklahoma

of Oklahoma. Education Publication 1. Oklahoma Geological Survey.

Eagle Environmental Consulting, Inc. 2022. Biological Assessment.

Eagle Environmental Consulting, Inc. 2022. Hazardous Materials Assessment.

Eagle Environmental Consulting, Inc. 2022. Waters of the US Delineation.

Environmental Protection Agency. 2019. National Multi-Pollutant County Maps, Map of Number of NAAQS by County Designated Nonattainment-US Map, Assessed at https://www3.epa.gov/airquality/greenbook/mapnpoll.html

Miser, H.D. 1954. Geologic Map of Oklahoma. Oklahoma Geological Survey.

Oklahoma Department of Environmental Quality. 2022. Data Viewer. Assessed at https://gis.deq.ok.gov/maps/

Oklahoma Climatologic Survey. 2022. Cherokee County, Oklahoma Climate Summary.

Oklahoma Department of Environmental Quality. 2014. The 303(d) list of Category 5 impaired waterbodies in Oklahoma. http://www.deq.state.ok.us/WQDNew/305b_303d/index.html.

Oklahoma Geological Survey Website. 2022. Major Geological Provinces of Oklahoma. http://www.ou.edu/content/ogs/generalinterest.html

Oklahoma Water Resources Board Website. 2022. Interactive Maps and GIS Data. http://www.owrb.qok.gov/maps/index.php.

United States Army Corps of Engineers. 1987. Wetland Delineation Manual, Wetlands Research Program Technical Report, Y-87-1 and Regional Supplement.

United States Environmental Protection Agency. 2019. Website. http://www.epa.gov/region6/water/swp/ssa/maps.htm

U.S. Department of Health and Human Resources Website. 2022. Income Ranges Associated with 2019 Poverty Guidelines. https://www.acf.hhs.gov/occ/resource/income-ranges-associated- with-2017-poverty-guidelines.

U.S. Environmental Protection Agency Website. 2019. Green Book Map Downloaded. Accessed at https://www.epa.gov/green-book/green-book-map-download

United States Federal Emergency Management Administration Website. 2022. FEMA Flood Map Service Center. http://msc.fema.gov/portal.

United States Department of Agriculture, Natural Resources Conservation Service. Web Soil Survey for Cherokee County, Oklahoma. http://websoilsurvey.nrcs.usda.gov.

U.S. National Park Service. 2022. National Wild and Scenic Rivers System List. https://www.rivers.gov/.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

U.S. National Park Service. 2022. Explore Designated Rivers Map. Access at: https://www.rivers.gov/oklahoma.php

U.S. Fish and Wildlife Service. 1985. Determination of the endangered and threatened status for the Piping Plover. Federal Register 50(238): 507020-34

U.S. Fish and Wildlife Service. 1985. Interior population of the Least Tern determined to be endangered. Federal Register 50: 21784-21792.

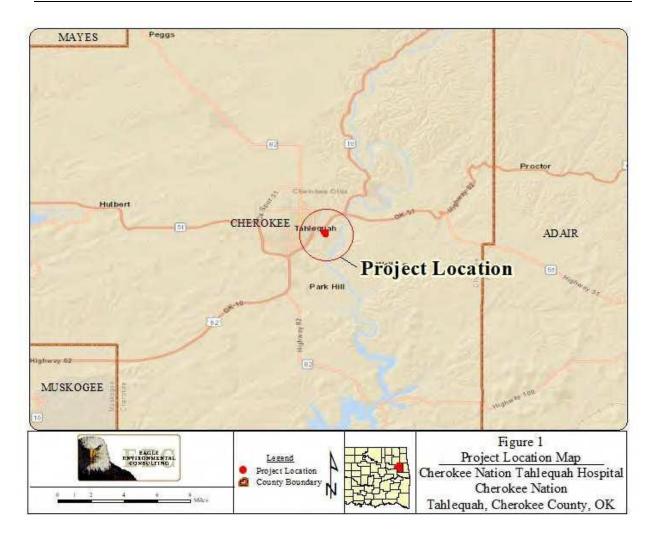
U.S. Fish and Wildlife Service. 1970. Determination of endangered status for the Whooping Crane. Federal Register 35: 8495.

United States Department of the Interior, U.S. Fish and Wildlife Service. 2021. Official Species List: Federally-listed threatened and endangered species. IPAC.

Cherokee Nation Hospital Project Cherokee County, Oklahoma

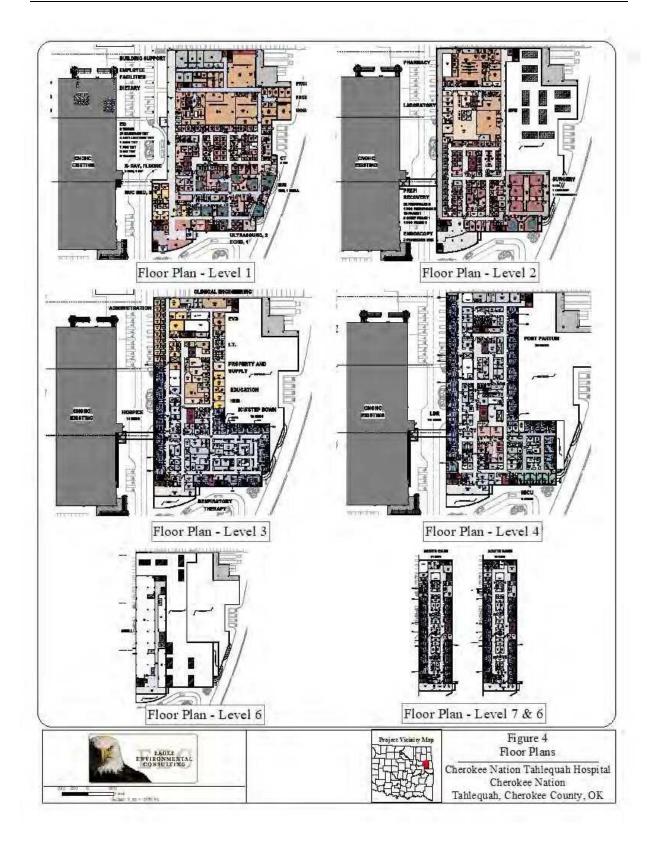
APPENDIX A

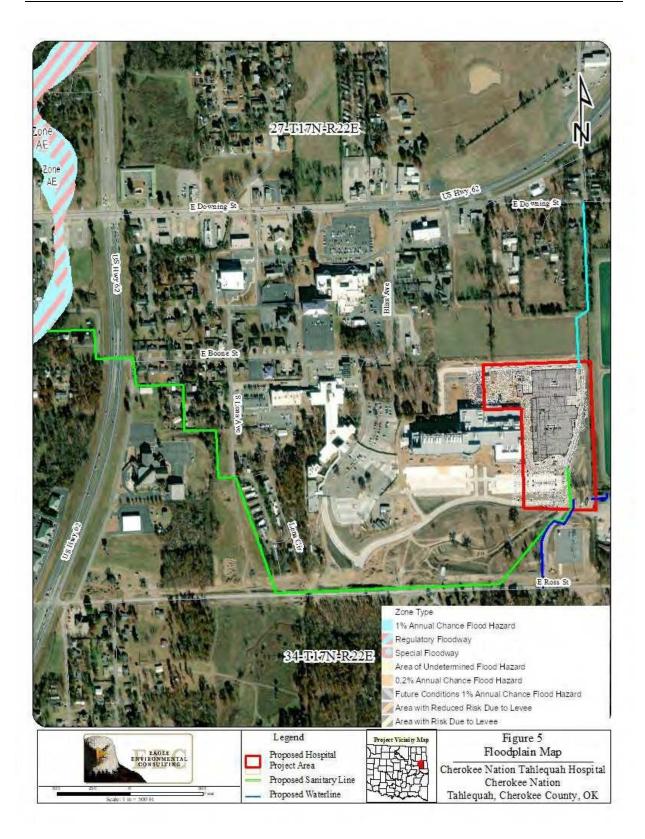
PROPOSED ACTION MAPS AND REPRESENTATIVE PHOTOGRAPHS







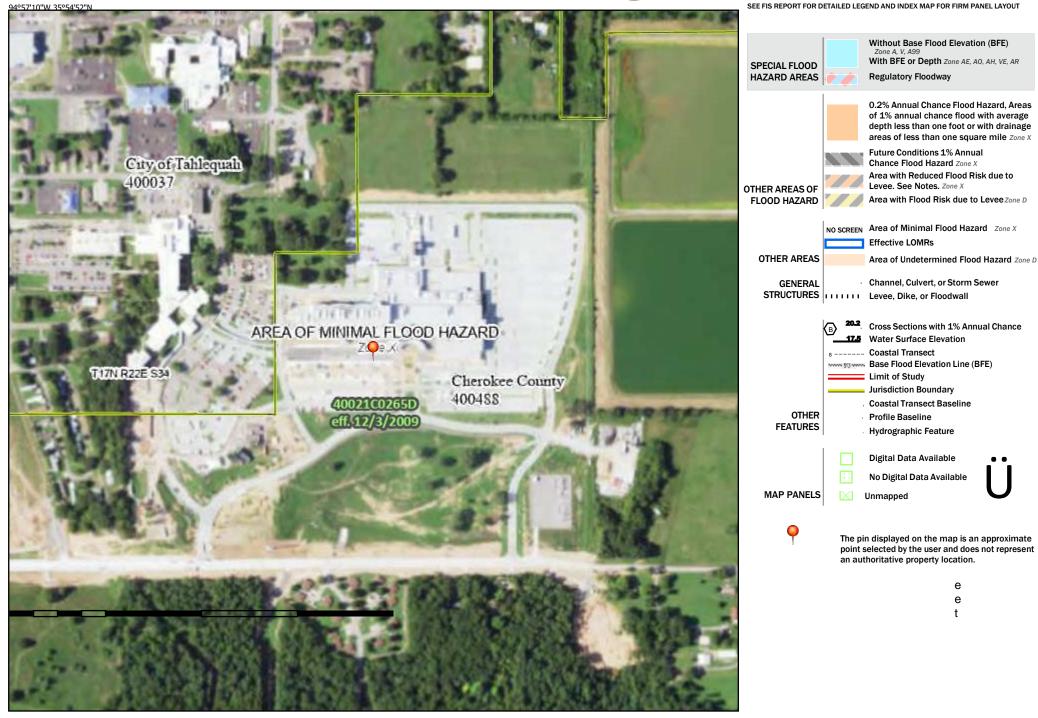




National Flood Hazard Layer FIRMette



Legend



1:6,000

94°56'32"W 35°54'23"N

This provided by FEMA. This map map was com plies exported on with 2/16/2022 FEM at 3:05 PM A's and does not reflect stan dard changes or s for amendment the s use subsequent of to this date digit and time. al The NFHL and effective floo d information may change map s if it or become is superseded by new data not void over time. as desc This map image ribe is void if the one or more of the d following map belo elements do not w. The appear: base basemap тар imagery, flood sho zone labels, legend, scale wn bar, map com plies creation date, community with FEM identifiers, FIRM A's panel number, and FIRM base тар effective date. accu Map images for racy unmapped and unmodernized stan areas cannot be dard used for regulatory The purposes. flood haza rd infor mati on is deriv ed direc tly from the auth orita tive NFH web servi

s

L

ces

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020













PL: 4

Proposed Action Maps and Site Photographs July 2022



PL: 5



PL: 6







PL: 8

Cherokee Nation Hospital Project Cherokee County, Oklahoma















PL: 12

Proposed Action Maps and Site Photographs July 2022



PL: 13



PL: 13







PL: 15

Proposed Action Maps and Site Photographs July 2022



PL: 16











PL: 20



PL: 20

PL: 19

APPENDIX B

AGENCY AND TRIBAL COORDINATION



Ms. Jonna Polk, Project Leader U.S. Fish and Wildlife Service 9014 E. 21st Street

Tulsa, Oklahoma 74129

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Ms. Polk,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vitaur Steven R. Votaw

Steven R. Votaw President

Via email: OKProjectReview@fws.gov



Mr. Jay Alred Cherokee Floodplain Administrator 213 W. Delaware Ave., Rm 200

Tahlequah, OK 74464

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Alred,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun R. Vataw

Steven R. Votaw President

Via email: jjalred66@gmail.com



Mr. Andrew Commer Chief of Regulatory Division, U.S. Army Corps of Engineers 2488 E. 81st Street Tulsa. OK 74137-4290

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Commer,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vataw Steven R. Votaw

Steven R. Votaw President

Via email: ceswt-ro@usace.army.mil



Mr. Jon A. Roberts, Senior Manager Office of External Affairs, OK Dept. of Environmental Quality P.O. Box 1677 Oklahoma City, Oklahoma 73101

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Roberts,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stur & Vitaw Steven R. Votaw

Steven R. Votaw President

Via email: EnvReviews@deq.ok.gov



Mr. Todd D. Fagin Oklahoma Biology Survey 111 E. Chesapeake Street Norman, Oklahoma, 73019

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Fagin,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun R Vataur Steven R. Votaw

Steven R. Votaw President

Via email: tfagin@ou.edu



Ms. Julie Cunningham, Executive Director Oklahoma Water Resources Board 3800 North Classen Blvd Oklahoma City, Oklahoma 73118

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Ms. Cunningham,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun R Vitaur Steven R. Votaw

Steven R. Votaw President

Via email: bill.cauthron@owrb.ok.gov



Mr. Steve Glascow, State Resource Conservationist U.S. Natural Resources of Conservation Service 100 USDA, Suite 206 Stillwater, Oklahoma 77074

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Glascow,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vataw Steven R. Votaw

Steven R. Votaw President

Via email: steven.glasgow@usda.gov



Mr. Brooks Tramell, Wetlands Program Coordinator Oklahoma Concervation Commission 2800 N Lincoln Blvd

Oklahoma City, Oklahoma 73105

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Tramell,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stury & Vitaw

Steven R. Votaw President

Via email: brooks.tramell@conservation.ok.gov; sarah.gilmer@conservation.ok.gov



Mr. David P. Brown, Associate Director Oklahoma Geological Survey 100 E. Boyd St., Suite N131 Norman, Oklahoma 73019

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Brown,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vataur Steven R. Votaw

Steven R. Votaw President

Via email: jwalter@ou.edu



Director Jason Lewis U.S. Geological Survey Oklahoma Water Science Center 202 NW 66th Street Oklahoma City, Oklahoma 73116

RE: Cherokee Nation Tahleguah Hospital, Cherokee County, OK

Dear Mr. Lewis,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stury & Vataw Steven R. Votaw

Steven R. Votaw President

Via email: jmlewis@usgs.gov



Mr. Robert Houston, Staff Director Office of Communities, Tribes and Environmental Assessment U.S. EPA Region 6, 1201 Elm Street, Suite 500, Mail Code: ORACN Dallas, TX 75270-2102

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Houston,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stury & Vitaw

Steven R. Votaw President

Via email: Houston.Robert@epa.gov



Mr. J.D. Strong. Director Oklahoma Department of Wildlife Conservation P.O. Box 53465 Oklahoma City, Oklahoma 73152

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Director Strong,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stur & Vataw Steven R. Votaw

President

Via email: rhonda.hurst@odwc.ok.gov



Mr. Eddie Streater Bureau of Indian Affairs P.O. Box 8002

Muskogee, Oklahoma 74402

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Streeter,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun R Vataur Steven R. Votaw

Steven R. Votaw President

Via email: eddie.streater@bia.gov



Dr. Andrea Hunter Director & Tribal Historic Preservation Officer The Osage Nation 627 Grandview Avenue Pawhuska, Oklahoma 74056

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Dr. Hunter,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vatan-

Steven R. Votaw President

Via email: ahunter@osagenation-nsn.gov



Robin Williams Tribal Historic Preservation Officer Wichita and Affiliated Tribes P.O. Box 729 Anadarko, Oklahoma 73005

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Preservation Officer Williams,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

EAGLE ENVIRONMENTAL CONSULTING, INC.

Steven R. Votaw

Steven R. Votav President

Via email: THPO@wichitatribe.com



Ms. Tamara Francis Tribal Historic Presveration Officer Caddo Nation of Oklahoma P.O. Box 487

Binger, OK 73009

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Ms. Francis,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vatan-Steven R. Votaw

President

Via email: tffourkiller.cn@gmail.com



Ms. Elizabeth Toombs Cherokee Nation Tribal Historic Preservation Office P.O. Box 948

Tahlequah, OK 74465

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Ms. Toombs,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stur R. Vataw Steven R. Votaw

Steven R. Votaw President

Via email: elizabeth-toombs@cherokee.org



Mr. Ben Yahola TPHO, Alabama-Quassarte Tribal Town PO Box 187 Wetumka, OK 74883

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Yahola,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stur & Vitaw Steven R. Votaw

Steven R. Votaw President

Via email: Ben.Yahola@alabama-quassarte.org



Mr. Bobby Komardley Chairman, Apache Tribe of Oklahoma PO Box 1330 Anadarko, OK 73005

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Komardley,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vataw

Steven R. Votaw President

Via email: bkomardley@outlook.com



Mr. Max Bear THPO, Cheyenne and Arapaho Tribes, Oklahoma 700 Black Kettle Blvd. Concho. OK 73022

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Bear,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

tun & Vataw Steven R. Votaw

Steven R. Votaw President

Via email: mbear@c-a-tribes.org



Ms. Corain Lowe-Zepeda THPO, Muscogee (Creek) Nation PO Box 580 Okmulgee, OK 74447

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Ms. Lowe-Zepeda,

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Washington County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at steve@eagle-env.com. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stur & Vataw Steven R. Votaw

Steven R. Votaw President

Via email: section106@mcn-nsn.gov

OBS Ref. 2022-054-BUS-EAG

Dear Mr. Votaw,

We have reviewed occurrence information on federal and state threatened, endangered or candidate species, as well as non-regulatory rare species and ecological systems of importance currently in the Oklahoma Natural Heritage Inventory database for the following location you provided:

Sec. 33-T17N-R22E, Cherokee County

We found 14 occurrence(s) of relevant species within the vicinity of the project location as described.

Species Name	Common Name	Federal Status
Nicrophorus americanus	American burying beetle	Threatened
County	TRS	Count
Cherokee	Sec. 9-T16N-R22E	1
Lampsilis rafinesqueana	Neosho Mucket	Endangered
County	TRS	Count
Cherokee	Sec. 1-T16N-R22E	1
Cherokee	Sec. 12-T17N-R22E	2
Cherokee	Sec. 24-T17N-R22E	1
Cherokee	Sec. 25-T17N-R22E	1
Cherokee	Sec. 26-T17N-R22E	1
Haliaeetus leucocephalus	Bald Eagle	Protected
County	TRS	Count
Cherokee	Sec. 1-T17N-R22E	1
Cherokee	Sec. 12-T17N-R22E	2
Cherokee	Sec. 35-T17N-R22E	4

Additionally, absence from our database does not preclude such species from occurring in the area.

If you have any questions about this response, please send me an email, or call us at the number given below.

Although not specific to your project, you may find the following links helpful.

ONHI, guide to ranking codes for endangered and threatened species: <u>http://www.oknaturalheritage.ou.edu/content/biodiversity-info/ranking-guide/</u>

Information regarding the Oklahoma Natural Areas Registry: <u>https://okregistry.wordpress.com/</u>

Todd Fagin Oklahoma Natural Heritage Inventory (405) 325-4700 tfagin@ou.edu J. KEVIN STITT GOVERNOR

MATT PINNELL LIEUTENANT GOVERNOR



TREY LAM EXECUTIVE DIRECTOR

LISA KNAUF OWEN ASSISTANT DIRECTOR

February 4, 2022

Steve Votaw President Eagle Environmental Consulting, Inc. PO Box 335 Vinita, OK 74301

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Mr. Votaw:

Your request for a wetland determination for the referenced project, as described in your letter of February 3, 2022 has been reviewed using the Soil Survey of Cherokee County and the U.S. Fish and Wildlife Service National Wetland Inventory maps. Neither hydric soils nor wetlands are indicated, indicating that these areas most likely do not contain wetland ecosystems and that this proposed project should not significantly impact wetland resources in the area. If you believe this determination to be inaccurate, an on-site investigation may be needed. This investigation needs to be coordinated with the U.S. Army Corps of Engineers, Regulatory Branch, in Tulsa. Their address and phone number is:

U.S. Army Corps of Engineers Mr. Andy Commer Chief of Regulatory Branch 2488 E 81st St. Tulsa, OK 74137 918/669-7400

Based on our wetlands determination criteria there should be no significant impact on wetland resources in the area described. If you have any further questions or concerns, please contact me at 405/534-6997.

Sincerely,

Brook & Framell

Brooks Tramell Wetlands Program Coordinator Water Quality Division

cc: Wetlands file

From:	steve@eagle-env.com
То:	laura.palmer@bia.gov
Cc:	steve@eagle-env.com
Subject:	FW: Proposed Tahlequah Hospital
Date:	Friday, February 4, 2022 10:35:31 AM
Attachments:	Scoping Letter Exhibit - 2-3-22.jpg
	Tahlequah Hospitall - Agency Scoping Letter - BIA.pdf
	image002.png

Ms. Palmer,

Eagle Environmental will be preparing and environmental assessment on behalf of the Cherokee Nation for the captioned project. We have been advised BIA will be the lead federal agency and therefore reviewing our forthcoming document. I am forwarding our scoping letter to you in Mr. Callison's absence. Please let me know if you have any questions or would like to discuss. Thank you.

Steven R. Votaw President



P.O. Box 335 Vinita, OK 74301 2 918-272-7656 http://www.eagle-env.com

From: steve@eagle-env.com <steve@eagle-env.com>
Sent: Friday, February 4, 2022 10:21 AM
To: 'eddie.streater@bia.gov' <eddie.streater@bia.gov>; Callison, Eric R <Eric.Callison@bia.gov>
Subject: Proposed Tahlequah Hospital

Hello,

Please find the attached scoping letter and exhibit for your review and comment. We are contacting you as part of our agency coordination effort relative to the proposed project area. We look forward to your response. Thank you.

Steven R. Votaw President

P.O. Box 335

ENVIRONMENTAL CONSULTING

From:	
To:	
Subject:	
Date:	
Attachme	ents:

Glasgow, Steven - NRCS, Stillwater, OK steve@eagle-env.com RE: [External Email]Proposed Tahlequah Hospital Monday, February 7, 2022 8:07:45 AM image005.png_

Per your request, we have reviewed the subject project information and determined that the proposed project will not impact any easements, watersheds or prime farmland soils as defined by the Farmland Protection Policy Act.

Steve Glasgow State Resource Conservationist

100 USDA, Suite 206 | Stillwater, Ok. 74074 | O: 405.742.1235 | C: 405.612.7800

NRCS Natural Resources Conservation Service

Helping People Help the Land...

From: steve@eagle-env.com <steve@eagle-env.com>
Sent: Friday, February 4, 2022 10:23 AM
To: Glasgow, Steven - NRCS, Stillwater, OK <steven.glasgow@usda.gov>
Subject: [External Email]Proposed Tahlequah Hospital

[External Email]

If this message comes from an unexpected sender or references a vague/unexpected topic; Use caution before clicking links or opening attachments. Please send any concerns or suspicious messages to: Spam.Abuse@usda.gov

Hello,

Please find the attached scoping letter and exhibit for your review and comment. We are contacting you as part of our tribal coordination effort relative to the proposed project area. We look forward to your response. Thank you.

Steven R. Votaw President



P.O. Box 335 Vinita, OK 74301 2 918-272-7656 http://www.eagle-env.com

This electronic message contains information generated by the USDA solely for the intended recipients. Any unauthorized interception of this message or the use or disclosure of the information it contains may violate the law and subject the violator to civil or criminal penalties. If you believe you have received this message in error, please notify the sender and delete the email immediately.



February 15, 2022

Kary L. Stackelbeck, Ph.D., State Archaeologist Oklahoma Archeological Survey 111 E. Chesapeake Norman, OK 73019

RE: Cherokee Nation Tahlequah Hospital, Cherokee County, OK

Dear Dr. Stackelbeck:

Eagle Environmental Consulting, Inc. proposes to perform the necessary surveys and data collection effort leading to the completion of an Environmental Assessment (EA) addressing the potential environmental impacts to tribally-owned and private properties adjacent to and near the W.W. Hastings Hospital in Tahlequah, OK. The federal action agency will be the U.S. Bureau of Indian Affairs (BIA). The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County, OK. The proposed action area and feature locations are depicted on the attached exhibit.

To assist in the early identification of potential environmental impacts, we request your comments regarding your areas of expertise. We would appreciate your comments by March 4, 2022. Replies should be addressed to Steve Votaw, Eagle Environmental Consulting, Inc, P.O. Box 335, Vinita, OK 74301 or by e-mail at <u>steve@eagle-env.com</u>. Thank you for your cooperation and prompt response.

Sincerely,

EAGLE ENVIRONMENTAL CONSULTING, INC.

Stur R. Vitaw

Steven R. Votaw President

Via email: dgreen@ou.edu

From:	Jon Roberts on behalf of DEQ EnvReviews	
То:	steve@eagle-env.com	
Subject:	Environmental Impact Reviews	
Date:	Friday, February 18, 2022 9:48:35 AM	
Attachments:	image001.png	

Dear Mr. Votaw:

In response to your requests, we have completed a general environmental impact review for the projects listed below.

Projects

- 1. Letter dated February 3, 2022 Cherokee Nation Tahlequah Hospital, Tahlequah, Cherokee County, OK [35.91141, -94.94533]
- 2. Letter dated February 3, 2022 Chickasaw WWTP Expansion, Bartlesville, Washington County, OK [36.75807, -95.96041]

Adverse Environmental Impacts Under DEQ Jurisdiction

None anticipated.

Additional Regulatory Considerations

A. For Project # 1, since the property is on Trust land, EPA has jurisdictional authority regarding storm water permitting. Please visit the EPA website at

https: //www.epa.gov/ npdes/ subm it ting- notice- intent- noi- notice- term ination- not- or- lowerosivity- waiver- lew- under/ for any storm water perm it ting questions.

B. For Project #2, please note that prior to beginning any construction activity disturbing more than one acre, you must submit an NOI and obtain authorization under OKR10, construction storm water. If you need assistance, please contact DEQ's Storm water Unit at (405) 702-6100.

C. For Project #2, please note that water and wastewater infrastructure projects that will require a construction permit from DEQ's Water Quality Division include the following:

- Construction of new water and wastewater treatment facilities;
- Modifications and upgrades to existing facilities;
- Construction of new water distribution and wastewater collection lines;
- Relocation of existing water distribution and wastewater collection lines.

Projects that do not require a construction permit include:

- Replacement of existing equipment with same type and size equipment;

- Replacement of existing water and wastewater lines with the same size line in the same location.

Please contact DEQ's Water Quality Division (Construction Permitting Section) if you have specific questions about these projects or need further clarification. Rocky Chen is the Manager of this section and can be reached at (405) 702-8140 or rocky.chen@deq.ok.gov.

Note: This is a summary of the most common regulatory requirements that may be applicable to these projects. Other regulatory requirements may apply.

Additional recommendations to consider may be found at https://go.usa.gov/xFE4c.

For future projects, please include GPS coordinates in decimal degrees (DD.DDDD) and continue including street addresses, section/township/range, or other location information.

Please submit future requests to <u>https://go.usa.gov/xFf7g</u> or <u>EnvReviews@deq.ok.gov</u> by attaching a single pdf file containing your request and any attachments.

Thank you for the opportunity to provide our comments. If you have any questions or need clarification, please contact me.

Regards,

Jon Roberts | Env. Programs Manager III

Office of Continuous Improvement | Department of Environmental Quality p. 405-702-7111 Oklahoma.gov | deq.ok.gov



Cherokee County 911

914 S College Ave Ste 911 Tahlequah, Ok 74464 www.cherokeecounty-911.com



Phone: 918-458-6513 Fax: 918-458-5735 Emergency: 911

CHEROKEE COUNTY 911 ADDRESS NOTIFICATION FORM

Valid 911 Address is listed below

3/2/2022 CHEROKEE NATION W.W HASTINGS HOSPITAL 19780 E ROSS ST TAHLEQUAH, OK 74464

You must take a copy of this verification to tile POST OFFICE in order to receive mail.

Cherokee County 911 and the U.S. Postal Service require that all residential and commercial structures within Cherokee County, Oklal10ma must have a locatable address assigned to the structure. Your cooperation in using the address assigned to you will ensure efficient mail service and emergency service response (Law Enforcement, Fire Department, and Emergency Medical Service).

You will need to notify the following of your 911 Address:

Telephone Company • County Assessor • Voter Registration • Finan.ciaJ Institution • Security Company • Friends and Family• Utility Company• etc.

How to use your address properly:

- It is *extremely* important that you post the house numbers at the end of your driveway using a minimum of three (3) inch reflective numbers that can be seen from all directions. This will ensw e that emergency service (Law Enforcement, Fire Department, and Emergency Medical Service) units will find you easily.
- For mail delivery, post your house numbers on your mail box using a minimum of three (3) inch reflective numbers on both sides of the mail box.
- Post Office Box Holders should continue to use their PO BOX numbers for all their correspondence as they have been doing, but should display their house numbers as described above. They should also notify the telephone company of their address.

you address, please contact the 911 Office at (918) 458-6513 or I l.com.

Alicia Felts 911 Coordinator

This is NOT a verification of Residence





P.O. Box 948 • Tahlequah, OK 74465-0948 918-453-5000 • www.clierokee.org Chuck Hoskin Jr. Principal Chief GP Yଦନ କିମନ୍ତ ତ-EOG କ

Bryan Warner Deputy Principal Chief ริZ.ติศV.ดิ พศภา DLd/1 0-EOG.ดิ

March 3, 2022

Andrea Taylor Cherokee Nation Environmental Programs P.O. Box 948 Tahlequah, OK 74465-0948 Steven R. Votaw Eagle Environmental Consulting P.O. Box 335 Vinita, OK 74301

Re: Cherokee Nation Tahlequah Hospital

Ms. Andrea Taylor and Mr. Steven R. Votaw:

The Cherokee Nation (Nation) is in receipt of your correspondence about the proposed **Cherokee Nation Tahlequah Hospital**, and appreciates the opportunity to provide comment upon this project. Please allow this letter to serve as the Nation's interest in acting as a consulting party to this proposed project.

The Nation maintains databases and records of cultural, historic, and pre-historic resources in this area. Our Historic Preservation Office (Office) reviewed this project, cross referenced the project's legal description against our information, and found instances where this project intersects or adjoins land held by the Nation in S34, T17N, R22E. According to previous related reports and our review, there are no significant resources located within the "CN Hospital Project" or waterline areas. Thus, this Office does not object to this portion of the proposed project proceeding. For this aforementioned portion of the project, the Nation requests that the Cherokee Nation Environmental Programs (CNEP) halt all project activities immediately and re-contact our Office for further consultation if items of cultural significance are discovered during the course of this portion of the project.

Additionally, this Office reviewed the "Alternative Parking Garage Location" and found instances where this portion of the project is within very close proximity to culturally sensitive resources located in the SE/4 NW/4, S34, T17N, R22E. Thus, this Office recommends that this alternative location is avoided for this proposed project. If CNEP selects this alternative parking garage location, this Office respectfully requests that CNEP re-contact this Office for additional consultation.

Additionally, the Nation requests that CNEP conduct appropriate inquiries with other pertinent Historic Preservation Offices regarding historic and prehistoric resources not included in the Nation's databases or records.

Cherokee Nation Tahlequah Hospital March 3, 2022 Page 2 of 2

If you require additional information or have any questions, please contact me at your convenience. Thank you for your time and attention to this matter.

Wado,

lizabile foombro

Elizabeth Toombs, Tribal Historic Preservation Officer Cherokee Nation Tribal Historic Preservation Office elizabeth-toombs@cherokee.org 918.453.5389



GW Y.9 DBP CHEROKEE NATION®

P.O. Box 948 • Tahlequah, OK 74465-0948 918-453-5000 • www.cherokee.org Chuck Hoskin Jr. Principal Chief GP କଫନ କମ୍ପକ ୦-EOG ନ

Bryan Warner Deputy Principal Chief SZAPVA WPA DL6A 0-EOGA

March 9, 2022

Lynda Ozan, Deputy SHPO Oklahoma Historical Society State Historical Preservation Office Oklahoma History Center 800 Nazih Zuhdi Oklahoma City, OK 73105

Dear Ms. Ozan:

In accordance with Section 106 of the National Historic Preservation Act, the Cherokee Nation respectfully requests your opinion on the possible impacts/effects of the following project:

Cherokee Nation Tahlequah Hospital

The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. A second alternative location for a parking garage may also be incorporated which would be situated on 1 acre of an existing asphalt parking lot adjacent to the existing W.W. Hastings Hospital. The overall project area encompasses approximately 13 acres. The project is located in Section 34, Township 17 North, Range 22 East, Cherokee County.

A site map is attached. The project described above will be completed with funding provided by the US Department of Health and Human Services, Office Indian Health Services. A scoping letter was sent to Oklahoma Archeological Survey (OAS) stating that Cherokee Nation was coordinating with U.S. Bureau of Indian Affairs (BIA), BIA is not the lead agency on this project. If you have any questions or require further information, please contact my office at (918) 453-5365. Thank you

Sincerely,

Andrea Taylor, Manager Cherokee Nation Environmental Programs



March 22, 2022

Eagle Environmental Consulting, Inc. Attn: Steven Votaw President PO Box 335 Vinita, OK 74301

Re: <u>OAS FY22-0995</u> BIA Cherokee Nation Construction of New Tahlequah Hospital. Legal Description: N ½ Section 34, T17N, R22E, Cherokee County, Oklahoma.

Dear Mr. Votaw:

The Community Assistance Program staff of the Oklahoma Archeological Survey has reviewed the above referenced project to identify areas that may potentially contain prehistoric or historic archeological materials (historic properties). Our records indicate that portions of your project area have been previously surveyed and that one significant cultural resource (Ross Cemetery – 34CK349) is located adjacent to and north of the proposed alternative parking garage location. If the alternative parking garage location will be constructed, additional consultation will be necessary prior to any proposed ground disturbing activities to address concerns over potential impacts to marked and potentially unmarked graves associated with the cemetery.

An additional field inspection is not considered necessary for the proposed Cherokee Nation Hospital footprint and sanitary and waterlines. However, should construction activities in these portions of the Area of Potential Effects (APE) expose buried archeological materials such as chipped stone, tools, pottery, bone, historic crockery, glass, metal items or building materials, this agency should be contacted immediately at (405)325-7211.

This environmental review and evaluation is done in cooperation with the State Historic Preservation Office, Oklahoma Historical Society. The responsible federal agency or their official delegate must also have a letter from that office to document consultation pursuant to Section 106 of the National Historic Preservation Act.

In addition to our review comments, under 36CFR Part 800.3 you are reminded of your responsibility to consult with the appropriate Native American tribe/groups to identify any concerns they may have pertaining to this undertaking and potential impacts to properties of traditional and/or ceremonial value.

Sincerely,

Kary Stackelbeck

Kary L. Stackelbeck, Ph.D. State Archaeologist

: dkg/kls cc: SHPO



Oklahoma Historical Society State Historic Preservation Office

Oklahoma History Center• 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917 (405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

March 25, 2022

Ms. Andrea Taylor, Manager Cherokee Nation Environmental Programs P.O. Box 948 Tahlequah, OK 74465

RE: <u>File #1 I 17-22</u>; Cherokee Nation IHS Project for the Cherokee Nation Tahlequah Hospital

Dear Ms. Taylor:

We have received and reviewed the documentation submitted on the referenced project in Cherokee County. Additionally, we have examined the information contained in the Oklahoma Landmarks Inventory (OLI) files and other materials on historic resources available in our office. We find that there are no known historic properties affected within the referenced project's area of potential effect.

In addition to our review, you must contact the Oklahoma Archeological Survey (OAS), 111 E. Chesapeake, #102, Norman OK 73019-5111 (#405/325-7211, FAX #405/325-7604), to obtain a determination about the presence of prehistoric resources that may be eligible for the National Register of Historic Places. Should the OAS conclude that there are no prehistoric archaeological sites or other types of "historic properties," as defined in 36 CFR Part 800.16(1), which are eligible for inclusion in the National Register of Historic Places within the project area and that such sites are unlikely to occur, we concur with that opinion.

The OAS may conclude that an on-site investigation of all or part of the project impact area is necessary to determine the presence of archaeological resources. In the event that such an investigation reveals the presence of prehistoric archaeological sites, we will defer to the judgment of the OAS concerning whether or not any of the resources should be considered "historic properties" under the Section 106 review process. If sites dating from the historic period are identified during the survey or are encountered during implementation of the project, additional assessments by the State Historic Preservation Office will be necessary.

Should further correspondence pertaining to this project be necessary, please reference the above underlined file number. If you have any questions, please contact Kristina Wyckoff, Historical Archaeologist, at 405/521-6381. Thank you.

Sincerely,

Lynda Ozan

Deputy State Historic Preservation Officer



LO:pm



United Keetoowah Band Of Cherokee Indians in Oklahoma Office of Historic Preservation P.O. Box 746 • Tahlequah, OK 74465 18300 W Keetoowah Circle • Tahlequah, OK 74464 Phone: (918) 871-2825 • Fax: (918) 414-4038 www.ukb-nsn.gov | ukbthpo@ukb-nsn.gov



04/08/22

RE: Section 106 Consultation - Cherokee Nation Tahlequah Hospital

To Whom It May Concern:

Thank you for consulting with the United Keetoowah Band of Cherokee Indians in Oklahoma (UKB). This response is regarding the request from your office for a review of the project listed above. We have reviewed the information provided in your letter of April 8th, 2022. We find after review of the information we concur with your "findings of no significant impact".

There remains the possibility that unrecorded cultural resources, including archaeological artifact or human remains, may be encountered during construction, demolition, or earthmoving activities of this project. Should this occur, we require that you contact our office immediately so we may offer appropriate comments under 36 CFR 800.13.

As the project moves forward we request the following conditions be followed: Condition 1: Inadvertent Discoveries - In the event that human remains, burials, funerary items, sacred objects, or objects of cultural patrimony are found during project implementation, the proponent or his/her authorized agent shall cease work immediately within 200 ft of the find. They shall take steps to protect the find from further damage or disruption. They shall contact the NAGPRA Coordinator, Julie Brison at (918) 871.2852 or by email jbrison@ukb-nsn.gov to report the find. The NAGPRA Coordinator shall contact the appropriate law enforcement authority if human remains are found. No further work shall be allowed on the project until the NAGPRA Coordinator has approved a plan for managing or preserving the remains or items.

Condition 2: Post Review Discoveries - In the event that pre-contact artifacts (i.e., arrowheads, spear points, mortars, pestles, other ground stone tools, knives, scrapers, pottery or flakes from the manufacture of tools, fire pits, culturally modified trees, etc.) or historic period artifacts or features (i.e., fragments of old plates or ceramic vessels, weathered glass, dumps of old cans, cabins, root cellars, etc.) are found during project implementation, the proponent or his/her authorized agent shall cease work immediately within 200 ft of the find. They then shall contact the Section 106 Coordinator Acee Watt to report the find. No further work shall be allowed on the project until the Section 106 has approved a work plan for managing or preserving the artifacts or features.



United Keetoowah Band Of Cherokee Indians in Oklahoma Office of Historic Preservation P.O. Box 746 • Tahlequah, OK 74465 18300 W Keetoowah Circle • Tahlequah, OK 74464 Phone: (918) 871-2825 • Fax: (918) 414-4038 www.ukb-nsn.gov ukbthpo@ukb-nsn.gov



Condition 3: Activities that have the potential to disturb cultural resources outside the areas specified in the accompanying document(s) are not approved and will not proceed until cultural resources review of potential adverse effects in the new area has been completed.

Please note that these comments are based on information available to us at the time of the project review. We reserve the right to revise our comments as information becomes available. If you have any questions or concerns, please contact our Section 106 Coordinator, Acee Watt at (918) 871.2852 or by email <u>awatt@ukb-nsn.gov</u> or UKB THPO Whitney Warrior (918) 871.2838 wwarrior@ukb-nsn.gov

Best Regards,

Acee Wall

Acee Watt Section 106 Coordinator Office of Historic Preservation United Keetoowah Band of Cherokee 918.871.2825 | 918.414.4038 awatt@ukb-nsn.gov



CHEROKEE NATION®

P.O., Box 948 • Tahlequah, OK 74465-0948 918-453-5000 • www.cherokee.org Chuck Hoskin Jr. Principal Chief GP କଫP ୫ମ୍ଡ୍ର ୦-୧୦ଫ୍ରେନ

Bryan Warner Deputy Principal Chief รัZภิРัVภ พิศภา ปได้ภา 0-EOGภ

April 8, 2022

Acee Watt Section 106 Coordinator Office of Historic Preservation United Keetoowah Band of Cherokee P.O. Box 746 Tahlequah, OK 74465

Dear Mr. Watt:

In accordance with Section 106 of the National Historic Preservation Act (NHPA) the Cherokee Nation respectfully requests your review and comment regarding the project below.

Cherokee Nation Tahlequah Hospital

The proposed project would involve constructing a new 401,000 square feet, seven-story high-rise hospital, two new surface parking areas, and a two-story 12,800 square feet freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. One alternative location for a parking garage was proposed adjacent to the existing W.W. Hastings Hospital but has since been removed from the project design. The overall project area encompasses approximately 31 acres. The project is located in **Section 34, Township 17 North, Range 22 East.**

This proposed project will be completed with funds provided by the American Rescue Plan Act (ARPA) & Department of Health and Human Services (DHHS).

Pursuant to the 36 C.F.R. 800 regulations implementing compliance with Section 106 of the NHPA, we are providing general project area maps and information so that your Tribe has an opportunity to bring to our attention any interests and concerns about the potential for impacts to properties of cultural and religious significance.

By this letter, the Cherokee Nation is providing notification and seeking comments regarding these properties. This Office will assume concurrence with the proposed project if no response is received within thirty days of this letter's receipt pursuant to 36 C.F.R. Part 800.4(d)(1)(i).

If you have any questions or require further information, please contact my office at (918) 453-5365. Thank you.

Sincerely,

ndrea Chylor

Andrea Taylor, Manager Cherokee Nation Environmental Programs





P.O., Box 948 • Tahlequah, OK 74465-0948 918-453-5000 • www.cherokee.org Chuck Hoskin Jr. Principal Chief GP କୁହାନ କୁମନ୍ତ ତ-EOG କ

Bryan Warner

Deputy Principal Chief รัZภิยัVภ พยา DLธา 0-EOGภ

April 8, 2022

President Terri Parton Wichita and Affiliated Tribes P.O. Box 729 Anadarko, OK 73005

RE: Cherokee Nation Tahlequah Hospital

Dear President Parton:

Please reference the initial scoping letter provided by Eagle Environmental Consulting dated February 3, 2022 regarding the captioned project. Since receipt of the aforementioned letter, the Cherokee Nation and our architect/engineer have designed new open parking facilities outside the originally presented and reviewed area of potential affect (APE) to avoid the culturally sensitive feature in close proximity to the originally proposed alternative parking garage facility. This letter is intended to provide you the proposed engineering design plan and location for the new parking areas and request your subsequent review of the expanded APE as part of the Section 106 coordination process. Please let me know if you need additional information, have any questions, or would like to discuss.

Thank you.

Sincerely

Andrea Taylor, Manager Cherokee Nation Environmental Programs

Attachment: Parking Area Design Plan Exhibit

APPENDIX C

WETLANDS AND WATERWAY DELINEATION REPORT OF SURVEY

WATERS OF THE US DELINEATION

Cherokee Nation Tahlequah Hospital Development Tahlequah, Cherokee County, Oklahoma

Prepared for:



Cherokee Nation 206 East Allen Road Tahlequah, OK 74464

and

CHILDERS ARCHITECT

Childers Architect 45 South 4th Street Fort Smith, AR 72901

Prepared by:



P.O. Box 335 Vinita, Oklahoma 74301 918-272-7656 9 North 9th Street Greenwood, Arkansas 72913 918-244-9595

May 2022

Stur R. Vataw

Steven R. Votaw President

TABLE OF CONTENTS

1.0	Introduction	1
2.0	General Survey Area Description	1
3.0	Wetland and Waterway Delineation Methodology	2
4.0	Survey Findings	2
5.0	Conclusion	6
6.0	References	7

LIST OF FIGURES

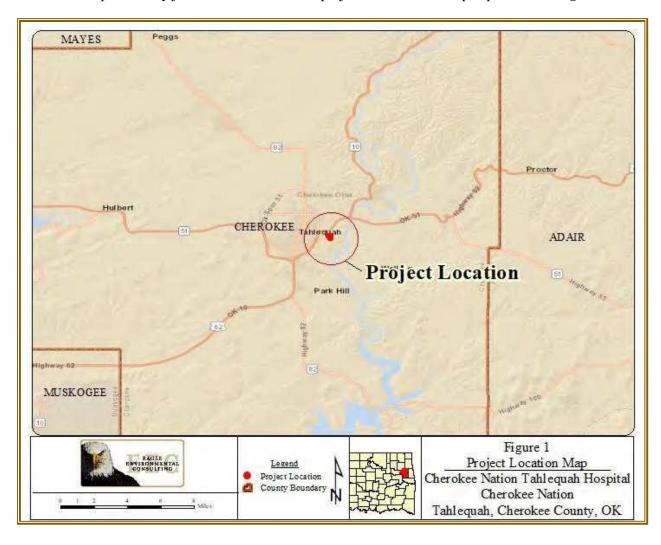
Figure 1	Project Location Map1
Figure 2	Waters of the US Location Map (Aerial)4
Figure 3	Waters of the US Location Map (USGS)5

LIST OF APENDICES

Appendix A	. Site Photographs
------------	--------------------

1.0 Introduction

Eagle Environmental Consulting, Inc. (EEC) conducted a Waters of the United States and wetland delineation survey associated with the proposed Cherokee Nation Tahlequah Hospital development project to identify and demarcate potentially jurisdictional waterways and/or wetlands within the project area. The project area is located in Section 27, Township 17 North, Range 22 East on the southwest corner of East Downing street and US Highway 62 Tahlequah, Oklahoma. The field survey was performed to collect and record physical characteristics of aquatic areas potentially considered jurisdictional by the U.S. Army Corps of Engineers (USACE) pursuant to Section 404 of the Clean Water Act. Each aquatic resource was identified and/or investigated according to the diagnostic field indicators used to confirm presence and determine the preliminary jurisdictional status. The project area location map is provided at *Figure 1*.



2.0 General Survey Area Description

The surveyed area is located in the Springfield Plateau ecoregion (39b) of Oklahoma. The **Springfield Plateau** is underlain by cherty limestone of the Mississippian Boone Formation; dissection, relief, and forest density are less than in neighboring Ecoregions 38 and 39b. Karst features, such as sinkholes and caves, are common. Cool, perennial, spring-fed streams occur. Prior to the 19th century, uplands were dominated by oak–hickory forest; savannas and tall grass prairies also occurred and were maintained by fire. Today, much of the forest, and nearly all of the prairie, has been replaced by agriculture or expanding

residential areas. Poultry and livestock farming are the main land uses. Application of poultry litter to agricultural fields and cattle farming have impaired downstream water quality. Streams in the Springfield Plateau (39a) have lower gradients, contain more clay, and are less clogged with gravel from bank erosion than in the Dissected Springfield Plateau–Elk River Hills (39b). The survey area included the previously developed hospital site and new utility corridors extending from the health care campus. Utility corridors transition through previously developed and residential areas.

3.0 Wetland and Waterway Delineation Methodology

The USACE Wetlands Delineation Manual (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains & Piedmont Region* (USACE 2010) were referenced in concert to identify wetlands. Wetland areas, if observed, would be identified using the routine on-site (level 2) method, as described in Section D of the 1987 USACE Wetlands Delineation Manual. The identification of wetlands consists of a three- parameter approach that involves determining the presence of hydrophytic vegetation, hydric soils, and wetland hydrology. Where differences in the two documents occur, the Regional Supplement takes precedence over the 1987 Corps Manual.

Hydrophytic plant communities are determined after species identification based on the wetland status indicators of the dominant plant species present within the sample plot. In accordance with the USACE delineation manual, plant species that have a wetland indicator status of facultative (FAC), facultative wetland (FACW), or obligate (OBL) represent hydrophytic vegetation. Wetland hydrology implies a hydrologic regime involving periodic inundation or saturation within the upper portions of the soil profile (for sufficient duration) during the growing season. Onsite indicators used as evidence of wetland hydrology include inundation, saturation, sediment deposition, drift lines, water marks, and scouring. Hydric soils are determined based on criteria established by the Soil Conservation Service (USDA, 2000) and described in the regional supplement. Indicators of hydric soils predominantly include soil color and redoximorphic (redox) concentrations (reddish mottles). Soil matrix and mottle color, when appropriate, are identified according to Munsell Soil Color Charts (Kollormorgen, 2000). In most circumstances, all three parameters must be present for the area to be a wetland. Data sampling points are established in representative areas within the wetland areas and in the adjacent uplands. Vegetation, soils, and hydrology characteristics are recorded on data forms for each sampling point and boundaries are established based on the results of the individual sample plots, after further refining as necessary.

Potentially jurisdictional waters of the United States, other than wetlands, were also to be defined if observed. These areas include creek channels, rivers, ponds, and/or lakes. These characteristics include, but are not limited to, a line impressed on a bank, defined bed and bank, shelving, ordinary high water mark, changes in soil characteristics, destruction of terrestrial vegetation, and presence of debris (33 CFR Part 328). Waterways are identified and located according to size, flow patterns, watershed characteristics, presence of an ordinary high water mark, and drainage basin.

4.0 Survey Findings

Waters of the United States

The onsite survey was conducted to identify and locate those areas exhibiting the required wetland parameters and onsite characteristics for waters of the United States, if observed. Data were collected for each investigated area to characterize and describe the observed indicators. The descriptions for the identified area(s) are provided below according to Field Site (FS) number. No wetlands, 2 waterways, and 1 detention pond was identified during the field survey was determined to meet the criteria was also observed. Photographs of the investigated area is provided at **Appendix A**. The waters of the US location map is provided on *Figures 2 & 3*.

Field Site Descriptions

FS-1 is a 0.43-acre detention pond is a small detention pond that is dominated by Bermuda grass, clover, and crab grass. FS-1 should not be considered jurisdictional by the USACE.

FS-2 is a 205-foot small ephemeral waterway that transitions adjacent to a residential housing edition. The feature flows along the utility corridor from north to south within the 2 to 5 foot-wide and 1 to 2 foot deep moderately incised channel with a less than 1 foot deep ordinary high water mark. The non- natural channel appears to have been previously channelized. FS-2 may be considered jurisdictional by the USACE.

FS-3 is a 50-foot stretch of an unnamed tributary to Tahlequah Creek. Channel dimensions were approximately 5 to 6 feet deep and 10 to 12 feet wide and exhibited an ordinary high water mark between 1 and 2 feet from the channel floor. The waterway transitions through a relatively young-aged riparian zone. FS-3 would be considered jurisdictional by the USACE.





5.0 Conclusion

The subject wetland and waterway delineation was performed to identify the presence of jurisdictional waterways and/or wetlands within the proposed project area. No wetlands, 2 waterways, and 1 detention pond was identified, recorded, and delineated during the field survey. The following table provides a summary of the feature type, linear footage, acreage and the centroid location coordinates for each aquatic feature:

Identified Aquatic Features					
Site Number	Feature Type	Feet	Acres	Latitude	Longitude
FS-1	Detention Pond		0.43	35.9105	-94.9448
FS-2	Waterway	205		35.9108	-94.9531
FS-3	Waterway	50		35.9132	-94.9569
Total 255 0.43					

6.0 References

Oklahoma Color Digital Ortho-Quadrangle Maps. 2022.

- Title 33. Code of Federal Regulations. Part 328. Definitions of Waters of the United States.
- U.S. Army Corps of Engineers. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, Environmental Laboratory, Vicksburg, MS.
- U.S. Army Corps of Engineers. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mtns & Piedmont Region.
- U.S. Department of Agriculture. 2012. Field Indicators of Hydric Soils of the United States. Soil Conservation Service.
- United States Department of Agriculture, Soil Conservation Service. 1981. Land Resource Regions and Major Land Resource Areas of the United States. Agriculture Handbook 296.

United States Geological Survey. 7.5-minute topographic map.

Woods, A.J., Omernik, J.M., Butler, D.R., Ford, J.G., Henley, J.E., Hoagland, B.W., Arndt, D.S., and Moran, B.C., 2005, Ecoregions of Oklahoma (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,250,000). Appendix A

Representative Site Photographs

FS 1:













FS 3:



































APPENDIX D

BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT Cherokee Nation Tahlequah Hospital Development Tahlequah, Cherokee County, Oklahoma

Prepared for:



Cherokee Nation 206 East Allen Road Tahlequah, OK 74464

and

CHILDERS A R C H I T E C T 45 South 4th Street Fort Smith, AR 72901

Prepared by:



P.O. Box 335 Vinita, Oklahoma 74301 918-272-7656 9 North 9th Street Ft. Smith, Arkansas 72901 918-244-9595

June 2022

tun R. Vataw

Steven R. Votaw President

TABLE OF CONTENTS

1.0	PROJECT OVERVIEW	. 1
1.1	FEDERAL NEXUS	.1
1.2	PROJECT DESCRIPTION	. 2
1.3	PROJECT AREA SETTING	. 2
2.0	FEDERALLY LISTED SPECIES AND DESIGNATED CRITICAL HABITAT	. 2
3.0	ENVIRONMENTAL BASELINE	.4
3.1	ECOLOGICAL PROCESSES AND CONDITIONS	. 4
3.2	SPECIES HABITAT WITHIN THE ACTION AREA	. 4
4.0	ANALYSIS OF EFFECTS	. 8
4.1	DIRECT EFFECTS	. 8
4.2	INDIRECT EFFECTS	. 8
4.3	INTERRELATED AND INTERDEPENDENT ACTIONS AND ACTIVITIES	. 8
5.0	CONCLUSION	10
6.0	REFERENCES	11

LIST OF FIGURES

FIGURE 1 PROJECT LOCATION MAP FIGURE 2 HABITAT ASSESSMENT MAP (Aerial)	
LIST OF TABLES	
TABLE 1 FEDERALLY LISTED T&E SPECIES	3

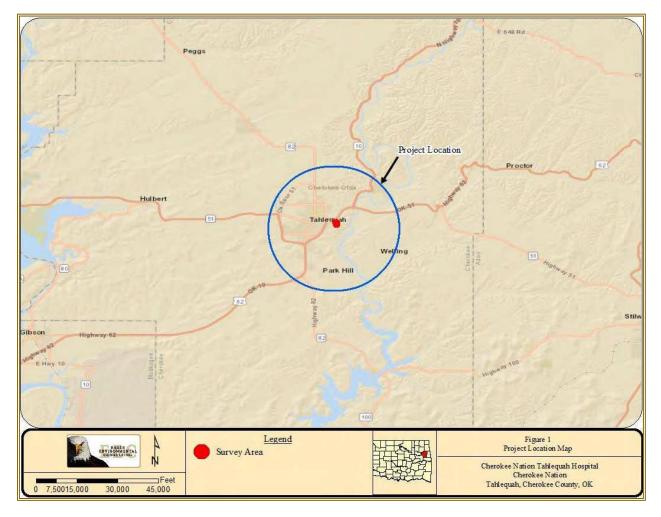
TABLE	2 SPECIES CONCLUSION TABLE

LIST OF APENDICES

APPENDIX A USFWS IPAC & ONHI SPECIES OCCURRENCE RECORDS APPENDIX B HABITAT ASSESSMENT SITE PHOTOS

1.1 Federal Nexus

A Biological Assessment (BA) was prepared to address the potential effects of the proposed new Cherokee Nation Tahlequah Hospital, parking area, and utility lines construction project in Tahlequah, Oklahoma on the federally-listed threatened or endangered (T&E) species present in or known to migrate through Cherokee County, OK. Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended, requires that, through consultation with the U.S. Fish and Wildlife Service (USFWS), federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species or result in the destruction or adverse modification of critical habitat. The proposed action would occur on lands owned or have utility line easement by the Cherokee Nation. The Cherokee Nation, as a sovereign nation, is considered the federal action agency. This BA evaluates the potential effects of the proposed project on species that are federally listed under the ESA. This BA was prepared to evaluate the potential impacts to federally-listed species which may be present within or utilize the existing habitats adjacent to the proposed construction corridor. Some wildlife species afforded by protection under the Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, and others are also addressed herein. The project location map is provided on *Figure 1*.



1.2 Project Description

The proposed project would involve constructing a new 401,000 square foot, seven-story highrise hospital, a seven-story parking garage with 1,000 spaces, and a two-story 12,800 square foot freestanding central energy plant. Approximately 1 mile of proposed sanitary sewer line and approximately 0.5 mile of proposed waterline would also be constructed to service the new facility. The hospital and parking area encompasses approximately 13 acres. The disturbance area associated with the hospital and adjacent parking areas encompasses approximately 1.04 acres. The utility line corridors to be temporarily disturbed would be 1.32 miles within a 25-foot-wide corridor encompassing approximately 4 acres. The utility lines would be offset from the existing infrastructure lines within the previously disturbed corridors. No trees are proposed to be removed during construction. All areas of soil disturbance will be restored to original contour, elevation, and grade. No trees are proposed to be removed as part of this project. The hospital and parking area has been previously disturbed. The utility line corridors would transition along existing utility line corridor easements which have also been previously cleared and are maintained on a generally routine basis.

1.3 Project Area Setting

Project Location

The project area is located in Section 34, Township 17 North, Range 22 East in Tahlequah, Cherokee Oklahoma. The assessment area is described as previously disturbed at the hospital and parking areas as well as the utility line corridors. All areas have been previously cleared and graded.

Ecoregion

The surveyed area is located in the Ozark Highlands Dissected Springfield Plateau–Elk River Hills ecoregion. The area is comprised of narrow ridgetops and intervening, steep V-shaped valleys. Carbonate rocks, along with associated karst features, are characteristic. Springs abound in valleys and contribute cool water to perennial streams. Cherty limestone of the Mississippian Boone Formation is extensive, but older shales, limestone, and dolomite are also exposed in valley bottoms. The region is considered rugged and wooded and upland natural vegetation is oak–hickory and oak–hickory–pine forests and associated woodlands. Livestock and poultry farming, woodland grazing, logging, recreation, and quarrying are the main land uses.

2.0 FEDERALLY LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

The official list of threatened and endangered species potentially present within or adjacent to the action area was generated for the proposed project by the United States Fish and Wildlife Service's online Information, Planning, and Conservation (IPAC) decision support system (USFWS, 2022). The federally-listed species and associated habitat requirements identified that may be affected by the proposed project include the Gray Bat, Northern Long-eared Bat, Ozark Big-eared bat, Piping Plover, Red Knot, Neosho Mucket, Rabbits-foot mussel, American Burying Beetle, and Monarch Butterfly as shown in *Table 2*. The official species list and action area map obtained from the USFWS are provided in *Appendix A*. The Oklahoma Natural Heritage Inventory (ONHI) was contacted to acquire known occurrence records of listed and/or sensitive species within the project area. While occurrences of the American burying beetle were reported with the standard search radii, no species occurrences were identified within the action area by ONHI database records. Correspondence is provided in *Appendix A*. Identification of the dominant vegetative species was performed through transect and random sampling within the dominant and homogenous vegetation areas. The major habitat within the action area was documented and described to determine if the habitat requirements exist for the respective threatened or endangered species as having the potential to be present in or migrate through the project area.

Table 2 - Federally Listed T&E Species			
Species/Critical Habitat	Listing Status	Habitat Requirements	Status within Action Area
Northern Long-eared Bat (Myotis septentrionalis)	Threatened	During summer, northern long-eared bats (NLEB) roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non- reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in barns and sheds. NLEB hibernate in caves and mines. Typically use large caves or mines with large passages/entrances, constant temperatures, and high humidity with no air currents. Specific areas where they hibernate have very high humidity. Occupy small cracks/crevices in caves.	Potential foraging and roost habitat not present within or adjacent to action area. No trees would be removed. No presence records provided by OK Natural Heritage Inventory (ONHI)
Gray Bat (Myotis grisescens)	Endangered	Foraging habitat primarily associated with aquatic resources. Cave obligate species. Limestone caves or rock slope faces. Forages on aquatic and terrestrial insects near streams and rivers.	No known caves would be affected. Disturbances to foraging areas would not occur. Habitat impacts associated with construction proposed during winter time frame associated with two creek crossings adjacent to residential areas.
Ozark Big-eared Bat (Corynorhinus townsendii ingens)	Endangered	Known to roost in caves, sandstone cracks, and talus. Cave obligate species relegated to NE OK, NW AR, and SW MO. Forages on insects atop mature canopy areas. Species possibly considered a lepidoptera specialist foraging primary on moths.	No potentially suitable habitat present. No known caves within or near action area.
Piping Plover (Charadruis melodus)	Threatened	Migratory stopover habitat includes sparsely vegetated sandy or gravelly shorelines and islands associated with the major river systems. Species does not nest in OK.	No suitable habitat present.
Red Knot (Calidris canutus rufa)	Threatened	Coastal areas, mudflats on lakes or reservoirs, and may use sandbars along the major river systems for forage and resting areas. Species does not nest in OK.	No suitable habitat present.
American Burying Beetle (Nicrophorus americanus)	Threatened	Breeding habitat: undisturbed, mature oak-hickory forests with substantial litter layers and deep, loose soils over grasslands or bottomland forests. Feeding habitat: undisturbed grasslands, grazed pasture, riparian zones, and oak-hickory forest, as well as a variety of various soil types.	Suitable habitat potentially present along utility line corridors which have been previously disturbed. Action area not located within priority conservation area.
Monarch Butterfly (<i>Danaus</i> plexippus)	Candidate	Healthy and abundant milkweed is needed for oviposition and larval consumption. Sufficient quality and quantity of nectar from flowers is needed for adult feeding throughout the breeding and migration seasons. Eastern US individuals overwinter in Mexico.	No suitable habitat observed within the area. Hospital and parking area construction. Utility lines mowed/maintained. No milkweed plants observed.
Neosho Mucket (Lampsilis rafinesqueana)	Endangered	Associated with shallow riffles and runs comprising gravel substrate and moderate to swift currents. The species is most often found in areas with swift current but can utilize slower current areas in some waterway. A few known records for this species are located in the Illinois River.	No suitable habitat was observed either onsite or within close proximity.
Rabbits-foot Mussel (Quadrula cylindrica cylindrica)	Threatened	Inhabits small to medium sized streams and some larger rivers. Usually occurs in shallow water areas along the bank and adjacent run and shoals with reduced water velocity. Substrates generally include gravel and sand.	No suitable habitat was observed either onsite or within close proximity.

m 11

USFWS, 2022

3.0 ENVIRONMENTAL BASELINE

3.1 Ecological Processes and Conditions

Soils

The Natural Resources Conservation Service (NRCS) Web Soil Survey was used to identify soil units within the study area (NRCS 2021). Multiple soil units are present within the proposed project area including; Captina silt loam, 1 to 3 percent slopes; Clarksville very gravelly silt loam, 1 to 8 percent slopes; Clarksville very gravelly silt loam, 5 to 20 percent slopes, stony; Clarksville very gravelly silt loam, 1 to 3 percent slopes; Britwater slopes; Bri

Climate

The climate is characterized as humid and mesothermal. The average annual precipitation is over 45 inches. The mean temperature is 61 degrees. The average nighttime low is between 12 and 24 degrees in January and the average daytime high temperatures range between 87 and 94 degrees in July.

Vegetation

The dominant vegetation consisted of Bermuda grass henbit, aster, plantain, and other forbs. The observed trees were scattered in a park like setting and consisted of post oak, black oak, black hickory, American elm, and eastern red cedar. No understory was present.

3.2 Species Habitat Within the Action Area

The survey area was canvassed to identify and describe the habitat for the listed T&E species that could be present within the proposed action area. The federally listed species and their habitat requirements are provided below.

<u>Northern Long-eared Bat</u>

The northern long-eared bat (NLEB) is a medium-sized bat about 3 to 3.7 inches in length but with a wingspan of 9 to 10 inches. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, Myotis, which are actually bats noted for their small ears (Myotis means mouse-eared). The northern long-eared bat is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia. The species' range includes 37 states. White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to this bat and is currently found in at least 25 of 37 states where the northern long-eared bat occurs.

Gray Bat

The gray bat is a small bat with grayish-brown fur and a slightly wooly appearance. Its body is approximately five inches in length and its wingspan is 11 to 13 inches. Gray bats feed on a variety of small, night-flying insects. Gray bats live in colonies within limestone caves in the Ozark region and occupy caves throughout the year. However, different caves are occupied during the summer and winter months. When foraging for their insect food, gray bats hunt over forested habitats, waterways, and wetlands.

<u>Ozark Big-eared Bat</u>

The Ozark big-eared bat is an obligate cave species associated with limestone karst features found in forested portions of the Ozark Highlands. Most of this bat population occurs in Adair, Cherokee, and Delaware counties in Oklahoma, and in Arkansas, and historically in southwest Missouri. These bats feed

primarily on lepidopterans (moths) above the tree canopy and in gaps and clearings within the forest, usually associated with oak and oak-hickory forest types.

<u> Piping Plover</u>

The piping plover is a small, stocky, sandy-colored bird resembling a sandpiper. The habitat requirements for the piping plover include sandy shorelines on lakes and sandbars along the major river systems for forage and resting areas. The piping plover is migratory in Oklahoma in the spring and fall. They do not generally nest in Oklahoma. Plovers often gather in groups on undisturbed beaches prior to their southward migration. By mid-September, both adult and young plovers will have departed for their wintering areas (USFWS, 2011).

<u>Red Knot</u>

The Red Knot is a rather large sandpiper that breeds in far northern Canada on tundra from May to June. Fall migrations typically begin in late July through mid-August where the species may travel as far as the coasts of South America. Migratory habitat requirements for the red knot include coastal areas, mudflats on lakes or reservoirs, and may use sandbars along the major river systems for forage and resting areas. This species is considered migratory in or through Oklahoma in the spring and fall.

American Burying Beetle

The American Burying Beetle (ABB) is a large beetle with a shiny black appearance with four orange-red spots on the wing covers (elytra). A large red spot on the pronotum of the beetle is indicative of the species. The habitat requirements for this beetle are not fully known; however, the ABB is considered a habitat generalist and is known to occupy a diverse range of habitats. Habitats associated with the ABB include open grasslands, forests, as well as transitional areas. Suitable habitat exists within the action area. The action area is not located within or near any priority conservation area. Suitable habitat was observed adjacent to the action area but not within.

<u>Monarch Butterfly</u>

Monarchs are typically medium to large-sized butterflies with predominantly orange and black coloration with white patches or dots along their wing margins. Adults do form pair bonds and usually mate more than once. One adult female will typically produce 300 to 1,100 eggs on milkweed plants which are the only food during their caterpillar phase. Healthy and abundant milkweed is needed for oviposition and larval consumption. Sufficient quality and quantity of nectar from flowers is needed for adult feeding throughout the breeding and migration seasons. For those individuals who make the historical migration from the Eastern US populations typically overwinter in Mexico. Western US populations traditionally winter along the California and Baja coastline. Suitable habitat observed within the northern portion of project corridor relative to flowering plants associated with nectar production for foraging adults. No milkweed plants observed.

<u>Neosho Mucket</u>

The Neosho Mucket mussel prefers shallow riffles and runs with gravel substrate and moderate swift currents and substrate that allows for burrowing as suitable habitat. The historical distribution for the Neosho Mucket Mussel was reported for the Illinois River, the Neosho River, the Verdigris River, and the Spring River and its tributaries in Oklahoma. It is one of the predominant mussels in a short stretch of the Spring River but most of the specimens found in the other rivers appear well-worn and old. The younger shells are often marked with greenish rays and chevrons. The female Neosho Mucket waves a lure that imitates a small fish to attract its host fish. Only black bass (largemouth, smallmouth and spotted) serve as the host for Neosho Mucket larvae, called glochidia, which the female releases in late spring. Sufficient numbers of bass may be lacking in the lower Neosho, Fall and Verdigris rivers. In the early 1990's, surveys indicated that living muckets were found in a stretch of the Illinois River from the

Oklahoma Arkansas state line downstream to the headwaters of Lake Tenkiller in Cherokee County but were not found within or downstream of the lake. More recent surveys suggest that the Neosho Mucket Mussell has been extirpated from the Caney, Verdigris, Neosho, and Spring Rivers in Oklahoma. As of 2010, the Neosho Mucket has been extirpated from approximately 62% of its river miles of its historical range. Currently, only the Spring River supports a viable population of the species (USFWS, 2010).

Rabbitsfoot Mussel

The rabbitsfoot is a freshwater clam with an elongate shell approximately 4-6 inches in length. Its color can vary from dark brown to light green. Multiple knobs are often evident on the shell of the rabbitsfoot. Rabbitsfoot mussels tend to select areas with sandy or gravel bottoms, often in side-channels with slower flow near the shore. The rabbitsfoot was historically found in the Verdigris, Neosho, Spring, Illinois, Blue and Little Rivers in Oklahoma. Populations currently remain in the Verdigris, Illinois, and Little rivers. While the rabbitsfoot still exist in the Spring and Neosho rivers, they are considered very rare or extirpated in the Oklahoma portion. Due to modification of the Verdigris River from construction of Oologah Reservoir and the McClellan-Kerr Navigation System, rabbitsfoot populations in that river have become reduced and isolated due to inundation of formerly-occupied habitat. Rabbitsfoot mussels prefer shallow areas with sand and gravel along the bank and next to shoals, which provide a refuge in fast- moving rivers. They are found in 13 states from Pennsylvania to Oklahoma. Rabbitsfoot rely on approximately a dozen species of shiners for its larva (glochidia) host.

Bald Eagle and Migratory Birds

The Bald Eagle (*Haliaeetus leucocephalus*) is a raptor protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Activities that would disturb eagles are prohibited under the Bald and Golden Eagle Protection Act. "Disturb" means to agitate an eagle to the degree that causes or is likely to (1) cause injury, (2) interfere with breeding, feeding or sheltering behavior, or (3) nest abandonment. The bald eagle prefers large trees or high cliffs along large waterways for perching and nesting purposes. Fish is the preferred diet of eagles, but they also eat small mammals, waterfowl, turtles and dead animals. Preferred foraging areas include quiet coastal areas, rivers or lakeshores with large tall trees. Methods used to identify suitable habitat included investigations of waterbodies potentially used for foraging, large nesting or perching trees adjacent to such water features and other areas which Bald Eagles are known to use. Suitable habitat was identified within the project area, primarily associated with the adjacent reservoir. However, no Bald Eagles or nests were observed during project corridor surveys. The project is not expected to impact the Bald Eagle. Migratory bird species are protected under the Migratory Bird Treaty Act (MBTA) as amended. The MBTA prohibits the take of any migratory bird without authorization for the USFWS.

Eagle Environmental Consulting conducted the primary field surveys on March 15 and April 4, 2022. The action area habitats were evaluated using pedestrian transects to identify the different types of vegetative communities. Twenty (20) habitat assessment sample sites (HASS) were utilized to identify and describe the dominant habitats within the action area to determine if any of the federally-listed T&E species or their habitat were present. The descriptions for each are provided below. Soil characteristics were also investigated for confirmation of accurate mapping. Photographs of the project area are provided at *Appendix B*. Habitat assessment sample site locations are shown below on *Figure 2*.

Habitat Assessment Sample Site Descriptions

HASS 1 and 2 were associated with an existing parking lot.

HASS 3 is situated in the basin of a detention pond. The dominant vegetation includes Bermuda, clover, wild onion, henbit, crab grass. No suitable or preferred habitat was observed.

HASS 4 was associated with a mowed and maintained Bermuda grass border adjacent to the entrance road and parking lot. The dominant vegetation includes Bermuda and post oak trees. The area did not exhibit suitable habitat.

HASS 5 was located near the southeast property corner and was dominated by rose, blackberry, green brier, Bermuda, Johnson grass, and serecia lespedeza. Potentially suitable ABB habitat may be present on the adjacent property but not within the action area.

HASS 6 is situated amongst a mowed and maintained lawn of Bermuda and henbit. A man-made stormwater drainage bisects the assessment site but does not provide habitat for the listed species.

HASS 7 is situated on a large parking lot.

HASS 8 is situated at the intersection of Ross Street and the hospital entrance road. The dominant vegetation was comprised of Bermuda grass. No suitable habitat was observed.

HASS 9 is situated in an open field that is dominated by Bermuda grass and clover. Scattered post oak trees and eastern red cedar were observed in the general area which is described as similar to a park. A narrow, man-made waterway transitions across the park-type area but did not exhibit an intact riparian zone. No suitable habitat for the listed species was present.

HASS 10 is situated under a power line and the dominant vegetation includes clover and Bermuda grass. The area was not indicative of any preferred or suitable habitat required by the listed species.

HASS 11 is located at the southern hospital property perimeter adjacent to Ross Street and along buried and overhead utility lines. The dominant vegetation consisted of mowed and maintained Bermuda grass. Suitable T&E species habitat was not observed.

HASS 12 was associated with the terrestrial habitat along a facility entrance road from Ross Street. The overall area exhibited a gentle slope hillside area dominated by Bermuda grass and adjacent to an overhead power line corridor. Trees were present with the larger general area which would not be disturbed. No suitable habitat was observed.

HASS 13 is situated in a small valley used as a fill material storage area. The disturbed area was dominated by Bermuda grass. No suitable habitat was observed.

HASS 14 is situated between Lena Avenue and overhead/buried utility line corridor. Bermuda grass, wild garlic, Callary pear, and henbit were identified as the dominant plant species. No effective or undisturbed habitats were identified or would be affected within the proposed utility line corridor.

HASS 15 is situated in an open field next to an elevated parking lot that is stabilized by rubble and rip rap. A small man-made drainage ditch transitions along the utility corridor. The dominant vegetation includes barnyard grass, wild garlic, and Bermuda grass. While an ephemeral drainage was present within the utility corridor, no suitable T&E species habitat was observed or would be affected.

HASS 16 is situated at the edge of the beginning of residential properties. The dominant vegetation includes Bermuda, clover, and henbit.

HASS 17 is located in and transitions through residential property. No habitat present.

HASS 18 is located in a developed area with the dominant vegetation including henbit, Bermuda, and black oak. The area is mowed/maintained and did not exhibit suitable habitat.

HASS 19 is located in a mowed and maintained lot that is dominated by Bermuda grass and henbit. The park like setting did not exhibit suitable habitat for the listed species. Mature oak trees are present in the general area but would be affected or removed.

HASS 20 is located on the previously cleared utility line corridor adjacent to an undisturbed forest block dominated by black oak, sugarberry, coral berry, and green brier. A small stream transitions west of and beyond the proposed utility line installation corridor. Neither the trees or waterway would be affected. Suitable ABB habitat may be present in the adjacent areas.

4.0 ANALYSIS OF EFFECTS

4.1 Direct Effects

Direct effects within the action area would consist of temporary impacts associated with utility line installation associated with soil disturbance during trench excavation. Temporary impacts are anticipated adjacent to the trench corridor where excavated soils would be side-cast. Utility lines would be installed within the open trench and then backfilled. The disturbed corridor would be restored to pre-disturbance elevation, grade, and contour to the extent practical. The area of temporary disturbance would be 4 acres. The hospital and parking areas were previously disturbed and covered with impervious surfaces. No trees would be removed. Herbaceous vegetation would be re-established on disturbed soils upon project completion. Corridor mowing or herbicide application may occur on an infrequent basis after project completion. Water quality impacts will be avoided to the extent possible and terrestrial erosion/sedimentation control measures will be employed as required. Specific surveys for the federally listed T&E species were not conducted as part of this assessment.

4.2 Indirect Effects

No other development associated with proposed project is expected. Increased public use of the expanded lease area is expected. Increased public use and construction of the proposed features may temporarily affect wildlife use and/or patterns within the action area. However, most indigenous and/or migratory species present or utilizing the action area are expected to adapt to those areas of modified landscape over time. No uses or projects are anticipated that would be tangential to the proposed. Provided no additional habitat disturbances are undertaken, the proposed project should have no indirect effects on the listed species other than described.

4.3 Interrelated and Interdependent Actions and Activities

This biological assessment addressed the potential impacts to regulated species associated with the proposed project. No immediate interrelated or interdependent actions are expected or planned as the result of the proposed project.

Tahlequah Hospital and Utility Lines Tahlequah, Cherokee County, Oklahoma



5.0 CONCLUSION

Threatened and Endangered Species Determination of Effect Rationale

Species occurrence records were requested from the ONHI. Occurrence records were recorded for the American Burying Beetle, Neosho Mucket, and Bald Eagle within their standard search radii but none were reported within or near the action area. The Species Conclusion Table (*Table 2*) below provides the potential effect determination to each of the federally-listed species:

Northern long-eared bat - No Effect. Suitable roost trees and foraging habitat are not present within or adjacent to the action area. The project would also employ the USFWS protective measures and standard best management practices would be employed during construction activities. This species should or will have migrated to winter hibernacula during the fall/winter periods of proposed utility line clearing and grubbing activities.

Gray bat - No Effect. No habitats for this species would be affected and no known caves are present within or near the action area. The project would also employ the USFWS protective measures and standard best management practices would be employed.

Ozark big-eared bat - No Effect. No known caves harboring this species are present within or near the project area. Suitable foraging habitat for this species is not present. No known caves are present within or near the action area.

American Burying Beetle - Potential suitable habitat for the ABB was identified beyond the disturbance zones of the proposed action. The action area has been previously disturbed, potentially suitable habitat was not present, and the project area is wholly located outside the established designated location lands.

Neosho Mucket, *Rabbitsfoot Mussel*, *Piping Plover*, *Red Knot*, *Monarch Butterfly* – No Effect. Suitable habitat not present. No individuals observed.

Table 2 - Species Conclusion Table					
Species/Critical Habitat	Habitat Evaluation	USFWS Consultation	ESA Determination		
Neosho Mucket	No Suitable Habitat Present. No presence records.	Not Required	No Effect		
Rabbitsfoot Mussel	No Suitable Habitat Present. No presence records.	Not Required	No Effect		
Northern Long-eared Bat	Roost trees and foraging habitat not present within or adjacent to action area.	Not Required	No Effect		
Gray Bat	No Caves Present. Potentially Suitable foraging habitat not present. Stormwater and water quality measures to minimize impacts will be employed during utility construction.	Not Required	No Effect		
Ozark Big-eared Bat	No Caves Present. No foraging habitat present No known caves within or near action area.	Not Required	No Effect		
Piping Plover	Suitable habitat not present. No individuals observed.	Not Required	No Effect		
Red Knot	Suitable habitat not present. No individuals observed.	Not Required	No Effect		

Table 2 - Species Conclusion Table				
Species/Critical Habitat	Habitat Evaluation	USFWS Consultation	ESA Determination	
American Burying Beetle	Suitable habitat not present in action area. Surveys not required.	Not Required	No Effect	
Monarch Butterfly	Suitable forage habitat not present. No host plant species observed. No individuals observed.	Not Required	No Effect	

Bald Eagle

No potential or suitable habitat was identified within the action area for the bald eagle. This species is generally associated larger ponds, creeks, and rivers. No bald eagles or nests were observed during the site visit. This project is not expected to impact the bald eagle.

Migratory Birds

Suitable nesting habitat is present within and/or adjacent to the utility line corridors. However, no bird nests were observed within the area planned for the proposed action. No active swallow nests were observed within the action area. Construction is encouraged to occur between August 15 and March 31 to avoid the nesting season to avoid potential impact to migratory birds. Suitable habitat for non-migratory ground nesting birds is also present and construction is encouraged to occur during the same time frame. Provided construction can be conducted within the non-nesting season, no adverse effects are anticipated to non-migratory birds.

6.0 **REFERENCES**

Natural Resources Conservation Service. 2022. Web Soil Survey.

Oklahoma Climatological Survey. 2021.

Oklahoma Natural Heritage Inventory. 2022. Species Occurrence Records.

United States Fish and Wildlife Service. 2022. Information, Planning, and Conservation (IPAC) decision support system.

United States Fish and Wildlife Service. 2022. ABB Section 4(d) Rule Determination Key.

United States Fish and Wildlife Service. 2022. NLEB Section 4(d) Rule Streamlined Consultation Form.

United States Fish and Wildlife Service. 2020. Monarch Butterfly Species Status Assessment.

Woods, A.J., J.M. Omernik, D.R. Butler, J.G. Ford, J.E. Henley, B.W. Hoagland, D.S. Arndt, and B.C. Moran. 2005. Ecoregions of Iowa and Missouri (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (scale 1:1,250,000).

APPENDIX A

OFFICIAL SPECIES LIST (IPAC) & ONHI OCCURENCE RECORDS



United States Department of the Interior

FISH AND WILDLIFE SERVICE Oklahoma Ecological Services Field Office 9014 East 21st Street Tulsa, OK 74129-1428 Phone: (918) 581-7458 Fax: (918) 581-7467



In Reply Refer To: Project Code: 2022-0049521 Project Name: Cherokee Nation Tahlequah Hospital June 02, 2022

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/ executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Oklahoma Ecological Services Field Office 9014 East 21st Street Tulsa, OK 74129-1428 (918) 581-7458

Project Summary

-	
Project Code:	2022-0049521
Event Code:	None
Project Name:	Cherokee Nation Tahlequah Hospital
Project Type:	Water Supply Pipeline - New Constr - Below Ground
Project Description:	Construct New Hospital and parking area along with installation of utility
	lines.

Project Location:

Approximate location of the project can be viewed in Google Maps: <u>https://www.google.com/maps/@35.9108379,-94.9459697715561,14z</u>



Counties: Cherokee County, Oklahoma

Endangered Species Act Species

There is a total of 9 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

1. <u>NOAA Fisheries</u>, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Gray Bat Myotis grisescens	Endangered
No critical habitat has been designated for this species.	
Species profile: <u>https://ecos.fws.gov/ecp/species/6329</u>	
Northern Long-eared Bat Myotis septentrionalis	Threatened
No critical habitat has been designated for this species.	
Species profile: <u>https://ecos.fws.gov/ecp/species/9045</u>	
Ozark Big-eared Bat Corynorhinus (=Plecotus) townsendii ingens	Endangered
No critical habitat has been designated for this species.	
Species profile: <u>https://ecos.fws.gov/ecp/species/7245</u>	

Birds

NAME	STATUS
Piping Plover Charadrius melodus	Threatened
Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except	
those areas where listed as endangered.	
There is final critical habitat for this species. The location of the critical habitat is not available.	
Species profile: <u>https://ecos.fws.gov/ecp/species/6039</u>	
Red Knot Calidris canutus rufa	Threatened
There is proposed critical habitat for this species. The location of the critical habitat is not	
available.	
Species profile: https://ecos.fws.gov/ecp/species/1864	

Clams NAME	STATUS
Neosho Mucket Lampsilis rafinesqueana There is final critical habitat for this species. The location of the critical habitat is not available. Species profile: <u>https://ecos.fws.gov/ecp/species/3788</u>	Endangered
Rabbitsfoot <i>Quadrula cylindrica cylindrica</i> There is final critical habitat for this species. The location of the critical habitat is not available. Species profile: <u>https://ecos.fws.gov/ecp/species/5165</u>	Threatened
Insects	CT ATLIC
NAME	STATUS
	STATUS Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the <u>National Wildlife Refuge</u> system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act^{1} and the Bald and Golden Eagle Protection Act^{2} .

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described <u>below</u>.

- 1. The Migratory Birds Treaty Act of 1918.
- 2. The Bald and Golden Eagle Protection Act of 1940.
- 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the <u>USFWS Birds of Conservation Concern</u> (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ <u>below</u>. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the <u>E-bird data mapping tool</u> (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found <u>below</u>.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. <u>https://ecos.fws.gov/ecp/species/1626</u>	Breeds Sep 1 to Jul 31
Black-billed Cuckoo Coccyzus erythropthalmus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. <u>https://ecos.fws.gov/ecp/species/9399</u>	Breeds May 15 to Oct 10

NAME	BREEDING SEASON
Eastern Whip-poor-will Antrostomus vociferus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Kentucky Warbler <i>Oporornis formosus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Prothonotary Warbler <i>Protonotaria citrea</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker <i>Melanerpes erythrocephalus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird <i>Euphagus carolinus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

- 1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
- 2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12

OBS Ref. 2022-054-BUS-EAG

Dear Mr. Votaw,

We have reviewed occurrence information on federal and state threatened, endangered or candidate species, as well as non-regulatory rare species and ecological systems of importance currently in the Oklahoma Natural Heritage Inventory database for the following location you provided:

Sec. 33-T17N-R22E, Cherokee County

We found 14 occurrence(s) of relevant species within the vicinity of the project location as described.

Species Name	Common Name	Federal Status
Nicrophorus americanus	American burying beetle	Threatened
County	TRS	Count
Cherokee	Sec. 9-T16N-R22E	1
Lampsilis rafinesqueana	Neosho Mucket	Endangered
County	TRS	Count
Cherokee	Sec. 1-T16N-R22E	1
Cherokee	Sec. 12-T17N-R22E	2
Cherokee	Sec. 24-T17N-R22E	1
Cherokee	Sec. 25-T17N-R22E	1
Cherokee	Sec. 26-T17N-R22E	1
Haliaeetus leucocephalus	Bald Eagle	Protected
County	TRS	Count
Cherokee	Sec. 1-T17N-R22E	1
Cherokee	Sec. 12-T17N-R22E	2
Cherokee	Sec. 35-T17N-R22E	4

Additionally, absence from our database does not preclude such species from occurring in the area.

If you have any questions about this response, please send me an email, or call us at the number given below.

Although not specific to your project, you may find the following links helpful.

ONHI, guide to ranking codes for endangered and threatened species: <u>http://www.oknaturalheritage.ou.edu/content/biodiversity-info/ranking-guide/</u>

Information regarding the Oklahoma Natural Areas Registry: <u>https://okregistry.wordpress.com/</u>

Todd Fagin Oklahoma Natural Heritage Inventory (405) 325-4700 tfagin@ou.edu

APPENDIX B

HABITAT ASSESSMENT AREA PHOTOS

Cherokee Nation Tahlequah Hospital & Parking Cherokee County, Oklahoma





HASS-2







HASS-4

Biological Assessment. June 2022



HASS-5



HASS-6



HASS-7



HASS-8

Cherokee Nation Tahlequah Hospital & Parking Cherokee County, Oklahoma

Biological Assessment. June 2022



HASS-9



HASS-10



HASS-11



HASS-12



HASS-13



HASS-13



HASS-14



HASS-15

Cherokee Nation Tahlequah Hospital & Parking Cherokee County, Oklahoma

Biological Assessment. June 2022



HASS-16



HASS-17



HASS-18



HASS-19



HASS-20



HASS-20

APPENDIX E

PHASE I ENVIRONMENTAL SITE ASSESSMENT









Cherokee Nation Tahlequah Hospital, Parking Areas &Utility Lines Tahlequah, Cherokee CO, Oklahoma

Prepared for:

Cherokee Nation 206 East Allen Road Tahlequah, OK 74464

and

Childers Architect 45 South 4th Street Fort Smith, AR 72901

Prepared by:



P.O. Box 335 Vinita, Oklahoma 74301

9 North 9th Street Fort Smith, Arkansas 72901

June 2022

tun R. Vatan

Steven R. Votaw President

TABLE OF CONTENTS

EXEC	UTIVE SUMMARY 1
1.0	INTRODUCTION
1.1	Purpose
1.2	Terms and Conditions
1.3	Limitations and Exceptions
1.4	Assessment Methods
2.0	GENERAL SITE SETTING
2.1	Current Use of the Property
2.2	Past Use of the Property7
2.2.1	Historical Aerial Photography8
2.2.2	City Directories
2.2.3	Sanborn Maps
2.3	Current Uses of Adjoining Property
2.4	Past Uses of Adjoining Property and Surrounding Areas
2.5	General Description of Structures
2.6	Roads
2.7	Potable Water Supply
2.8	Sewage Disposal System
3.0	USER PROVIDED INFORMATION
3.1	Title Records
3.2	Environmental Liens or Activity and Use Limitations
3.3	Specialized Knowledge
3.4	Commonly Known or Reasonably Ascertainable Information
3.5	User Provided Response to Questionnaire
4.0	RECORDS REVIEW
4.1	Standard Environmental Record Sources 10
4.1.1	Federal CERCLIS List
4.1.2	National Priorities List (NPL) 10
4.1.3	Delisted NPL Sites
4.1.4	CERCLIS No Further Remedial Action Planned Site10
4.1.5	Resource Conservation and Recovery Act (RCRA) 11
4.1.6	RCRA Non-CORRACTS Treatment, Storage and Disposal Facilities 11

4.1.7	RCRA Generators List	. 11
4.1.8	Federal, State, and Tribal Institutional Controls/Engineering Control	. 11
4.1.9	Emergency Response Notification System (ERNS) List	. 12
4.1.10	State and Tribal Equivalent NPL	. 12
4.1.11	Tribal Landfills or Solid Waste Disposal Sites	. 12
4.1.12	State Landfill or Solid Waste Disposal Sites	. 12
4.1.13	State and Tribal Registered Underground Storage Tanks (UST)	. 12
4.1.14	State and Tribal Leaking Underground Storage Tanks (LUST)	. 13
4.1.15	State and Tribal Voluntary Cleanup (VCP) Sites	. 13
4.1.16	State and Tribal Brownfields Sites	. 13
4.2	Physical Setting Sources	. 13
4.2.1	Topographic/Hydrologic/Geologic/Hydrogeologic Conditions	. 13
5.0	SITE RECONNAISSANCE	. 14
5.1	Property Observations.	. 14
5.1.1	Hazardous Substances and Petroleum Products	. 14
5.1.2	Other Storage Tanks.	. 14
5.1.3	Odors	. 14
5.1.4	Pools of Liquid.	. 14
5.1.5	Drums	. 14
5.1.6	Hazardous Substance and Petroleum Product Containers	. 14
5.1.7	Unidentified Substance Containers	. 15
5.1.8	Indications of PCB's	. 15
5.2	Interior Observations	. 15
5.2.1	Heating/Cooling	. 15
5.2.2	Stains or Corrosion	. 15
5.2.3	Drains and Sumps	. 15
5.3	Exterior Observations	. 15
5.3.1	Pits, Ponds, or Lagoons	. 15
5.3.2	Stained Soil or Pavement	. 15
5.3.3	Stressed Vegetation	. 16
5.3.4	Solid Waste	. 16
5.3.5	Wastewater	. 16
5.3.6	Wells	. 16
5.3.7	Septic System	. 16

5.3.8	Asbest	tos Containing Material17	7
5.3.9	Lead I	Based Paint	7
6.0	INTE	RVIEWS17	7
6.1	Curre	nt Owner 17	7
6.2	Past O	Wner	7
6.3	STAT	E/FEDERAL AGENCY COORDINATION12	7
7.0	DATA	GAP AND DATA FAILURE 17	7
8.0	FIND	INGS	3
9.0	OPIN	ION	3
10.0	CONC	CLUSIONS	3
11.0	REFE	RENCES	3
12.0	ENVI	RONMENTAL PROFESSIONAL STATEMENT 18	3
LIST (OF FIG	<u>URES</u>	
Figure	e 1: Ge	neral Location Map	5
Figure	2: Ta	rget Property and Photo Location Map	5
LIST (OF API	ENDICES	
Appen	dix A	Representative Photos	
Appen	dix B	Historical Photography and Topographic Maps	
Appen	dix C	Sanborn Map(s)	
Appen	dix D	User Inquiry Questionnaire	
Appen	dix E	EDR Database Records/Agency Coordination/Documentation	
Appen	dix F	Qualifications	

Cherokee Nation Tahlequah Hospital Tahlequah, Cherokee County, Oklahoma

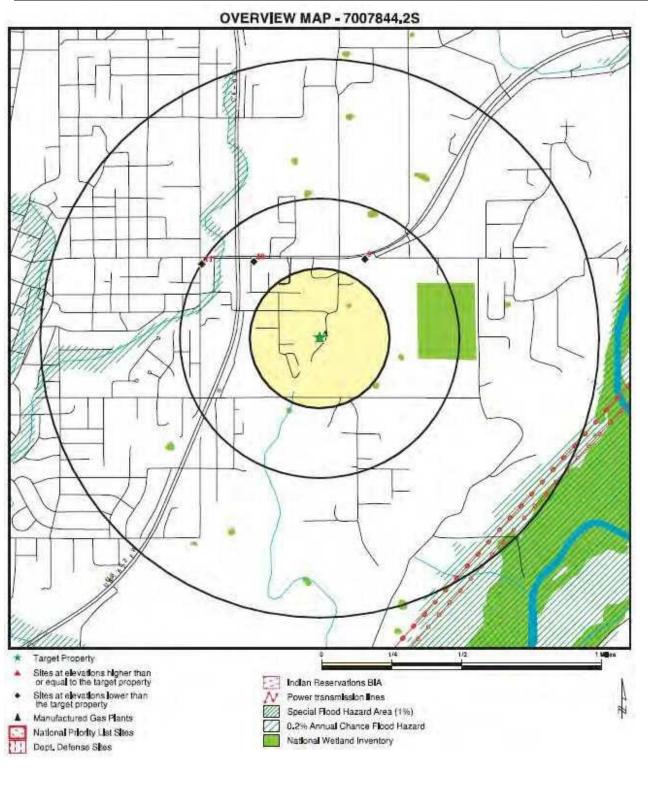
EXECUTIVE SUMMARY

- On June 6, 2022 Environmental Data Resources provided the current environmental regulatory database information in accordance with ASTM 1527-21 search distances.
- On March 16, 2022, a field survey was conducted by Sean Votaw of Eagle Environmental Consulting (EEC).
- No Recognized Environmental Conditions (REC's), Controlled Recognized Environmental Conditions (CRECs), or Historical Recognized Environmental Conditions (HRECs) associated with the Subject Property and/or surrounding properties were identified, observed, or reported as present on or adjacent to the subject property which may pose a potential liability.
- The results of environmental records search identified within the federal/state databases are provided below:

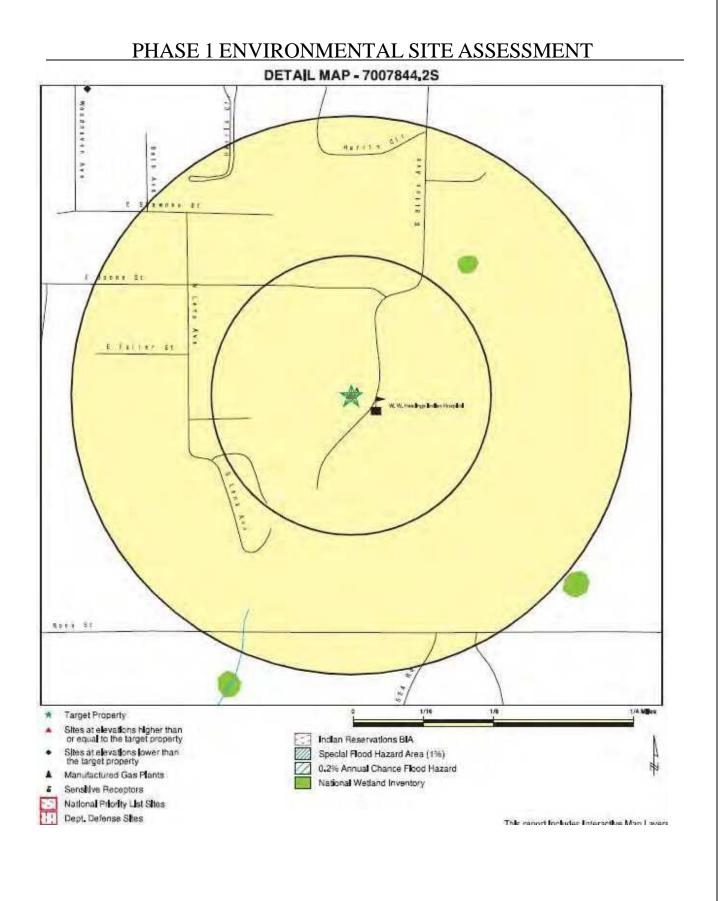
Target Property Address: 100 SOUTH BLISS AVE TAHLEQUAH, OK 74464

Click on Map ID to see full detail.

W.W. HASTINGS HOSPIT		DATABASE ACRONYMS	ELEVATION	DIRECTION
W.W. HASTINGS HOSFIT	100 S BLISS	INDIAN UST, ECHO		TP
WW HASTINGS HOSPITAL	100 S BLISS	UST		TP
WW HASTINGS HOSP	100 S BLISS	RCRA NonGen / NLR, FINDS		TP
CHEROKEE NATION OSU	100 BLISS AVENUE	ECHO		TP
CHEROKEE NATION OSU	100 BLISS AVENUE	FINDS		TP
W.W. HASTINGS HOSPIT	100 S. BLISS AVE	US BROWNFIELDS		TP
	100 S. BLISS AVENUE	ERNS		TP
	100 SOUTH BLISS AVE	ERNS		TP
E-Z MART #4366	1600 E DOWNING ST	LUST, UST, HIST UST	Lower	1723, 0.326, NNE
BIG B FOOD & DELI #2	1100 E. DOWNING	LUST, UST, HIST UST	Lower	1910, 0.362, NW
MARY'S LIQUOR MART	902 E DOWNING ST	LUST, UST, HIST UST	Lower	2633, 0.499, WNW
	WW HASTINGS HOSPITAL WW HASTINGS HOSP CHEROKEE NATION OSU CHEROKEE NATION OSU W.W. HASTINGS HOSPIT E-Z MART #4366 BIG B FOOD & DELI #2	WW HASTINGS HOSPITAL100 S BLISSWW HASTINGS HOSP100 S BLISSCHEROKEE NATION OSU100 BLISS AVENUECHEROKEE NATION OSU100 BLISS AVENUEW.W. HASTINGS HOSPIT100 S. BLISS AVEW.W. HASTINGS HOSPIT100 S. BLISS AVEE-Z MART #43661600 E DOWNING STBIG B FOOD & DELI #21100 E. DOWNING	WW HASTINGS HOSPITAL100 S BLISSUSTWW HASTINGS HOSP100 S BLISSRCRA NonGen / NLR, FINDSCHEROKEE NATION OSU100 BLISS AVENUEECHOCHEROKEE NATION OSU100 BLISS AVENUEFINDSW.W. HASTINGS HOSPIT100 S. BLISS AVENUEUS BROWNFIELDS100 S. BLISS AVENUEERNS100 SOUTH BLISS AVEE-Z MART #43661600 E DOWNING STLUST, UST, HIST USTBIG B FOOD & DELI #21100 E. DOWNINGLUST, UST, HIST UST	WW HASTINGS HOSPITAL100 S BLISSUSTWW HASTINGS HOSP100 S BLISSRCRA NonGen / NLR, FINDSCHEROKEE NATION OSU100 BLISS AVENUEECHOCHEROKEE NATION OSU100 BLISS AVENUEFINDSW.W. HASTINGS HOSPIT100 S. BLISS AVENUEUS BROWNFIELDS100 S. BLISS AVENUEERNS100 S. OUTH BLISS AVEERNSE-Z MART #43661600 E DOWNING STLUST, UST, HIST USTLowerBIG B FOOD & DELI #21100 E. DOWNINGLUST, UST, HIST USTLower



PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma Eagle Environmental Consulting, Inc. June 2022



PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma Eagle Environmental Consulting, Inc. June 2022

PHASE 1 ENVIRONMENTAL SITE ASSESSMENT 1.0 INTRODUCTION

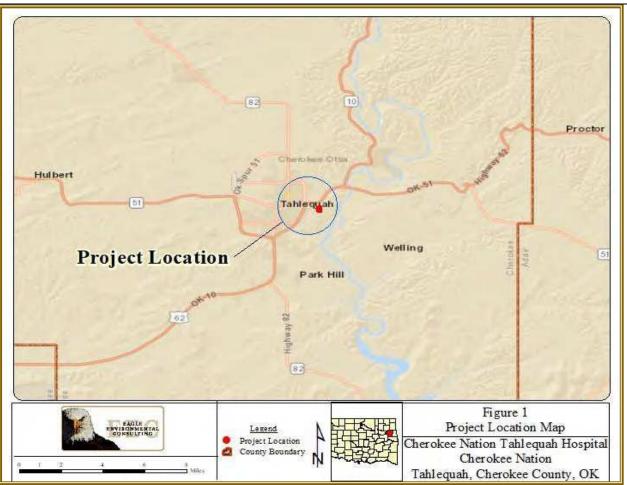
1.1 Purpose

The purpose of the Phase I Environmental Site Assessment (ESA) was to identify any recognized environmental conditions (REC's) present on or adjacent to the subject property which may pose a potential liability. Additionally, this Phase I ESA was conducted to identify Controlled Recognized Environmental Conditions (CRECs) and Historical Recognized Environmental Conditions (HRECs) associated with the Subject Property and/or surrounding properties. Per new standards. The term recognized environmental conditions (REC) means the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property due to any release to the environment under conditions indicative of a release to the environment or under conditions that pose a material threat of a future release to the environment. The term is not intended to include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be *de minimis* are not considered recognized environmental conditions. The intent of the assessment was to satisfy one of the requirements necessary to qualify for the innocent landowner defense against liability under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) constituting all appropriate inquiry.

1.2 Terms and Conditions

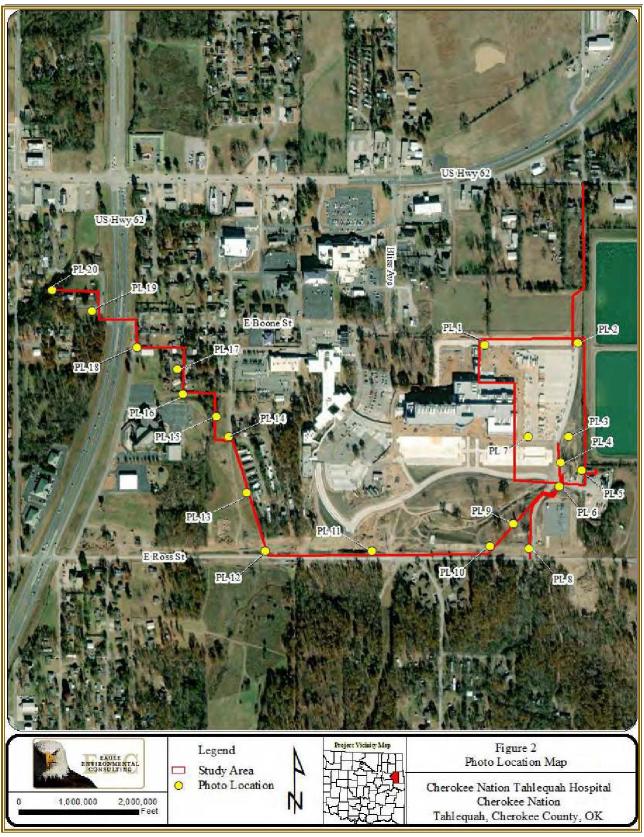
Eagle Environmental Consulting, (EEC) performed a Phase I ESA on approximately 20 acres of land primarily associated with the Cherokee Nation hospital and parking area as well as the proposed water and wastewater utility line corridors. The general assessment area consisted of previously developed health care facilities, attendant parking area, roads, and residential development in Tahlequah, Cherokee County, Oklahoma. The property is located in Section 27, Township 17 North, Range 22 East. **Figure 1** shows the general assessment areas. **Figure 2** depicts the target properties and recorded photograph locations.

The ASTM Standard Practice E 1527-21, entitled, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, was used as guidance to conduct the Phase 1 ESA for the property and adjacent areas to identify areas of environmental concern. The use of ASTM E 1527-21 is in compliance with the Environmental Protection Agency (EPA) All Appropriate Inquiries Final Rule. The Phase I ESA was conducted and a report prepared for the sole use by the Client. EEC will keep confidential and not disclose to any person or entity, without prior written consent of the Client, any data or information generated in conjunction with the performance of the Phase I ESA. Provisions of confidentiality shall not apply to data or information obtained from the public domain or acquired from third parties not under obligation to the Client for confidentiality.



1.3 Limitations and Exceptions

This Phase I ESA is not a comprehensive property characterization and should not be construed as such. The findings and opinions conveyed via this Phase I ESA are based on information obtained from a variety of sources identified herein, which EEC believes to be reliable. However, EEC has no control over regulatory databases, agency information releases, testing and analysis services, interviewed personnel response, or third party generated information, and therefore, disclaims any responsibility for errors and omissions arising therefrom. The conclusions set forth in this report are limited by the data presented in this report and the limited investigation performed by EEC under the Phase I ESA. Since the development of this Phase I ESA did not involve the sampling of soil, rock, groundwater, surface water, or air; it is, therefore, not possible to confirm the presence or absence of toxic or hazardous substances, waste or materials in the environments associated with the property. The photographs and maps included within this Phase I ESA are presented for the purpose of assisting the reader in visualizing the property. The findings of this report are valid as of the date of the investigation. However, changes in the conditions of the property can occur with the passage of time, whether due to natural processes or anthropogenic activities on this or adjacent properties. In addition, changes in applicable appropriate standards may occur resulting from legislation, broadening of knowledge, or other reasons.



PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma Eagle Environmental Consulting, Inc. June 2022

EEC assumes no responsibility to monitor any changes at the property or to advise if there are any changes as to what constitute hazardous materials substances or petroleum products. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside of EEC control. EEC does not claim responsibility for any incorrect information that may have been supplied by agencies, organizations or individuals that may be included in the findings of this report. EEC cannot be held liable due to remote and rugged property setting, complete visibility of all portions of said property could not be observed and any REC's that may not be visible.

This Phase 1 ESA does not address the other environmental concerns that do not fall within the ASTM's definition of recognized environmental conditions. Examples of other environmental concerns that do not fall under ASTM recognized environmental conditions include:

- Asbestos-containing materials (ACM) in structures on the property.
- Lead-based paint on structures on the property.
- Regulatory restrictions related to wetlands, aquifer recharge zones, endangered species habitats, or other environmentally sensitive settings.
- Health and Safety.
- Cultural and historic resources.

1.4 Assessment Methods

The Phase I ESA consisted of the following components:

- **Records Review** Review of records that are a matter of public record regarding facilities associated with the Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the EPA Emergency Response Notification System (ERNS), Toxic Release Inventory System (TRIS), underground storage tanks (USTs), leaking underground storage tanks (LUSTs) and permitted solid waste disposal and processing facilities.
- Site Reconnaissance Property visit to document the present surface conditions, physical characteristics and general appearance of the property and to examine all outdoor areas of the subject property looking for evidence of environmental impact, degradation and potential environmental hazards.
- **Interviews** Interviews with present owners, past owners, and occupants of a property, in addition to state and/or local government officials is required by this standard practice to obtain information indicating recognized environmental conditions in connection with the property.
- Assessment Report The preparation of a Phase I ESA report that documented observations and information collected about the property and to present findings and recommendations. This study did not include a subsurface investigation.

2.0 GENERAL SITE SETTING

2.1 Current Use of the Property

The property under assessment includes approximately 20 acres of land that has been previously developed by healthcare facilities, parking areas, and utility line infrastructure installation. The majority of the assessment area is developed and/or has been previously disturbed. Representative photographs of the property are provided in **Appendix A**.

2.2 Past Use of the Property

Historical aerial imagery and limited familiarity of the target properties were utilized to discern previous land usage. Past property use includes undeveloped lands presumably used for livestock grazing, healthcare facility construction, parking area development, and utility line installation.

2.2.1 Historical Aerial Photography and Topographic Maps

Aerial photography was reviewed and provided by Environmental Data Resources (EDR) for dates provided below. Historical photographs and topographic maps are provided in **Appendix B**.

Photo Year	Land Use	Comments/Remarks/Changes
1938	Undeveloped	The target property appears to have been undeveloped and part of rural agriculture operation.
1971	Developed	Between 1938 and 1971 it appears that parts of the assessment area have been developed into residential areas.
1973	Developed	There was no obvious change to the target property between 1971-1973.
1980	Developed	It appears that sanitary lagoons east of the target property were constructed between 1973-1980.
1995	Developed	Between 1980-1995, it appears that some residential development has taken place, as well as, some commercial buildings constructed.
2006	Developed	Residential additions developed between 1995-2006.
2010	Developed	There was no change to the target property between 2006-2010.
2013	Developed	There was no change to the target property between 2010-2013.
2017	Developed	Construction activities appear to have occurred on the target property between 2013-2017.

2.2.2 City Directories

A city directory search was not acquired for the target property from EDR due to understood current land ownership of the assessment area.

2.2.3 Sanborn Maps

The Sanborn library collection was searched for fire insurance map coverage. The property was not found within the holdings of the Sanborn Library collection. Sanborn documentation is provided in **Appendix C**.

2.3 Current Uses of the Adjoining Property

The target property is bordered on the north by a small tract of undeveloped land, as well as, residential areas and businesses. To the east, the target property is bordered by what appears to be a waste water treatment lagoon. The upper west adjoining property is a cemetery and a parking area for the Cherokee Nation Outpatient Health Clinic (CNOHC). The west adjoining property - the Cherokee Nation Outpatient Health Center. The south adjoining property is woodlands and residential areas.

2.4 Past Uses of the Adjoining Property and Surrounding Areas

Aerial photography was obtained from EDR and provided in **Appendix B**.

Photo Year	Land Use	Comments/Remarks/Changes
1938 - 2017	Undeveloped/ Developed	The surrounding properties in all cardinal directions exhibit tribal, residential and/or commercial construction between 1938-2017 with the majority of growth between 1973-2006.

2.5 General Description of Structures

The Cherokee Nation Hospital and appurtenant features observed within the target property appear to consist of new (or very recent) construction. Residential structures adjacent to the assessment areas appear to vary in age potentially dating between the 1970's to early 2000's. No structures were observed within the utility line corridors.

2.6 Roads

Access to the target property is provided from Bliss Avenue along the western property perimeter and from Ross Street along the southern property boundary, both of which are asphalt paved. Existing road infrastructure

PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma

is present at and adjacent to the hospital property/parking areas. Access roads thereto are also present and consisted of asphalt residential streets. Roads or streets in proximity to the utility line corridors were comprised of asphalt and gravel.

2.7 Potable Water Supply

X

Potable water supply provided by the city of Tahlequah.

Potable water supply provided by private water well.

Potable water supply is not provided with this property.

2.8 Sewage Disposal System



The sewage disposal is connected to a city of Tahlequah municipal sanitary system.

Sewage disposal is connected to a septic system with a lateral field.

No sewage disposal system is associated with the evaluated property.

3.0 USER PROVIDED INFORMATION

3.1 Title Records

The user of the Phase 1 ESA is the Cherokee Nation. No other title records were obtained.

3.2 Environmental Liens or Activity and Use Limitations

Based on the search of state and federal environmental database records conducted by EDR, no liens or use limitations were identified associated with the property (See Appendix E).

3.3 Specialized Knowledge

The current user provided no information. However, the Cherokee Nation employs certified and approved health and safety protocols and measures relative to storage and use of potentially hazardous materials consistent with safe use, handling, and storage.

3.4 Commonly Known or Reasonably Ascertainable Information

The user or owner evaluates, documents and retains ascertainable information as part of their health and safety management program and protocols.

3.5 User Provided Response to Questionnaire

The All-Appropriate Inquiries user questionnaire was requested but not received from the user.

RECORDS REVIEW 4.0

4.1 **Standard Environmental Record Sources**

On June 7, 2022, Environmental Data Resources, Inc. (EDR) conducted a search of state and federal environmental database records. The searches met the specific requirements of ASTM Standard Practice for Environmental Site Assessments. The target property was not listed in any of the databases searched by EDR. The information obtained from the EDR database search is found in Appendix E.

4.1.1 Federal CERCLIS/ SEMS List

The Superfund Enterprise Management System (SEMS) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly known as CERCLIS, renamed to SEMS by the EPA in 2015. The Superfund program was created to protect citizens from the dangers posed by abandoned or uncontrolled hazardous waste sites. In 1980, Congress established the Superfund program by passing the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Information System (CERCLIS) which provides the Federal government the authority to respond to hazardous substance emergencies, and to develop long-term solutions for the nation's most serious hazardous waste problems. The CERCLIS database contains information on hazardous waste sites, potentially hazardous waste sites and remedial activities conducted across the nation.

Х

No SEMS sites were identified within 1/2 mile of the property.

SEMS site(s) were identified within ¹/₂ mile of target property.

4.1.2 National Priorities List (NPL)

The National Priorities List identifies "Superfund" sites that have had documented contamination. The CERCLIS database includes sites that are on the NPL or being considered for the NPL.



No NPL sites were identified within $\frac{1}{2}$ mile of the property.

NPL sites were identified within ¹/₂ mile of the property.

4.1.3 **Delisted NPL Sites**

The Delisted National Priorities List identifies "Superfund" sites with documented contamination that have been satisfactorily resolved, cleaned, removed, and/or closed according to specified state/federal regulatory requirements.



No Delisted NPL sites were identified within ¹/₂ mile of the property.



Delisted NPL sites were identified within ¹/₂ mile of the property.

CERCLIS No Further Remedial Action Planned Site 4.1.4

Potentially hazardous waste sites that have been assessed and require no further remedial action planned (NFRAP) have been removed from CERCLIS.



No CERCLIS NFRAP sites were identified within ¹/₂ mile of the property.

CERCLIS NFRAP sites were identified within 1/2 mile of the property. See Section 4.1.1 for details.

4.1.5 Resource Conservation and Recovery Act (RCRA) CORRACTS Facilities

Facilities that store, treat, or dispose of hazardous waste are responsible for investigating and cleaning their facilities. The EPA refers to this clean-up requirement as corrective action. The USEPA Corrective Action Report (CORRACTS) identifies hazardous waste handlers with RCRA corrective action activity.



No RCRA CORRACTS Facilities were identified within ¹/₂ mile of the property.

RCRA CORRACTS Facilities were identified within ¹/₂ mile of the property.

4.1.6 RCRA Non-CORRACTS Treatment, Storage, and Disposal Facilities

This database includes selective information on sites which transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act. TSD's are facilities that treat, store, or dispose of hazardous waste.



No RCRA Non-CORRACTS Facilities were identified within ¹/₂ mile of the property.



RCRA Non-CORRACTS Facilities were identified within 1/2 mile of the property.

4.1.7 RCRA Generators List

RCRAInfo is the Environmental Protection Agency's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.



No RCRA Generators were identified within $\frac{1}{2}$ mile of the property.

RCRA Non-Generators were identified within the target property associated with the existing facility. No violations or non-compliance issues were identified or reported.

4.1.8 Federal, State, and Tribal Institutional Controls/Engineering Control Registries

Institutional controls are legal or administrative measures that limit human exposure to hazardous waste or hazardous constituents. Examples include use control areas, easements, zoning restrictions, and deed notices. They are intended to bolster the integrity of remedies and minimize the potential exposure to contamination by limiting land or resource use. Institutional controls are typically used any time contaminants are left in place at cleanup levels that are based on restricted site uses. In addition, institutional controls may be required during implementation of a remedy that will eventually achieve unrestricted site use cleanup levels but will take a long time, for example, for sites undergoing long term groundwater remediation and sites where a monitored natural attenuation remedy is approved. Institutional controls are generally used in conjunction with, rather than in lieu of, engineering measures, such as waste treatment or containment.



No sites with institutional or engineering controls were identified on the property.

Sites with institutional or engineering controls were identified on the property.

4.1.9 Emergency Response Notification System (ERNS) List

The U.S. EPA Emergency Response Notification System (ERNS) is a computer database containing information on release notifications of oil and hazardous substances that have occurred throughout the United States and have been reported to the National Response Center (NRC). The NRC is the sole federal point of contact for reporting oil and chemical spills. Releases are recorded when they are initially reported to the federal government by any party.



X

Х

No known reported releases of oil or hazardous substances were identified for this property.

Two (2) reported releases of oil or hazardous substances were identified for this property. Diesel fuel releases were reported by a private entity. Approximately 260 gallons of fuel were released during filling operation. Fire department was contacted, spill cleaned, and impact site was cleaned. No further action was required.

4.1.10 State and Tribal Equivalent NPL and CERCLIS

No state or Tribal NPL equivalent sites were identified within 1 mile of the property and no CERCLIS equivalent sites were identified within ¹/₂ mile of the property.

State or Tribal NPL equivalent sites were identified within 1 mile of the property.

4.1.11 Tribal Landfills or Solid Waste Disposal Sites

No Tribal permitted solid waste disposal or processing facilities were located on or within a ¹/₂ mile radius of the property.



Х

Tribal permitted solid waste disposal or processing facilities were located on or within a ¹/₂ mile radius of the property.

4.1.12 State Landfill or Solid Waste Disposal Sites

x

No State landfill or solid waste disposal or processing facilities were located on or within a $\frac{1}{2}$ mile radius of the property.



State landfill or solid waste disposal or processing facilities were located on or within a ¹/₂ mile radius of the property.

4.1.13 State and Tribal Registered Underground Storage Tanks (UST)

The Oklahoma Department of Environmental Quality (ODEQ) enforces state and federal regulations and administers certain assistance programs applicable to the storage, quality, and delivery of refined petroleum products (i.e., gasoline and other fuels) and records information on the release of petroleum products. EDR was used to identify the location of any underground (UST), aboveground (AST) or leaking underground storage tanks (LUST). Tanks were identified or recorded at the target property. No monitoring wells were identified.

Owner Name	Facility ID	Capacity (gal)	Contents	Installed	Closed	Identified Issues	Current Status
WW Hastings Hospital	1157118	6000	Diesel	Unknown	11/15/2012	None	Permanently Removed

PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma Eagle Environmental Consulting, Inc. June 2022

WW Hastings Hospital	1157118	8000	Antifreeze	Unknown	11/15/2012	None	Permanently Removed
Date of Reg	ulatory Agend	cy Inquiry:	June 7, 2022	Source:	EDR	А	gency: ODEQ

4.1.14 State and Tribal Leaking Underground Storage Tanks (LUST)

The EDR database was searched to identify the location of any leaking underground storage tanks within the standard search radii.



No LUST's were located on or within the subject property. Three LUST records were reported by EDR along U.S. Highway 62 north of the target property. All sites are situated at lower elevation.



LUST's were located on or within the subject property.

LUST's were located within 1/8 mile of the target property.

4.1.15 State and Tribal Voluntary Cleanup (VCP) Sites

The voluntary cleanup program provides an opportunity for private parties and government entities to clean up properties that may be contaminated. Sites within the program can range in size and contain single or multiple sources of contamination.



No VCP sites were identified within a ¹/₂ mile of the subject property.

VCP sites were identified within a ¹/₂ mile of the subject property.

4.1.16 State and Tribal Brownfields Sites

Brownfields are defined by Oklahoma law as abandoned, idle or underused industrial or commercial facilities or other real property at which expansion or redevelopment of the real property is complicated by environmental contamination caused by regulated substances. Documentation provided by EDR is located in **Appendix E**.



Х

No Brownfields sites were identified within a $\frac{1}{2}$ mile of the subject property.

Brownfields sites were identified within adjacent to the subject property. Four parcels were reported in the vicinity of the target property associated with the existing W.W. Hastings Hospital. No issues or concerns were reported or identified.

4.2 Physical Setting Sources

4.2.1 Topographic/Hydrologic/Geologic/Hydrogeologic Conditions

The property is located on the Tahlequah, OK 7.5-minute USGS topographic map. Elevation at the property is approximately 895 ft. Surface water runoff flows generally west. The property is underlain by Paleozoic era, Mississippian system, Osagean and Kinderhookian series rock. The soil compositions are made of Clarksville stony silt loam (somewhat excessively drained), Tonti gravelly silt loam (moderately well drained), Clarksville very gravelly silt loam (somewhat excessively drained), Captina silt loam (moderately well drained), Britwater gravelly silt loam (well drained), and Britwater silt loam (well drained).

5.0 SITE RECONNAISSANCE

5.1 **Property Observations**

On March 16th, 2022, Sean Votaw of EEC performed the site reconnaissance survey at the target property. The hospital and parking areas were described as a mostly developed area that transitions through mowed and maintained areas. No oil or gas wells were observed. There were a few small areas of solid material dumping were observed along the sanitary system utility line corridor but did not evidence and RECs. The property to the north and northwest is developed as part of a housing development and a church. Bordering the south was undeveloped forest land and a few private residences. To the east the area is used a sanitary water treatment plant. No RECS were observed.

5.1.1 Hazardous Substances and Petroleum Products in Connection with Identified Uses

No petroleum products or hazardous substances were observed at the subject property.

Petroleum products or hazardous substances were observed at the subject property.

5.1.2 Other Storage Tanks

No other storage tanks were observed at the subject property.

Other storage tanks were observed at the subject property.

5.1.3 Odors



Х

Х

No odors or vapors were identified at the target property.

Odors or vapors were identified at the subject property adjacent to the used oil drums.

5.1.4 Pools of Liquid



No pools of liquid or hazardous or petroleum substances were observed at the target property.

Pools of liquid or hazardous or petroleum substances were observed at the target property.

5.1.5 Drums

No drums were identified within the target property.



х

Drums were identified within the subject property. Investigation showed them to be empty.

5.1.6 Hazardous Substance and Petroleum Products Containers

х

No hazardous substances or containers were observed at the target property.

PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma

Hazardous substances or containers were observed at the target property.

5.1.7 Unidentified Substance Containers



No unidentified substance containers were observed at the target property.



Unidentified substance containers were observed at the target property.

5.1.8 PCB's

Polychlorinated Biphenyls (PCBs) were used as a dielectric fluid in transformers, capacitors, and ballasts prior to the Toxic Substance Control Act of 1976. The EPA banned further manufacture of equipment containing PCB's in 1979.



No transformers, capacitors, ballasts were observed at the subject property.

Transformers were observed at the adjacent property but no leakage was observed. No PCB materials reported to be used in transformers or at the target property.

5.2 Interior Observations

5.2.1 Heating/Cooling



There is no obvious energy source at the target property.



X

5.2.2 Stains or Corrosion

No obvious areas of staining and/or corrosion were observed at the target property.

Minor rust staining was observed.

5.2.3 Drains and Sumps

x

No drains, sumps, or storm drains were observed at the target property.

Heating and cooling equipment was not identified at the target property.

Drains, sumps, or storm drains were observed at the target property.

5.3 Exterior Observations



Pits, Ponds, or Lagoons

No pits or lagoons were observed at the target property. However, wastewater treatment lagoons were observed adjacent to and east of the target property. No issues were identified.



х

Pits, ponds, or lagoons were observed adjacent to the subject property.

5.3.2 Stained Soil or Pavement

No stained soils or pavement was observed at the subject property.

PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma Eagle Environmental Consulting, Inc. June 2022

	Stained soils or pavement was observed at the subject property.
5.3.3	Stressed Vegetation
X	No stressed vegetation was observed at the subject property.
	Stressed vegetation was observed at the subject property.
5.3.4	Solid Waste
	No trash and/or refuse receptacles were observed at the subject property.
X	Solid waste receptacles were observed on the northern portion of the property.
5.3.5	Wastewater
X	No wastewater was observed at the subject property.
	Wastewater was observed at the property.

5.3.6 Wells

The Oklahoma Water Resources Board groundwater wells standards and protection interactive mapping was accessed on February 21, 2021. No water well locations were identified at the property on interactive mapping. The Oklahoma Corporation Commission Website Data Miner was used to search for oil and gas locations at the property. No wells were observed that related to the property. No oil and gas wells were observed at the property. The EDR radius report did not report any water wells or oil and gas wells at the property.

Г		1

Х

Water wells were identified at the property associated with the UST detection system.

Water wells were identified.

No water wells were identified at the property. Multiple water wells were reported within the search radii.



No oil and gas wells were identified within the subject property.

Oil and gas wells were identified.

5.3.7 Septic System

Since 1992, the Oklahoma Department of Environmental Quality (ODEQ) has been the reservoir for records pertaining to septic systems that was transferred from the Department of Health.



No septic systems were identified within the subject property.

A septic system was identified by the owner.

5.3.8 Asbestos Containing Material

No structures were observed on the property. No demolition activities are proposed.

5.3.9 Lead Based Paint

Lead is a soft, bluish metallic element that has been used in a wide variety of products. According to EPA, paint manufacturers frequently used lead as a primary ingredient in many oil-based interior and exterior house paints through the 1940s and gradually decreased its use in the 1950s and 1960s as latex paints became more widespread. The federal Department of Housing and Urban Development (HUD) estimated that 75 % of the houses built in the United States before 1978 contain some lead-based paint. Lead from paint, chips, and dust can pose health hazards if not properly managed. The Consumer Product Safety Commission (CPSC) prohibited use of lead in paint for residential use in 1978 in concentrations greater than 0.06 percent lead by weight. It should be noted that the use of LBP in commercial and industrial buildings and has not been prohibited. Painted surfaces at the property may contain lead-based paint.

6.0 INTERVIEWS

6.1. Current Owner

No specific interviews were conducted with the owner. The Cherokee Nation environmental department provided a previously prepared Phase I ESA for the adjacent property to the north. No issues or concerns were identified from the Phase I ESA completed for the adjacent property and none were identified or expressed by the Cherokee Nation relative to the subject property. EEC contacted Capt. Enlow with City of Tahlequah Fire Department by phone. One electrical outlet fire call was recently completed at the W.W. Hastings Hospital. No hazardous material response calls were reported for the subject property. Two diesel spills were responded to which occurred at the Hastings Hospital approximately 7 plus years ago. The spills were cleaned with no further action required. No other issues or responses were reported at or near the subject property.

6.2 Past Owner

The former owner was not able to be located.

6.3 State and Local Agency Coordination

Oklahoma Department of Environmental Quality

The ODEQ rely on their current databased records which are acquired by and provided through the EDR database search results. The state agencies no longer provide substantive response information regarding routine inquiries. Email inquiries typically redirect search efforts to online databases. Said databases are accessed by EDR and provided through the database search results. In the event substantive issues have been reported at a given property, those records are provided to EDR and then researched as needed and required by EEC. No such information was reported.

7.0 DATA GAP AND DATA FAILURE

A data gap is defined as a lack or inability to obtain information required by this practice despite good faith efforts by the environmental professional to gather such information and that the data gap impacts the environmental professional to identify recognized environmental conditions. Data gaps were encountered in association with the assessment of the property. It was not possible to confirm land use within the property for

PHASE I ESA – Cherokee Nation Tahlequah Hospital Cherokee County, Oklahoma Eagle Environmental Consulting, Inc. June 2022

each 5-year interval of time back to 1938. Based on the aerial photograph review, the target property appeared to be undeveloped prior to 1938 with no obvious land development. It can be inferred that the land was used for agricultural purposes.

Data failure is a failure to achieve the historical research objectives in Section 8 of the standard practice that are reasonably ascertainable and likely to be useful. Data failure is one type of data gap. Data failure was not encountered during this assessment.

8.0 FINDINGS

Described below are the findings obtained by the Phase 1 ESA: There were no REC's, CREC's, or HREC's identified within or adjacent to the target property. No issues were identified in the environmental database records/research that required further investigation.

9.0 **OPINION**

Based on the property site visit, EDR database records, review of past aerial photography of the property, it is the opinion of the environmental professional that the target property has been previously developed by outpatient health facility buildings, parking areas, and roads. The utility line corridors are undeveloped but have been disturbed. No REC's, CREC's, or data gaps were reported or observed at the target property.

10.0 CONCLUSIONS

We have performed a *Phase I Environmental Site Assessment* in conformance with the scope and limitations of ASTM Practice E1527-21 of Phase I ESA of the target property located at 19600 E. Ross Street, Tahlequah, OK in the Southeast Quarter of Section 34, Township 17 North, Range 22 East. The purpose of the Phase 1 ESA was to identify any recognized environmental conditions. The term recognized environmental conditions means the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property due to release to the environment under conditions indicative of a release to the environment or under conditions that pose a material threat of a future release to the environment. No REC's, CREC's or data gaps were reported or observed at the target property.

11.0 REFERENCES

ASTM International. 2013. Standard Practice for Environmental Site Assessments: Phase 1 Site Assessment Process, E 1527-21. 59 pages.

Cherokee Nation. 2022. Phase I ESA. Tahlequah Hospital Foundation, Inc. Environmental Data Records, Inc. (EDR). 2022. The EDR Radius Map Report. Environmental Data Records, Inc. (EDR). 2022. EDR Aerial Photo Decade Package. Environmental Data Records, Inc. (EDR). 2022. Certified Sanborn Map Report.

12.0 ENVIRONMENTAL PROFESSIONAL STATEMENT

We declare that, to the best of our professional knowledge and belief, we meet the definition of environmental professional as defined in 312.10 of 40 CFR 312 and we have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312. Qualifications of the environmental professionals are provided in **Appendix F**.

Stur R. Pitaw

June 26, 2022

Steven R. Votaw President

Law

June 22, 2022

Sean Votaw Environmental Professional Certified ASTM Assessor Appendix A

Representative Photos



PL:1















PL: 5



PL: 6





PL: 8







PL: 10





PL: 12



PL: 13



PL: 13



PL: 14



PL: 15







PL: 17



PL: 18



PL: 20



PL: 20

PL: 19

Appendix B

Historical Photography

Cherokee Nation Tahlequah Hospital

100 South Bliss Ave Tahlequah, OK 74464

Inquiry Number: 7007844.5 June 07, 2022

The EDR Aerial Photo Decade Package



6 Armstrong Road, 4th floor Shelton, CT 06484 Toll Free: 800.352.0050 www.edrnet.com

Site Name:

Client Name:

06/07/22

Cherokee Nation Tahlequah H 100 South Bliss Ave Tahlequah, OK 74464 EDR Inquiry # 7007844.5 Eagle Env. Consulting Inc. P.O. Box 335 Vinita, OK 74301 Contact: Sean T Votaw



Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Searc	h Results:			
Year	<u>Scale</u>	<u>Details</u>	<u>Source</u>	
2017	1"=500'	Flight Year: 2017	USDA/NAIP	
2013	1"=500'	Flight Year: 2013	USDA/NAIP	
2010	1"=500'	Flight Year: 2010	USDA/NAIP	
2006	1"=500'	Flight Year: 2006	USDA/NAIP	
1995	1"=500'	Acquisition Date: March 23, 1995	USGS/DOQQ	
1980	1"=500'	Flight Date: March 18, 1980	USDA	
1973	1"=500'	Flight Date: February 20, 1973	USGS	
1971	1"=500'	Flight Date: February 15, 1971	USGS	
1938	1"=500'	Flight Date: September 18, 1938	USDA	

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Disclaimer - Copyright and Trademark Notice

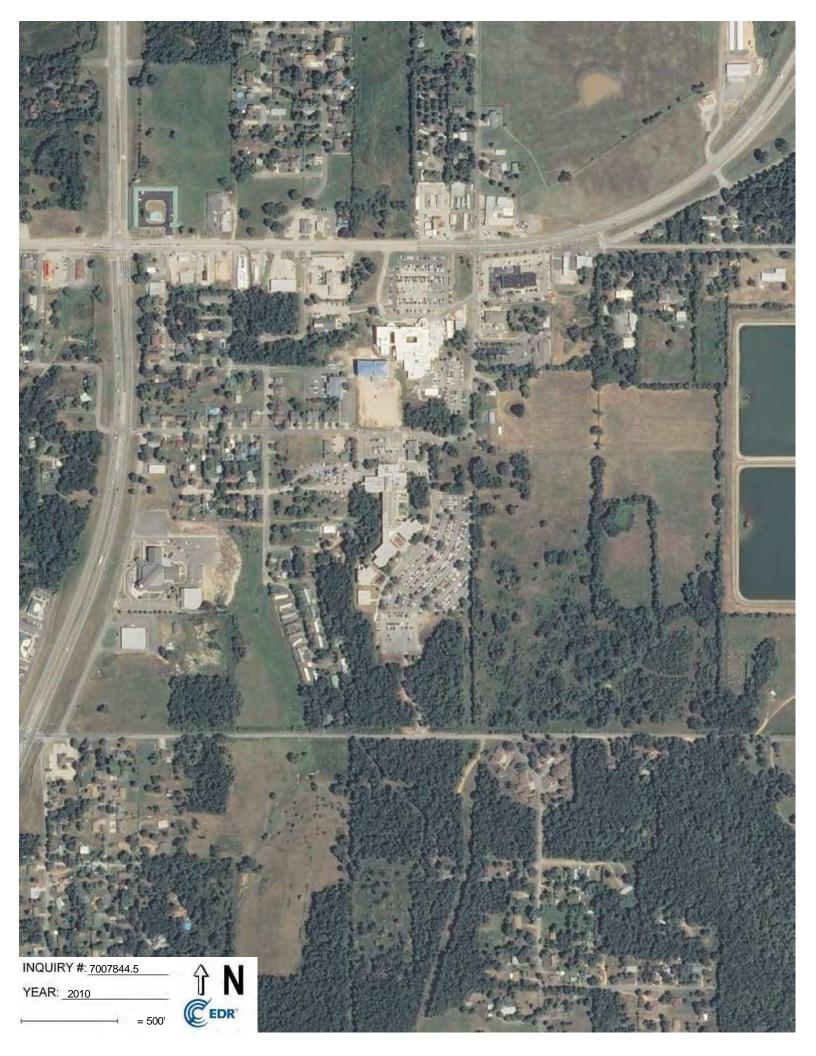
This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2022 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.



















Appendix C

Sanborn Map(s)

Cherokee Nation Tahlequah Hospital 100 South Bliss Ave Tahlequah, OK 74464

Inquiry Number: 7007844.3 June 06, 2022

Certified Sanborn® Map Report



6 Armstrong Road, 4th floor Shelton, CT 06484 Toll Free: 800.352.0050 www.edrnet.com

Certified Sanborn® Map Report

Cherokee Nation Tahleguah H 100 South Bliss Ave Tahlequah, OK 74464 EDR Inquiry # 7007844.3

Site Name:

Eagle Env. Consulting Inc. P.O. Box 335 Vinita, OK 74301 Contact: Sean T Votaw

Client Name:



06/06/22

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by Eagle Env. Consulting Inc. were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:		
Certification #	7E83-4F3A-8F04	
PO #	NA	
Project	CN Hastings Tahlequah Hospital	

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.



Sanborn® Library search results

Certification #: 7E83-4F3A-8F04

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

Library of Congress

University Publications of America

EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

Eagle Env. Consulting Inc. (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive. the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2022 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

7007844 - 3 page 2

Appendix D

User Inquiry Questionnaire

Appendix E

EDR Database Records/Agency Coordination/Documentation

Cherokee Nation Tahlequah Hospital

100 South Bliss Ave Tahlequah, OK 74464

Inquiry Number: 7007844.2s June 06, 2022

The EDR Radius Map[™] Report with GeoCheck[®]



6 Armstrong Road, 4th floor Shelton, CT 06484 Toll Free: 800.352.0050 www.edrnet.com

FORM-LBD-GXH

TABLE OF CONTENTS

SECTION

PAGE

Executive Summary	ES1
Overview Map	2
Detail Map	3
Map Findings Summary	4
Map Findings	8
Orphan Summary	30
Government Records Searched/Data Currency Tracking	GR-1

GEOCHECK ADDENDUM

Physical Setting Source Addendum	A-1
Physical Setting Source Summary	A-2
Physical Setting SSURGO Soil Map	A-5
Physical Setting Source Map	A-11
Physical Setting Source Map Findings	A-13
Physical Setting Source Records Searched	PSGR-1

Thank you for your business. Please contact EDR at 1-800-352-0050 with any questions or comments.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2020 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E1527-21), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

100 SOUTH BLISS AVE TAHLEQUAH, OK 74464

COORDINATES

Latitude (North):	35.9111800 - 35 54 40.24"
Longitude (West):	94.9501680 - 94^ 57' 0.60''

Universal Tranverse Mercator: Zone 15			
UTM X (Meters):	324024.2		
UTM Y (Meters):	3975653.8		
Elevation:	895 ft. above sea level		

20150809

USDA

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:142Version Date:201	238152 TAHLEQUAH, OK 19
---	----------------------------

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from: Source:

TC7007844.2s EXECUTIVE SUMMARY 1

Target Property Address: 100 SOUTH BLISS AVE TAHLEQUAH, OK 74464

Click on Map ID to see full detail.

MAP				RELATIVE	DIST (ft. & mi.)
ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	ELEVATION	DIRECTION
A1	W.W. HASTINGS HOSPIT	100 S BLISS	INDIAN UST, ECHO		TP
A2	WW HASTINGS HOSPITAL	100 S BLISS	UST		TP
A3	WW HASTINGS HOSP	100 S BLISS	RCRA NonGen / NLR, FINDS		TP
A4	CHEROKEE NATION OSU	100 BLISS AVENUE	ECHO		TP
A5	CHEROKEE NATION OSU	100 BLISS AVENUE	FINDS		TP
A6	W.W. HASTINGS HOSPIT	100 S. BLISS AVE	US BROWNFIELDS		TP
A7		100 S. BLISS AVENUE	ERNS		TP
A8		100 SOUTH BLISS AVE	ERNS		TP
9	E-Z MART #4366	1600 E DOWNING ST	LUST, UST, HIST UST	Lower	1723, 0.326, NNE
10	BIG B FOOD & DELI #2	1100 E. DOWNING	LUST, UST, HIST UST	Lower	1910, 0.362, NW
11	MARY'S LIQUOR MART	902 E DOWNING ST	LUST, UST, HIST UST	Lower	2633, 0.499, WNW

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 8 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
W.W. HASTINGS HOSPIT	INDIAN UST	N/A
100 S BLISS TAHLEQUAH, OK 74464	Database: INDIAN UST R6, Date of Government Ve Facility ID: 0317OK ECHO Registry ID: 110004743859	rsion: 10/12/2021
WW HASTINGS HOSPITAL 100 S BLISS TAHLEQUAH, OK 74464	UST Facility Id: 1157118 TankStatus: POU	N/A
WW HASTINGS HOSP 100 S BLISS TAHLEQUAH, OK 74464	RCRA NonGen / NLR EPA ID:: OK5750311537 FINDS Registry ID:: 110004743859	OK5750311537
CHEROKEE NATION OSU 100 BLISS AVENUE TAHLEQUAH, OK 74464	ECHO Registry ID: 110070530675	N/A
CHEROKEE NATION OSU 100 BLISS AVENUE TAHLEQUAH, OK 74464	FINDS Registry ID:: 110070530675	N/A
W.W. HASTINGS HOSPIT 100 S. BLISS AVE TAHLEQUAH, OK 74464	US BROWNFIELDS ACRES property ID: 149901 Cleanup Completion Date: -	N/A
100 S. BLISS AVENUE 100 S. BLISS AVENUE TAHLEQUAH, OK 74464	ERNS NRC Report #: 1035105 Incident Date Time: 2013-01-01 00:30:00	N/A
100 SOUTH BLISS AVE	ERNS NRC Report #: 1052039	N/A

ERNS N/A NRC Report #: 1052039 Incident Date Time: 2013-06-27 20:00:00

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Lists of Federal NPL (Superfund) sites

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
	Federal Superfund Liens

Lists of Federal Delisted NPL sites

Delisted NPL_____National Priority List Deletions

Lists of Federal sites subject to CERCLA removals and CERCLA orders

FEDERAL FACILITY	Federal Facility Site Information listing
SEMS	Superfund Enterprise Management System

Lists of Federal CERCLA sites with NFRAP

SEMS-ARCHIVE Superfund Enterprise Management System Archive

Lists of Federal RCRA facilities undergoing Corrective Action

CORRACTS Corrective Action Report

Lists of Federal RCRA TSD facilities

RCRA-TSDF_____RCRA - Treatment, Storage and Disposal

Lists of Federal RCRA generators

 RCRA-LQG
 RCRA - Large Quantity Generators

 RCRA-SQG
 RCRA - Small Quantity Generators

 RCRA-VSQG
 RCRA - Very Small Quantity Generators (Formerly Conditionally Exempt Small Quantity Generators)

Federal institutional controls / engineering controls registries

LUCIS Land Use Control Information System US ENG CONTROLS Engineering Controls Sites List US INST CONTROLS Institutional Controls Sites List

Lists of state- and tribal hazardous waste facilities

SHWS_____The Land Report

Lists of state and tribal landfills and solid waste disposal facilities

SWF/LF Permitted Solid Waste Disposal & Processing Facilities

Lists of state and tribal leaking storage tanks

LAST_____Leaking Aboveground Storage Tanks List INDIAN LUST_____Leaking Underground Storage Tanks on Indian Land

Lists of state and tribal registered storage tanks

FEMA UST	Underground Storage Tank Listing
AST	Aboveground Storage Tanks

State and tribal institutional control / engineering control registries

INST CONTROL Institutional Control Sites

Lists of state and tribal voluntary cleanup sites

 INDIAN VCP
 Voluntary Cleanup Priority Listing

 VCP
 Voluntary Cleanup Site Inventory

Lists of state and tribal brownfield sites

BROWNFIELDS Brownfield Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Lists of Landfill / Solid Waste Disposal Sites

SWRCY	Recycling Facilities
INDIAN ODI	Report on the Status of Open Dumps on Indian Lands
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
ODI	Open Dump Inventory
IHS OPEN DUMPS	Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL_____Delisted National Clandestine Laboratory Register US CDL_____National Clandestine Laboratory Register

Local Lists of Registered Storage Tanks

HIST UST ______ Underground Storage Tank List, List II Version

Local Land Records

LIENS 2 CERCLA Lien Information

Records of Emergency Release Reports

HMIRS Hazardous Materials Information Reporting System

OK COMPLAINT_____Oklahoma Complaint System Database

Other Ascertainable Records

FUDS	Formerly Used Defense Sites
	Department of Defense Sites
	State Coalition for Remediation of Drycleaners Listing
	Einancial Assurance Information
	Financial Assurance Information
	2020 Corrective Action Program List
	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	Risk Management Plans RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide
1110	Act)/TSCA (Toxic Substances Control Act)
MLTS	Act)/TSCA (Toxic Substances Control Act) Material Licensing Tracking System
COAL ASH DOF	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Formerly Utilized Sites Remedial Action Program Uranium Mill Tailings Sites Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
UXO	Unexploded Ordnance Sites
DOCKET HWC	Hazardous Waste Compliance Docket Listing
FUELS PROGRAM	EPA Fuels Program Registered Listing
AIRS	Permitted AIRS Facility Listing
ASBESTOS	Asbestos Notification
DRYCLEANERS	PFAS Contamination Site Location Listing
DRYCLEANERS	Drycleaner Facility Listing
Financial Assurance	Financial Assurance Information Listing
TIER 2	Tier 2 Data Listing
UIC	Underground Injection Wells Database Listing
MINES MRDS	Mineral Resources Data System

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto	EDR Exclusive Historical Auto Stations

EDR Hist Cleaner EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	Recovered Government Archive State Hazardous Waste Facilities List
RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property. Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in **bold italics** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Lists of state and tribal leaking storage tanks

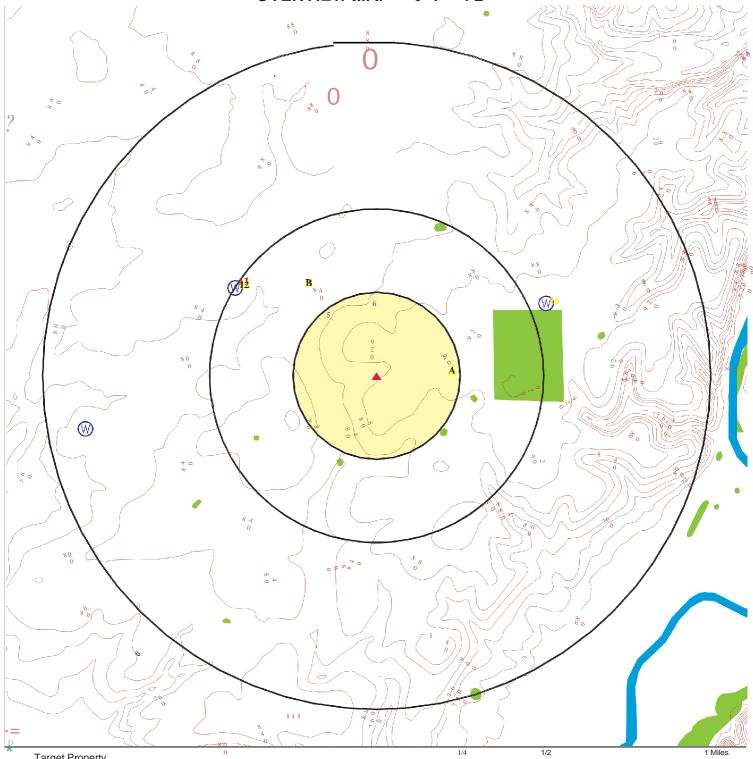
LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Oklahoma Corporation Commission's Leaking UST list.

A review of the LUST list, as provided by EDR, and dated 12/02/2021 has revealed that there are 3 LUST sites within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
<i>E-Z MART #4366</i> STATUS: Closed Facility Id: 1109406 Close Date: 08/03/2005 Close Date: 07/22/2003	1600 E DOWNING ST	NNE 1/4 - 1/2 (0.326 mi.)	9	24
BIG B FOOD & DELI #2 STATUS: Closed Facility Id: 1110244 Close Date: 01/08/2021	1100 E. DOWNING	NW 1/4 - 1/2 (0.362 mi.)	10	26
MARY'S LIQUOR MART STATUS: Closed Facility Id: 1109523 Close Date: 02/26/2004	902 E DOWNING ST	WNW 1/4 - 1/2 (0.499 mi.)	11	28

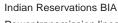
There were no unmapped sites in this report.

OVERVIEW MAP - 7007844 2S



Target Property

- Sites at elevat1 ons higher than or equal to the target property
- Sites at elevations lower than the target property
- .1 Manufactured Gas Plants
- National Priority List Sites [:]
- [2J Dept. Defense Sites





Power transmission lines

Special Flood Hazard Area (1%) 0.2% Annual Chance Flood Hazard

National Wetland Inventory

display and hide map information. The legend includes only those icons for the default mp view.

Ħ

SITE NAME: Cherokee Nation Tahlequah Hospital	CLIENT: Eagle Env. Consulting Inc.
ADDRESS: 100 South Bliss Ave	CONTACT: Sean TVo taw
Tahlequah OK 74464	INQUIRY#: 7007844.2s
LAT/LONG: 35.91118 / 94.950168	DATE: June 06, 2022 8:22 pm

This r port includes Interactive Map Layers to

/or

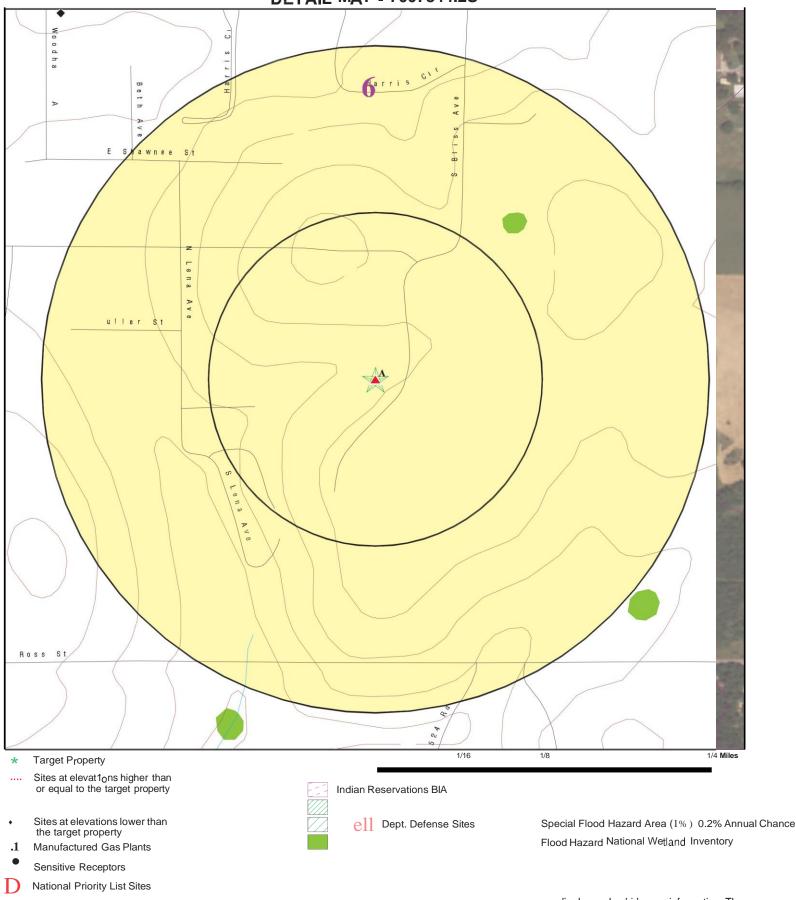
е

displ and hide map information. The legend .ncludes only those icons for the default ma

9

SITE NAME: Cherokee Nation Tahlequah Hospital	CLIENT: Eagle Env. Consulting Inc.
ADDRESS: 100 South Bliss Ave	CONTACT: Sean TVo taw
Tahlequah OK 74464	INQUIRY#: 7007844.2s
LAT/LONG: 35.91118 / 94.950168	DATE: June 06, 2022 8:22 pm

DETAIL MAP - 7007844.2S



display and hide map information. The legend i ncludes only those icons for the default map volw.

SITE NAME:	Cherokee Nation Tahlequah Hospital	CLIENT:	Eagle Env. Consulting Inc.
ADDRESS:	100 South Bliss Ave	CONTACT:	Sean TVo taw
	Tahlequah OK 74464	INQUIRY#:	7007844.2s
LAT/LONG:	35.91118 / 94.950168	DATE:	June 06, 2022 8:22 pm

This r port includes Interactive Map Layers to

/or

е

displ and hide map information. The legend $\cdot ncludes$ only those icons for the defaul ap v1

SITE NAME: Cherokee Nation Tahlequah Hospital	CLIENT: Eagle Env. Consulting Inc.
ADDRESS: 100 South Bliss Ave	CONTACT: Sean TVo taw
Tahlequah OK 74464	INQUIRY#: 7007844.2s
LAT/LONG: 35.91118 / 94.950168	DATE: June 06, 2022 8:22 pm

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMEN	TAL RECORDS							
Lists of Federal NPL (Su	perfund) site	s						
NPL Proposed NPL NPL LIENS	1.000 1.000 1.000		0 0 0	0 0 0	0 0 0	0 0 0	NR NR NR	0 0 0
Lists of Federal Delisted	INPL sites							
Delisted NPL	1.000		0	0	0	0	NR	0
Lists of Federal sites su CERCLA removals and (rs						
FEDERAL FACILITY SEMS	0.500 0.500		0 0	0 0	0 0	NR NR	NR NR	0 0
Lists of Federal CERCL	A sites with N	FRAP						
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Lists of Federal RCRA fa undergoing Corrective A								
CORRACTS	1.000		0	0	0	0	NR	0
Lists of Federal RCRA T	SD facilities							
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Lists of Federal RCRA g	enerators							
RCRA-LQG RCRA-SQG RCRA-VSQG	0.250 0.250 0.250		0 0 0	0 0 0	NR NR NR	NR NR NR	NR NR NR	0 0 0
Federal institutional con engineering controls reg								
LUCIS US ENG CONTROLS US INST CONTROLS	0.500 0.500 0.500		0 0 0	0 0 0	0 0 0	NR NR NR	NR NR NR	0 0 0
Federal ERNS list								
ERNS	TP	2	NR	NR	NR	NR	NR	2
Lists of state- and tribal hazardous waste facilitie								
SHWS	1.000		0	0	0	0	NR	0
Lists of state and tribal and solid waste disposa								
SWF/LF	0.500		0	0	0	NR	NR	0
Lists of state and tribal	leaking stora	ge tanks						
LAST	0.500		0	0	0	NR	NR	0

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LUST INDIAN LUST	0.500 0.500		0 0	0 0	3 0	NR NR	NR NR	3 0
Lists of state and tribal	registered sto	orage tanks						
FEMA UST UST AST INDIAN UST	0.250 0.250 0.250 0.250	1 1	0 0 0 0	0 0 0 0	NR NR NR NR	NR NR NR NR	NR NR NR NR	0 1 0 1
State and tribal institution control / engineering co		s						
INST CONTROL	0.500		0	0	0	NR	NR	0
Lists of state and tribal	voluntary clea	anup sites						
INDIAN VCP VCP	0.500 0.500		0 0	0 0	0 0	NR NR	NR NR	0 0
Lists of state and tribal	brownfield sit	es						
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONME	NTAL RECORD	<u>s</u>						
Local Brownfield lists								
US BROWNFIELDS	0.500	1	0	0	0	NR	NR	1
Local Lists of Landfill / S Waste Disposal Sites	Solid							
SWRCY INDIAN ODI DEBRIS REGION 9 ODI IHS OPEN DUMPS	0.500 0.500 0.500 0.500 0.500		0 0 0 0	0 0 0 0 0	0 0 0 0 0	NR NR NR NR NR	NR NR NR NR NR	0 0 0 0
Local Lists of Hazardou Contaminated Sites	s waste /							
US HIST CDL US CDL	TP TP		NR NR	NR NR	NR NR	NR NR	NR NR	0 0
Local Lists of Registere	d Storage Tar	nks						
HIST UST	0.250		0	0	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency	Release Repo	rts						
HMIRS OK COMPLAINT	TP TP		NR NR	NR NR	NR NR	NR NR	NR NR	0 0
Other Ascertainable Re								
RCRA NonGen / NLR	0.250	1	0	0	NR	NR	NR	1

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
	TP		NR	NR	NR	NR	NR	0
	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250	0			NR	NR	NR	0
FINDS	TP	2	NR	NR	NR	NR	NR	2
UXO ECHO	1.000 TP	2	0 NR		0 NR	0 NR	NR	0
DOCKET HWC	TP	2	NR	NR NR	NR	NR	NR NR	2 0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
ASBESTOS	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
TIER 2	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
MINES MRDS	TP		NR	NR	NR	NR	NR	ŏ
EDR HIGH RISK HISTORIC	AL RECORDS							
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
	0.120		Ū					0

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERN	MENT ARCHIV	ES						
Exclusive Recovered Go	vt. Archives							
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals		10	0	0	3	0	0	13

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation Site

Tank ID:

Tank Status: Total Capacity:

Substance:

Tank Type:

Closed Date:

Decode of Tank Status: Closure Status:

Tank Construction:

Pipe Construction:

Tank Material:

Date Installed:

1

6000

UST

Diesel

Not reported

11/15/2012

Single Walled

Single-Walled

Permanently Out Of Use

Permanently out of use

Tank Removed From Ground

Fiberglass Reinforced Plastic

EDR ID Number Database(s) EPA ID Number

A1 Target Property	W.W. HASTINGS HOSPITAL 100 S BLISS TAHLEQUAH, OK 74464	INDIA	N UST ECHO	1016457374 N/A
	Site 1 of 8 in cluster A			
Actual: 895 ft.	Indian UST: Region: Facility ID: Tribe: Name: Name 2: Address: City,State,Zip: Tank Name: Federally Regulated Tank: Tank Status Description: Date Of Tank Status Change: Substance Desc: Date Installed as of 05/21: Telephone Number as of 05/2 Compartment Name: Overfill Installed: Spill Installed:	Diesel 1984-06-01 00:00:00		
	ECHO: Envid: Registry ID: DFR URL: Name: Address: City,State,Zip:	1016457374 110004743859 http://echo.epa.gov/detailed-facility-report?fid=1100047438 W.W. HASTINGS HOSPITAL 100 S BLISS TAHLEQUAH, OK 74464	3859	
A2 Target Property	WW HASTINGS HOSPITAL 100 S BLISS TAHLEQUAH, OK 74464		UST	U004198412 N/A
	Site 2 of 8 in cluster A			
Actual: 895 ft.	UST: Facility ID: Contact Name: Contact Address: Contact Telephone: Contact City,St,Zip: Lat/Long:	1157118 Indian Health Services - Okc Area FIVE CORPORATE PLAZA3625 NW 56TH 4059513857 Oklahoma City, OK 73112 35.9124 / -94.9499		

TC7007844.2s Page 8

Transporter Activity:

Transfer Facility Activity: Recycler Activity with Storage: MAP FINDINGS

Database(s)

EDR ID Number EPA ID Number

	WW HASTINGS HOSPITAL (Continued)			
	Pipe Material:	Fiberglass		
	Tank ID:	2		
	Tank Status:	Permanently Out Of Use		
	Total Capacity:	8000		
	Substance:	Antifreeze		
	Date Installed:	Not reported		
	Tank Type:	UST		
	Closed Date:	11/15/2012		
	Decode of Tank Status:	Permanently out of use		
	Closure Status:	Tank Removed From Ground		
	Tank Construction:	Single Walled		
	Tank Material:	Fiberglass Reinforced Plastic		
	Pipe Construction:	Single-Walled		
	Pipe Material:	Fiberglass		
A3 Target	WW HASTINGS HOSP 100 S BLISS		RCRA NonGen / NLF FINDS	
Property	TAHLEQUAH, OK 74464			
	Site 3 of 8 in cluster A			
Actual:	RCRA NonGen / NLR:			
395 ft.	Date Form Received by Agen	cy:	19950925	
	Handler Name:	WW HASTINGS HOSP		
	Handler Address:		100 S BLISS	
	Handler City, State, Zip:		TAHLEQUAH, OK 74464	
	EPA ID:		OK5750311537	
	Contact Name:		JERRY HAMMONS	
	Contact Address: Contact City,State,Zip:		100 S BLISS TAHLEQUAH, OK 74464	
	Contact Telephone:		918-458-3137	
	Contact Fax:		Not reported	
	Contact Email:		Not reported	
	Contact Title:		Not reported	
	EPA Region:			
	Land Type:		Not reported	
	Federal Waste Generator Des	scription:	Small Quantity (Dn-Site Burner Exemption:
	Non-Notifier:			and Refining Furnace Exemption:
	Biennial Report Cycle:		Underground In	ection Control:
	Accessibility:			
	Active Site Indicator:			
	State District Owner:			
	State District:			
	Mailing Address:			
	Mailing City,State,Zip: Owner Name:			
	Owner Type:			
	Operator Name:			
	Operator Type:			
	Short-Term Generator Activity	r.		
	Importer Activity:	-		
	Mixed Waste Generator:			
	Transporter Activity			

Not a generator, verified Not reported Not reported Not reported Not reported Not reported Not reported S BLISS TAHLEQUAH, OK 74464 INDIAN HEALTH SVC Federal NAME UNKNOWN Federal No No No No No No No No No

EDR ID Number Database(s) EPA ID Number

1000239956

WW HASTINGS HOSP (Continued)

Off-Site Waste Receipt:	No
Universal Waste Indicator:	No
Universal Waste Destination Facility:	No
Federal Universal Waste:	No
Active Site Fed-Reg Treatment Storage and Disposal Facility:	Not reported
Active Site Converter Treatment storage and Disposal Facility:	Not reported
Active Site State-Reg Treatment Storage and Disposal Facility:	Not reported
Active Site State-Reg Handler:	
Federal Facility Indicator:	The site is federally-owned, The site is federally-operated
Hazardous Secondary Material Indicator:	NN
Sub-Part K Indicator:	Not reported
Commercial TSD Indicator:	No
Treatment Storage and Disposal Type:	Not reported
2018 GPRA Permit Baseline:	Not on the Baseline
2018 GPRA Renewals Baseline:	Not on the Baseline
Permit Renewals Workload Universe:	Not reported
Permit Workload Universe:	Not reported
Permit Progress Universe:	Not reported
Post-Closure Workload Universe:	Not reported
Closure Workload Universe:	Not reported
202 GPRA Corrective Action Baseline:	No
Corrective Action Workload Universe:	No
Subject to Corrective Action Universe:	No
Non-TSDFs Where RCRA CA has Been Imposed Universe:	No
TSDFs Potentially Subject to CA Under 3004 (u)/(v) Universe:	No
TSDFs Only Subject to CA under Discretionary Auth Universe:	No
Corrective Action Priority Ranking:	No NCAPS ranking
Environmental Control Indicator:	No
Institutional Control Indicator:	No
Human Exposure Controls Indicator:	N/A
Groundwater Controls Indicator:	N/A
Operating TSDF Universe:	Not reported
Full Enforcement Universe:	Not reported
Significant Non-Complier Universe:	No
Unaddressed Significant Non-Complier Universe:	No
Addressed Significant Non-Complier Universe:	No
Significant Non-Complier With a Compliance Schedule Universe:	No
Financial Assurance Required:	Not reported
Handler Date of Last Change:	20000902
Recognized Trader-Importer:	No
Recognized Trader-Exporter:	No
Importer of Spent Lead Acid Batteries:	No
Exporter of Spent Lead Acid Batteries:	No
Recycler Activity Without Storage:	Not reported
Manifest Broker:	Not reported
Sub-Part P Indicator:	No

Handler - Owner Operator: Owner/Operator Indicator: Owner/Operator Name: Legal Status: Date Became Current: Date Ended Current: Owner/Operator Address: Owner/Operator City,State,Zip: Owner/Operator Telephone:

Operator NAME UNKNOWN Federal Not reported Not reported UNKNOWN UNKNOWN, OK 00000-0000 000-000-0000

Database(s)

EDR ID Number EPA ID Number

1000239956

WW HASTINGS HOSP (Continued)

Owner/Operator Telephone Ext: Owner/Operator Fax: Owner/Operator Email:

Owner/Operator Indicator: Owner/Operator Name: Legal Status: Date Became Current: Date Ended Current: Owner/Operator Address: Owner/Operator City,State,Zip: Owner/Operator Telephone: Owner/Operator Telephone Ext: Owner/Operator Fax: Owner/Operator Email:

Historic Generators: Receive Date:

Handler Name:

State District Owner:

Current Record:

Recognized Trader Importer:

Recognized Trader Exporter:

Non Storage Recycler Activity:

Electronic Manifest Broker:

Spent Lead Acid Battery Importer:

Spent Lead Acid Battery Exporter:

Not reported Not reported Not reported

Owner INDIAN HEALTH SVC Federal Not reported UNKNOWN UNKNOWN, OK 00000-0000 000-000-0000 Not reported Not reported Not reported

19950925

WW HASTINGS HOSP

Not a generator, verified Not reported No No No No Yes Not reported Not reported

List of NAICS Codes and Descriptions: NAICS Codes:

Federal Waste Generator Description:

Large Quantity Handler of Universal Waste:

Facility Has Received Notices of Violations: Violations:

Evaluation Action Summary: Evaluations: No Evaluations Found

No Violations Found

No NAICS Codes Found

FINDS:

Registry ID: 110004743859

Click Here:

Environmental Interest/Information System:

US EPA Assessment, Cleanup and Redevelopment Exchange System (ACRES) is an federal online database for Brownfields Grantees to

electronically submit data directly to EPA. Cherokee Nation Facility Registry System (CNFRS) is a data flow system that validates existing FRS data and exchanges data about open tribal dump sites in the Cherokee Nation.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport,

	WW HASTINGS HOSP	Continued)		1000239956
		and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.		
		<u>Click this hyperlink</u> while viewing on your computer to access additional FINDS: detail in the EDR Site Report.		
4 arget roperty	CHEROKEE NATION (100 BLISS AVENUE TAHLEQUAH, OK 744	DSU HEALTH SCIENCE CENTER	ECHO	1024930554 N/A
	Site 4 of 8 in cluster A	N N N N N N N N N N N N N N N N N N N		
ctual:	ECHO:			
95 ft.	Envid: Registry ID: DFR URL: Name: Address: City,State,Zip:	1024930554 110070530675 http://echo.epa.gov/detailed-facility-report?fid=11007053 CHEROKEE NATION OSU HEALTH SCIENCE CENT 100 BLISS AVENUE TAHLEQUAH, OK 74464		
arget	CHEROKEE NATION (100 BLISS AVENUE TAHLEQUAH, OK 744	DSU HEALTH SCIENCE CENTER	FINDS	1025457530 N/A
arget roperty	100 BLISS AVENUE	164	FINDS	
5 arget Property Actual: 95 ft.	100 BLISS AVENUE TAHLEQUAH, OK 744 Site 5 of 8 in cluster A FINDS:	164	FINDS	
arget Property	100 BLISS AVENUE TAHLEQUAH, OK 744 Site 5 of 8 in cluster A FINDS: Registry ID: Click Here:	164	FINDS	
arget roperty cctual: 95 ft. 6 arget	100 BLISS AVENUE TAHLEQUAH, OK 744 Site 5 of 8 in cluster A FINDS: Registry ID: Click Here:	110070530675 est/Information System: US National Pollutant Discharge Elimination System (NPDES) module of the Compliance Information System (ICIS) tracks surface water permits issued under the Clean Water Act. Under NPDES, all facilities that discharge pollutants from any point source into waters of the United States are required to obtain a permit. The permit will likely contain limits on what can be discharged, impose monitoring and reporting requirements, and include other provisions to ensure that the discharge does not adversely affect water quality. Click this hyperlink while viewing on your computer to access additional FINDS: detail in the EDR Site Report. PITAL US BROWN		
arget roperty	100 BLISS AVENUE TAHLEQUAH, OK 744 Site 5 of 8 in cluster A FINDS: Registry ID: Click Here: Environmental Intere W.W. HASTINGS HOS 100 S. BLISS AVE	An Anton System: US National Pollutant Discharge Elimination System (NPDES) module of the Compliance Information System (ICIS) tracks surface water permits issued under the Clean Water Act. Under NPDES, all facilities that discharge pollutants from any point source into waters of the United States are required to obtain a permit. The permit will likely contain limits on what can be discharged, impose monitoring and reporting requirements, and include other provisions to ensure that the discharge does not adversely affect water quality. <u>Click this hyperlink</u> while viewing on your computer to access additional FINDS: detail in the EDR Site Report. PITAL US BROWN		N/A 1018273391

EDR ID Number EPA ID Number

Database(s)

Grant Type:

Section 128(a) State/Tribal

EDR ID Number Database(s) EPA ID Number

.W. HASTINGS HOSPITAL (Continued) Property Number:	<u>.</u>
Parcel size:	- 27.33
Latitude:	35.9117859
Longitude:	-94.9504065
HCM Label:	-94.9504005
Map Scale:	-
Point of Reference:	
Highlights:	Former Use: The Subject Property consists of four tracts of land with
rigingrio.	acreages of 13.84, 3.466, 1.535, and 8.49 for a total of 27.331
	acres. The subject property has a physical address of 100 S. Bliss
	Avenue, Tahlequah, OK 74464 and is located approximately 0.25 miles
	from both Oklahoma State Highway 82 (west of subject property) and
	Oklahoma State Highway 62 (north of subject property). The 13.84
	tract of land is occupied by a 129,301 square foot hospital building,
	a 12,517 square foot Annex building, a 4,320 square foot Physical
	Therapy building, and a Maintenance building that is 5,200 square
	feet. There are large paved parking lots surrounding the buildings
	and concrete sidewalks throughout the area connecting the buildings.
	A helicopter pad is located on the north side of the property.
	Undeveloped areas are covered by native grasses and trees. This area
	is zoned Commercial. The ground surface at the site slopes west south
	west. The property is currently owned by the Indian Health Service,
	but after RECs are cleaned up the property will be transfered to the
	Cherokee Nation. The Cherokee Nation currently, in conjuunction with
_	Indian Health Service is running the hospital.
Datum:	North American Datum of 1983
Acres Property ID:	149901
IC Data Access:	-
Start Date:	-
Redev Completition Date:	-
Completed Date: Acres Cleaned Up:	-
Cleanup Funding:	
Cleanup Funding Source:	
Assessment Funding:	9000
Assessment Funding Source:	EPA
Redevelopment Funding:	-
Redev. Funding Source:	
Redev. Funding Entity Name:	
Redevelopment Start Date:	
Assessment Funding Entity:	US EPA - State & Tribal Section 128(a) Funding
Cleanup Funding Entity:	-
Grant Type:	
Accomplishment Type:	Phase I Environmental Assessment
Accomplishment Count:	Y
Cooperative Agreement Number:	00F29501
Start Date:	11/29/2010
Ownership Entity:	Government
Completion Date:	6/8/2011
Current Owner:	Indian Health Service
Did Owner Change:	-
Cleanup Required:	Υ
Video Available:	Ν
Photo Available:	Υ
Institutional Controls Required:	U
IC Category Proprietary Controls:	-
IC Cat. Info. Devices:	-

EDR ID Number Database(s) EPA ID Number

W.W. HASTINGS HOSPITAL (Continued)

IC Cat. Gov. Controls:	-
IC Cat. Enforcement Permit Tools:	-
IC in place date:	-
IC in place:	Ν
State/tribal program date:	-
State/tribal program ID:	-
State/tribal NFA date:	-
Air cleaned:	-
Asbestos found:	Y
Asbestos cleaned:	Y
Controled substance found:	-
Controled substance cleaned: Drinking water affected:	-
Drinking water cleaned:	-
Groundwater affected:	-
Groundwater cleaned:	-
Lead contaminant found:	-
Lead cleaned up:	_
No media affected:	-
Unknown media affected:	-
Other cleaned up:	-
Other metals found:	-
Other metals cleaned:	-
Other contaminants found:	Y
Other contams found description:	Radon
PAHs found:	-
PAHs cleaned up:	-
PCBs found:	-
PCBs found: PCBs cleaned up:	-
	- - Y
PCBs cleaned up:	- - Y Y
PCBs cleaned up: Petro products found:	-
PCBs cleaned up: Petro products found: Petro products cleaned:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage: Future use residential acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use greenspace acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage: Future use residential acreage: Future use commercial acreage: Future use industrial acreage: Future use industrial acreage:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage: Future use residential acreage: Future use residential acreage: Future use residential acreage: Future use industrial acreage: Future use industrial acreage: Superfund Fed. landowner flag:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage: Future use industrial acreage: Future use commercial acreage: Future use commercial acreage: Surface Water: Future use residential acreage: Future use residential acreage: Superfund Fed. landowner flag: Arsenic cleaned up:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage: Future use residential acreage: Future use residential acreage: Future use residential acreage: Future use industrial acreage: Future use industrial acreage: Superfund Fed. landowner flag:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use greenspace acreage: Future use greenspace acreage: Future use industrial acreage: Surface Water: Past use industrial acreage: Future use industrial acreage: Superfund Fed. landowner flag: Arsenic cleaned up: Cadmium cleaned up: Chromium cleaned up:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use residential acreage: Past use residential acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage: Future use residential acreage: Future use residential acreage: Future use industrial acreage: Future use industrial acreage: Superfund Fed. landowner flag: Arsenic cleaned up: Cadmium cleaned up:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use greenspace acreage: Surface Water: Past use commercial acreage: Future use greenspace acreage: Future use residential acreage: Future use residential acreage: Future use industrial acreage: Future use industrial acreage: Superfund Fed. landowner flag: Arsenic cleaned up: Chromium cleaned up: Copper cleaned up: Iron cleaned up:	-
PCBs cleaned up: Petro products found: Petro products cleaned: Sediments found: Sediments cleaned: Soil affected: Soil cleaned up: Surface water cleaned: VOCs found: VOCs cleaned: Cleanup other description: Num. of cleanup and re-dev. jobs: Past use greenspace acreage: Past use greenspace acreage: Surface Water: Past use commercial acreage: Past use industrial acreage: Future use greenspace acreage: Future use residential acreage: Future use industrial acreage: Superfund Fed. landowner flag: Arsenic cleaned up: Cadmium cleaned up: Chromium cleaned up: Copper cleaned up:	-

1018273391

Database(s) EPA II

EDR ID Number EPA ID Number

W.W. HASTINGS HOSPITAL (Continued)

No clean up: Pesticides cleaned up: Selenium cleaned up: SVOCs cleaned up: Unknown clean up: Arsenic contaminant found: Cadmium contaminant found: Chromium contaminant found: Copper contaminant found: Iron contaminant found: Mercury contaminant found: Nickel contaminant found: No contaminant found: Pesticides contaminant found: Selenium contaminant found: SVOCs contaminant found: Unknown contaminant found: Future Use: Multistory Media affected Bluiding Material: Media affected indoor air: Building material media cleaned up: Indoor air media cleaned up: Unknown media cleaned up: Past Use: Multistory Property Description:

Below Poverty Number: Below Poverty Percent: Meidan Income: Meidan Income Number: Meidan Income Percent: Vacant Housing Number: Vacant Housing Percent: Unemployed Number: Unemployed Percent: The Subject Property consists of four tracts of land with acreages of 13.84, 3.466, 1.535, and 8.49 for a total of 27.331 acres. The subject property has a physical address of 100 S. Bliss Avenue, Tahlequah, OK 74464 and is located approximately 0.25 miles from both Oklahoma State Highway 82 (west of subject property) and Oklahoma State Highway 62 (north of subject property). The 13.84 tract of land is occupied by a 129,301 square foot hospital building, a 12,517 square foot Annex building, a 4,320 square foot Physical Therapy building, and a Maintenance building that is 5,200 square feet. There are large paved parking lots surrounding the buildings and concrete sidewalks throughout the area connecting the buildings. A helicopter pad is located on the north side of the property. Undeveloped areas are covered by native grasses and trees. This area is zoned Commercial. The ground surface at the site slopes west south west. The property is currently owned by the Indian Health Service, but after RECs are cleaned up the property will be transfered to the Cherokee Nation. The Cherokee Nation currently, in conjuunction with Indian Health Service is running the hospital.

115 18.17 1327 195 30.81 29 11.55 24 3.79

-

1018273391

Map ID Direction Distance Elevation Site

EDR ID Number Database(s) EPA ID Number

A7 Target Property	100 S. BLISS AVENUE TAHLEQUAH, OK 74464	ERNS	5 2013035105 N/A
	Site 7 of 8 in cluster A		
Actual: 895 ft.	Site 7 of 8 in cluster A Incident Commons: NRC Report #: Description of Incident: Incident Cause: Incident Date Time: Incident DTG: Incident Location: Loaction Address: Location Street 1: Location Street 1: Location Street 2: Location Nearest City: Location Nearest City: Location State: Location Zip: Distance From City: Distance Units: Direction From City: Lat Deg: Lat Min:	1035105 CALLER STATED DUE TO A FAULTY SWITCH THERE WAS A SPI AN ABOVE GROUND DIESEL STORAGE TANK. STORAGE TANK EQUIPMENT FAILURE 2013-01-01 00:30:00 OCCURRED Not reported 100 S. BLISS AVENUE Not reported Not reported TAHLEQUAH OK CHEROKEE 74464 Not reported Not reported	LL OF DIESEL FROM
	Lat Verci Lat Verci Lat Quad: Long Deg: Long Min: Long Sec: Long Quad: Location Section: Location Township: Location range: Potential Range:	Not reported Not reported	
	Incidents: NRC Report #: Aircraft Type: Aircraft Model: Aircraft ID: Aircraft Fuel Capacity: Aircraft Fuel Capacity Units: Aircraft Fuel on Board: Aircraft Fuel on Board Units: Aircraft Spot Number: Aircraft Runway Number: Road Mile Marker: Building ID: Type of Fixed Object: Power Generating Facility: Generating Capacity: Type of Fuel: NPDES: NPDES Compliance: Pipeline Type: DOT Regulated:	1035105 Not reported Not reported Vot reported Not reported U Not reported Not reported U Not reported U Not reported U Not reported U Not reported U Not reported U Not reported U Not reported U	

EDR ID Number EPA ID Number

(Continued)

ABOVE Pipeline Above Ground: Exposed Underwater: Ν **Pipeline Covered:** U Railroad Hotline: Grade Crossing: U Location Subdivision: **Railroad Milepost:** Type Vehicle Involved: Crossing Device Type: Device Operational: 11 DOT Crossing Number: Brake Failure: 11 Description of Tank: Tank Above Ground: Transportable Container: Ν Tank Regulated: U Tank Regulated By: Tank ID: Capacity of Tank: 300 Capacity of Tank Units: Actual Amount: Actual Amount Units: Platform Rig Name: Platform Letter: Location Area ID: Location Block ID: OCSG Number: OCSP Number: State Lease Number: Pier Dock Number: Berth Slip Number: Continuous Release Type: Initial Continuous Release No: Continuous Release Permit: Allision: U Type of Structure: Structure Name: Structure Operational: U Airbag Deployed: П Date Tiem Normal Service: Service Disruption Time: Service Disruption Units: Transit Bus Flag: CR Begin Date: CR End Date: CR Change Date: FBI Contact: FBI Contact Date Time: Sub Part C Testing Reg: XXX Conductor Testing: Engineer Testing: Trainman Testing: Yard Foreman Testing: RCL Operator Testing: Brakeman Testing: Not reported Train Dispatcher Testing: Not reported Signalman Testing: Not reported

Not reported Not reported Not reported Not reported Not reported Not reported 300 GALLON ABOVE GROUND STORAGE TANK ABOVE Not reported Not reported GALLON(S) Not reported Not reported

2013035105

Database(s)

EDR ID Number EPA ID Number

(Continued)

Incident Details:

Sheen Size:

Sheen Color:

Other Employee Testing:	Not reported
Unknown Testing:	Not reported
Passenger Handling:	Not reported
Passenger Route:	XXX
Passenger Delay:	XXX

ncident Details:	
NRC Report #:	1035105
Fire Involved:	Ν
Fire Extinguished:	U
Any Evacuations:	Ν
Number Evacuated:	Not reported
Who Evacuated:	Not reported
Radius of Evacuation:	Not reported
Any Injuries:	N
Number Injured:	Not reported
Number Hospitalized:	Not reported
Any Fatalities:	N
Number Fatalities:	Not reported
Any Damages:	N
Damage Amount:	Not reported
Air Corridor Closed:	Ν
Air Corridor Desc:	Not reported
Air Closure Time:	Not reported
Waterway Closed:	N
Waterway Desc:	Not reported
Waterway Closure Time:	Not reported
Road Closed:	N
Road Desc:	Not reported
Road Closure Time:	Not reported
Closure Direction:	Not reported
Major Artery:	N
Track Closed:	Ν
Track Desc:	Not reported
Track Closure Time:	Not reported
Media Interest:	NONE
Medium Desc:	LAND
Additional Medium Info:	ONTO THE GROUND
Body of Water:	Not reported
Tributary of:	Not reported
Release Secured:	Y
Estimated Duration of Release:	Not reported
Release rate:	Not reported
Desc Remedial Action:	THE FIRE DEPARTMENT WAS CALLED AND A CLEAN UP CONTRACTOR WAS HIRED.
	THE CLEAN UP HAS BEEN DONE AND A SOIL SAMPLE HAS BEEN TAKEN. CALLER
	STATED THEY ARE AWAITING THE RESULTS OF THE SOIL SAMPLES AS ADDITIONAL
	STEPS MAY BE REQUIRED.
State Agency on Scene:	FIRE DEPT
State Agency Report Number:	Not reported
Other Agency Notified:	Not reported
Weather Conditions:	Not reported
Air Temperature:	Not reported
Wind Speed:	Not reported
Wind Direction:	Not reported
Water Supply Contaminated:	U
Chaon Cizar	Not reported

Not reported

Not reported

2013035105

Not reported

Not reported Not reported

Not reported

Not reported

Not reported

Not reported

Not reported

Not reported Not reported

FIRE DEPT

Not reported

Not reported

Not reported Not reported

Not reported

Not reported

Not reported

Not reported

Not reported NO

1035105

Ν

Database(s) EF

EDR ID Number EPA ID Number

2013035105

(Continued)

Direction of Sheen Travel: Sheen Odor Description: Wave Condition: Current Speed: Current Direction: Water Temperature: Track Close Dir: **Empl Fatality:** Pass Fatality: Community Impact: Wind Speed Unit: **Employee Injuries:** Passenger Injuries: Occupant Fatality: Current Speed Unit: Road Closure Units: Track CLosure Units: Sheen Size Units: Additional Info: State Agency Notified: Federal Agency Notified: nearest River Mile Marker: Sheen Size Length: Sheen Size Length Units: Sheen Size Width: Sheen Size Width Units: Offshore: **Duration Unit:** Release Rate Unit: Release Rate Rate: Passengers Transferred:

Calls:

NRC Report #: Site ID: Date Time Received: Date Time Complete: Call Type: Responsible Company: Responsible Org Type: Responsible Org Type: Responsible City: Responsible State: Responsible Zip: On Behalf: Source:

20131035105 2013-01-08 12:59:34 2013-01-08 13:08:22 INC WW HASTINGS HOSPITAL PRIVATE ENTERPRISE TAHLEQUAH OK 74464 Not reported TELEPHONE

Material Involved: NRC Report #: Chris Code: Case Number: UN Number: Amount of Material: Unit of Measure: Name of Material: If Reached Water: Amount in Water:

1035105 ODS 000000-00-0 Not reported 260 GALLON(S) OIL: DIESEL NO Not reported

MAP FINDINGS Map ID Direction Distance EDR ID Number Elevation Site Database(s) EPA ID Number (Continued) 2013035105 Unit of Measure Reach Water: Not reported **A8** ERNS 2013052039 **100 SOUTH BLISS AVE** N/A Target Property TAHLEQUAH, OK Site 8 of 8 in cluster A Incident Commons: Actual: 895 ft. NRC Report #: 1052039 CALLER IS REPORTING THAT THERE WAS AN ABOVE GROUND TANK FOR DIESEL Description of Incident: THAT OVERFLOWED FROM AN UNKNOWN REASON ONTO THE GROUND, STREET AND THE DRAIN SYSTEM ON PROPERTY. Type of Incident: STORAGE TANK Incident Cause: UNKNOWN Incident Date Time: 2013-06-27 20:00:00 Incident DTG: OCCURRED Incident Location: Not reported Loaction Address: 100 SOUTH BLISS AVE Location Street 1: Not reported Not reported Location Street 2: TAHLEQUAH Location Nearest City: Location State: OK Location County: CHEROKEE Location Zip: Not reported **Distance From City:** Not reported **Distance Units:** Not reported **Direction From City:** Not reported Lat Deg: Not reported Lat Min: Not reported Lat Sec: Not reported Lat Quad: Not reported Long Deg: Not reported Long Min: Not reported Long Sec: Not reported Long Quad: Not reported Location Section: Not reported Location Township: Not reported Location range: Not reported Potential Range: Ν Incidents:

NRC Report #: 1052039 Aircraft Type: Not reported Aircraft Model: Not reported Aircraft ID: Not reported Aircraft Fuel Capacity: Not reported Aircraft Fuel Capacity Units: Not reported Aircraft Fuel on Board: Not reported Aircraft Fuel on Board Units: Not reported Aircraft Spot Number: Not reported Aircraft Hanger: Not reported Aircraft Runway Number: Not reported Road Mile Marker: Not reported Building ID: Not reported Type of Fixed Object: Not reported

U

Power Generating Facility:

EDR ID Number EPA ID Number

2013052039

(Continued)

Generating Capacity: Type of Fuel: NPDES: NPDES Compliance: Pipeline Type: DOT Regulated: Pipeline Above Ground: Exposed Underwater: **Pipeline Covered:** Railroad Hotline: Grade Crossing: Location Subdivision: **Railroad Milepost:** Type Vehicle Involved: Crossing Device Type: Device Operational: DOT Crossing Number: Brake Failure: Description of Tank: Tank Above Ground: Transportable Container: Tank Regulated: Tank Regulated By: Tank ID: Capacity of Tank: Capacity of Tank Units: Actual Amount: Actual Amount Units: Platform Rig Name: Platform Letter: Location Area ID: Location Block ID: OCSG Number: OCSP Number: State Lease Number: Pier Dock Number: Berth Slip Number: Continuous Release Type: Initial Continuous Release No: Continuous Release Permit: Allision: Type of Structure: Structure Name: Structure Operational: Airbag Deployed: Date Tiem Normal Service: Service Disruption Time: Service Disruption Units: Transit Bus Flag: CR Begin Date: CR End Date: CR Change Date: FBI Contact: FBI Contact Date Time: Sub Part C Testing Reg: Conductor Testing: **Engineer Testing:**

Not reported Not reported Not reported U Not reported 11 ABOVE Ν U Not reported U Not reported Not reported Not reported Not reported U Not reported U Not reported ABOVE U U Not reported U Not reported Not reported U U Not reported XXX Not reported Not reported

EDR ID Number EPA ID Number

(Continued)		2013052039
Trainman Testing:	Not reported	
Yard Foreman Testing:	Not reported	
RCL Operator Testing:	Not reported	
Brakeman Testing:	Not reported	
Train Dispatcher Testing:	Not reported	
Signalman Testing:	Not reported	
Other Employee Testing:	Not reported	
Unknown Testing:	Not reported	
Passenger Handling:	Not reported	
Passenger Route:	XXX	
Passenger Delay:	XXX	
Incident Details:		
NRC Report #:	1052039	
Fire Involved:	N	
Fire Extinguished:	U	
Any Evacuations:	N	
Number Evacuated:	Not reported	
Who Evacuated:	Not reported	
Radius of Evacuation:	Not reported	
Any Injuries:	N	
Number Injured:	Not reported	
Number Hospitalized:	Not reported	
Any Fatalities:	N	
Number Fatalities:	Not reported	
Any Damages:	N	
Damage Amount:	Not reported	
Air Corridor Closed:	N	
Air Corridor Desc:	Not reported	
Air Closure Time:	Not reported	
Waterway Closed:	N	
Waterway Desc:	Not reported	
Waterway Closure Time:	Not reported	
Road Closed:	Ν	
Road Desc:	Not reported	
Road Closure Time:	Not reported	
Closure Direction:	Not reported	
Major Artery:	Ν	
Track Closed:	Ν	
Track Desc:	Not reported	
Track Closure Time:	Not reported	
Media Interest:	NONE	
Medium Desc:	WATER	
Additional Medium Info:	STORM WATER DRAIN SYSTEM ON PROPERTY	
Body of Water:	STORM WATER DRAIN SYSTEM ON PROPERTY	
Tributary of:	Not reported	
Release Secured:	Y	
Estimated Duration of Release:	Not reported	
Release rate:		
Desc Remedial Action:	HAZMAT CONTRACTOR WAS ON SCENE FOR CLEAN UP. ABSORE WILL RETURN TO FINISH CLEAN UP TODAY.	DANIO USED. INET
State Agency on Scene:	FD	
State Agency Report Number:	Not reported	
Other Agency Notified:	Not reported	
Weather Conditions:	Not reported	
Air Temperature:	Not reported	
Wind Speed:	Not reported	
	and the second	

052039

EDR ID Number EPA ID Number

(Continued)

Wind Direction: Not reported Water Supply Contaminated: U Sheen Size: Not reported Sheen Color: Not reported Direction of Sheen Travel: Not reported Sheen Odor Description: Not reported Not reported Wave Condition: Current Speed: Not reported Current Direction: Not reported Water Temperature: Not reported Track Close Dir: Not reported **Empl Fatality:** Not reported Pass Fatality: Not reported Community Impact: Not reported Wind Speed Unit: Not reported Employee Injuries: Not reported Passenger Injuries: Not reported Occupant Fatality: Not reported Current Speed Unit: Not reported Road Closure Units: Not reported Track CLosure Units: Not reported Sheen Size Units: Not reported Additional Info: Not reported FD, INDIAN HEALTH SERVICE State Agency Notified: Federal Agency Notified: Not reported nearest River Mile Marker: Not reported Not reported Sheen Size Length: Not reported Sheen Size Length Units: Sheen Size Width: Not reported Sheen Size Width Units: Not reported Offshore: Ν **Duration Unit:** Not reported Release Rate Unit: Not reported Not reported Release Rate Rate: NO Passengers Transferred:

Calls:

NRC Report #: Site ID: Date Time Received: Date Time Complete: Call Type: Responsible Company: Responsible Org Type: Responsible Org Type: Responsible City: Responsible State: Responsible Zip: On Behalf: Source: 1052039 20131052039 2013-06-28 10:02:06 2013-06-28 10:07:32 INC WW HASTINGS HOSPITAL PRIVATE ENTERPRISE TAHLEQUAH OK Not reported Not reported Not reported TELEPHONE

Material Involved: NRC Report #: Chris Code: Case Number: UN Number: Amount of Material:

1052039 ODS 000000-00-0 Not reported 700

2013052039

Map ID Direction Distance Elevation Site MAP FINDINGS

EDR ID Number Database(s) EPA ID Number

(Continued)

Unit of Measure:	GALLON
Name of Material:	OIL: DIE
If Reached Water:	YES
Amount in Water:	0
Unit of Measure Reach Water:	UNKNO\

N(S) ESEL WN AMOUNT

9 NNE 1/4-1/2 0.326 mi. 1723 ft.	E-Z MART #4366 1600 E DOWNING ST TAHLEQUAH, OK 74464		LUST UST HIST UST	U001224281 N/A
Relative: Lower Actual: 878 ft.	LUST: Name: Address: City,State,Zip: Facility ID: Case Number: Case Type: Tank Type: Release Date: Close Date: Lat/Long: Status:	E-Z MART #4366 1600 E DOWNING ST TAHLEQUAH, OK 74464 1109406 064-2737 Confirmed Release UST 03/21/2003 08/03/2005 35.9152 / -94.9471 Closed		
	Name: Address: City,State,Zip: Facility ID: Case Number: Case Type: Tank Type: Release Date: Close Date: Lat/Long: Status:	E-Z MART #4366 1600 E DOWNING ST TAHLEQUAH, OK 74464 1109406 SOR-2737 Suspicion of Release Not reported 03/31/2003 07/22/2003 35.9152 / -94.9471 Closed		
	UST: Facility ID: Contact Name: Contact Address: Contact Telephone: Contact City,St,Zip: Lat/Long:	1109406 GPM Southeast, LLC 8565 Magellan Parkway 8047301568 Richmond, VA 23227 35.9152 / -94.9471		
	Tank ID: Tank Status: Total Capacity: Substance: Date Installed: Tank Type: Closed Date: Decode of Tank Status: Closure Status: Tank Construction: Tank Material:	1 Permanently Out Of Use 9994 Gasoline 01/01/1974 UST 07/15/2005 Permanently out of use Tank Removed From Ground Single Walled Steel		

2013052039

EDR ID Number EPA ID Number

E-Z MART #4366 (Continued)

Pipe Construction: Pipe Material: Single-Walled Steel

Tank ID: Tank Status: Total Capacity: Substance: Date Installed: Tank Type: Closed Date: Decode of Tank Status: Closure Status: Tank Construction: Tank Material: Pipe Construction: Pipe Material:

Tank Material: Pipe Construction: Pipe Material: Tank ID: Tank Status: Total Capacity: Substance: Date Installed: Tank Type: Closed Date: Decode of Tank Status:

Closure Status:

Tank Material:

Pipe Material:

Tank Construction:

Pipe Construction:

2 Permanently Out Of Use 6045 Gasoline 01/01/1974 UST 07/15/2005 Permanently out of use Tank Removed From Ground Single Walled Steel Single-Walled Steel

4 Currently In Use 12000 E-10 06/13/2005 UST Not reported Currently in use Not reported Double Walled Steel With Fiberglass Double-Walled Flexible Plastic

Tank ID: Tank Status: Total Capacity: Substance: Date Installed: Tank Type: Closed Date: Decode of Tank Status: Closure Status: Tank Construction: Tank Material: Pipe Construction: Pipe Material: 5 Currently In Use 12000 Diesel ,E-10 06/13/2005 UST Not reported Currently in use Not reported Double Walled Steel With Fiberglass Double-Walled Flexible Plastic

HIST UST:

Facility ID:1109406Owner Name:E-Z Mart Stores, Inc.Owner Address:P.O. Box 1426

Owner City,St,Zip: Texarkana, TX 75504 Tank ID: Tank Status: Installed Date: Tank Capacity:

Product:

U001224281

rently in Use 1/1/1974 0:00:00 6045 Gasoline

Facility ID: Owner Name:

1109406 E-Z Mart Stores, Inc.

Database(s)

EDR ID Number EPA ID Number

Total Capacity: Substance: Date Installed:

P.O. Box 1426
Texarkana, TX 75504
1
Currently in Use
1/1/1974 0:00:00
9994
Gasoline

10 NW 1/4-1/2 0.362 mi. 1910 ft.	BIG B FOOD & DELI #2 1100 E. DOWNING TAHLEQUAH, OK 74464		LUST UST HIST UST	U001224288 N/A
Relative: Lower Actual: 843 ft.	LUST: Name: Address: City,State,Zip: Facility ID: Case Number: Case Type: Tank Type: Release Date: Close Date: Lat/Long: Status:	BIG B FOOD & DELI #2 1100 E. DOWNING TAHLEQUAH, OK 74464 1110244 SOR-4511 Suspicion of Release UST 06/01/2020 01/08/2021 35.9150 / -94.9544 Closed		
	UST: Facility ID: Contact Name: Contact Address: Contact Telephone: Contact City,St,Zip: Lat/Long:	1110244 LaHoma, Mark, and Terry Bigby dba Bigby Companies 429 S Muskogee Ave 9184561782 Tahlequah, OK 74464 35.915 / -94.9544		
	Tank ID: Tank Status: Total Capacity: Substance: Date Installed: Tank Type: Closed Date: Decode of Tank Status: Closure Status: Tank Construction: Tank Material: Pipe Construction: Pipe Material:	1 Permanently Out Of Use 6000 Diesel 01/01/1983 UST 05/18/2020 Permanently out of use Tank Removed From Ground Single Walled Steel Single-Walled Steel		
	Tank ID: Tank Status:	Tank Type: Closed Date: Decode of Tank Status:		

Permanently out of use

Database(s)

EDR ID Number EPA ID Number

BIG B FOOD & DELI #2 (Continued)

Closure Status:
Tank Construction:
Tank Material:
Pipe Construction:
Pipe Material:

Tank Removed From Ground Single Walled Steel Single-Walled Steel

Tank ID:		3
Tank Status:		Permanently Out Of Use
Total Capacity:		10000
Substance:		E-10
Date Installed:		01/01/1983
Tank Type:		UST
Closed Date:		05/18/2020
Decode of Tank Sta	atus:	Permanently out of use
Closure Status:		Tank Removed From Ground
Tank Construction:		Single Walled
Tank Material:		Steel
Pipe Construction:		Single-Walled
Pipe Material:		Steel
HIST UST:		
Facility ID: Owner Name:	1110244 Gilbert S.	0,
Owner Address:	429 S. Mu	skuyee

Owner City,St,Zip:Tahlequah, OK 74464TankID:1Tank Status:Currently in UseInstalledDate:1/1/1986 0:00:00Tank Capacity:6000Product:Diesel

Facility ID:	1110244
Owner Name:	Gilbert S. Bigby
Owner Address:	429 S. Muskogee

Owner City,St,Zip:Tahlequah, OK 74464TankID:2Tank Status:Currently in UseInstalledDate:1/1/1986 0:00:00Tank Capacity:10000Product:Gasoline

Facility ID:1110244Owner Name:Gilbert S. BigbyOwner Address:429 S. Muskogee

Owner City,St,Zip:	Tahlequah, OK 74464
Tank ID:	3
Tank Status:	Currently in Use
Installed Date:	1/1/1986 0:00:00
Tank Capacity:	10000
Product:	Gasoline

U001224288

Database(s)

EDR ID Number EPA ID Number

11 WNW 1/4-1/2 0.499 mi. 2633 ft.	MARY'S LIQUOR MART 902 E DOWNING ST TAHLEQUAH, OK 74464		LUST UST HIST UST	U001224286 N/A
Relative: Lower Actual: 837 ft.	LUST: Name: Address: City,State,Zip: Facility ID: Case Number: Case Type: Tank Type: Release Date: Close Date: Lat/Long: Status:	MARY'S LIQUOR MART 902 E DOWNING ST TAHLEQUAH, OK 74464 1109523 064-2453 Confirmed Release UST 01/23/2001 02/26/2004 35.9151 / -94.9575 Closed		
	UST: Facility ID: Contact Name: Contact Address: Contact Telephone: Contact City,St,Zip: Lat/Long:	1109523 Dirk Van Veen 902 E. Downing St. 9184564631 Tahlequah, OK 74464 35.9151 / -94.9575		
	Tank ID: Tank Status: Total Capacity: Substance: Date Installed: Tank Type: Closed Date: Decode of Tank Status: Closure Status: Tank Construction: Tank Material: Pipe Construction: Pipe Material:	1 Permanently Out Of Use 8000 Gasoline 04/04/1971 UST 11/26/2014 Permanently out of use Tank Removed From Ground Single Walled Steel Single-Walled Steel		
	Tank ID: Tank Status: Total Capacity: Substance: Date Installed: Tank Type: Closed Date: Decode of Tank Status: Closure Status: Tank Construction: Tank Material: Pipe Construction: Pipe Material: HIST UST:	2 Permanently Out Of Use 6000 Gasoline 07/01/1974 UST 11/26/2014 Permanently out of use Tank Removed From Ground Single Walled Steel Single-Walled Steel		
	Facility ID: Owner Name:	Owner Address:		

1109523
M
&
B
I
N
V
Ē
S
З Т
M
E
N
Т
S
Р
0
В
0
Х
1

TC7007844.2s Page 34

EDR ID Number Database(s) EPA ID Number

MARY'S LIQUOR MART (Continued)

Owner City,St,Zip:	Tahlequah, OK 74465
Tank ID:	1
Tank Status:	Currently In Use
Installed Date:	4/4/1971 0:00:00
Tank Capacity:	8000
Product:	Gasoline

Facility ID:	1109523
Owner Name:	M & B INVESTMENTS
Owner Address:	PO BOX 180

Owner City,St,Zip:	Tahlequah, OK 74465
Tank ID:	2
Tank Status:	Currently In Use
Installed Date:	7/1/1974 0:00:00
Tank Capacity:	6000
Product:	Gasoline

U001224286

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
	_		-		

NO SITES FOUND

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Lists of Federal NPL (Superfund) sites

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/05/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 26 Source: EPA Telephone: N/A Last EDR Contact: 06/01/2022 Next Scheduled EDR Contact: 07/11/2022 Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC) Telephone: 202-564-7333

EPA Region 1 Telephone 617-918-1143

EPA Region 3 Telephone 215-814-5418

EPA Region 4 Telephone 404-562-8033

EPA Region 5 Telephone 312-886-6686

EPA Region 10 Telephone 206-553-8665 EPA Region 6 Telephone: 214-655-6659

EPA Region 7 Telephone: 913-551-7247

EPA Region 8 Telephone: 303-312-6774

EPA Region 9 Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/05/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 26 Source: EPA Telephone: N/A Last EDR Contact: 06/01/2022 Next Scheduled EDR Contact: 07/11/2022 Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991 Date Data Arrived at EDR: 02/02/1994 Date Made Active in Reports: 03/30/1994 Number of Days to Update: 56 Source: EPA Telephone: 202-564-4267 Last EDR Contact: 08/15/2011 Next Scheduled EDR Contact: 11/28/2011 Data Release Frequency: No Update Planned

Lists of Federal Delisted NPL sites

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/27/2022	Source: EPA
Date Data Arrived at EDR: 05/05/2022	Telephone: N/A
Date Made Active in Reports: 05/31/2022	Last EDR Contact: 06/01/2022
Number of Days to Update: 26	Next Scheduled EDR Contact: 07/11/2022
	Data Release Frequency: Quarterly

Lists of Federal sites subject to CERCLA removals and CERCLA orders

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 05/25/2021 Date Data Arrived at EDR: 06/24/2021 Date Made Active in Reports: 09/20/2021 Number of Days to Update: 88 Source: Environmental Protection Agency Telephone: 703-603-8704 Last EDR Contact: 04/01/2022 Next Scheduled EDR Contact: 07/11/2022 Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/05/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 26 Source: EPA Telephone: 800-424-9346 Last EDR Contact: 06/01/2022 Next Scheduled EDR Contact: 07/25/2022 Data Release Frequency: Quarterly

Lists of Federal CERCLA sites with NFRAP

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/05/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 26 Source: EPA Telephone: 800-424-9346 Last EDR Contact: 06/01/2022 Next Scheduled EDR Contact: 07/25/2022 Data Release Frequency: Quarterly

Lists of Federal RCRA facilities undergoing Corrective Action

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Source: EPA Telephone: 800-424-9346 Last EDR Contact: 04/06/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

Lists of Federal RCRA TSD facilities

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 02/28/2022 Date Data Arrived at EDR: 03/02/2022 Date Made Active in Reports: 03/17/2022 Number of Days to Update: 15 Source: Environmental Protection Agency Telephone: 214-665-6444 Last EDR Contact: 04/06/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

Lists of Federal RCRA generators

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/28/2022 Date Data Arrived at EDR: 03/02/2022 Date Made Active in Reports: 03/17/2022 Number of Days to Update: 15 Source: Environmental Protection Agency Telephone: 214-665-6444 Last EDR Contact: 04/06/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 02/28/2022 Date Data Arrived at EDR: 03/02/2022 Date Made Active in Reports: 03/17/2022 Number of Days to Update: 15 Source: Environmental Protection Agency Telephone: 214-665-6444 Last EDR Contact: 04/06/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

RCRA-VSQG: RCRA - Very Small Quantity Generators (Formerly Conditionally Exempt Small Quantity Generators) RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Very small quantity generators (VSQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/28/2022 Date Data Arrived at EDR: 03/02/2022 Date Made Active in Reports: 03/17/2022 Number of Days to Update: 15 Source: Environmental Protection Agency Telephone: 214-665-6444 Last EDR Contact: 04/06/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 02/08/2022 Date Data Arrived at EDR: 02/11/2022 Date Made Active in Reports: 05/10/2022 Number of Days to Update: 88 Source: Department of the Navy Telephone: 843-820-7326 Last EDR Contact: 05/05/2022 Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 02/21/2022 Date Data Arrived at EDR: 02/23/2022 Date Made Active in Reports: 05/24/2022 Number of Days to Update: 90

Source: Environmental Protection Agency Telephone: 703-603-0695 Last EDR Contact: 05/24/2022 Next Scheduled EDR Contact: 09/05/2022 Data Release Frequency: Varies

US INST CONTROLS: Institutional Controls Sites List

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 02/21/2022 Date Data Arrived at EDR: 02/23/2022 Date Made Active in Reports: 05/24/2022 Number of Days to Update: 90 Source: Environmental Protection Agency Telephone: 703-603-0695 Last EDR Contact: 05/04/2022 Next Scheduled EDR Contact: 09/05/2022 Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2021 Date Data Arrived at EDR: 03/01/2022 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 9 Source: National Response Center, United States Coast Guard Telephone: 202-267-2180 Last EDR Contact: 03/22/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

Lists of state- and tribal hazardous waste facilities

SHWS: Voluntary Cleanup & Superfund Site Status Report Land restoration projects carried out in several DEQ programs.

Date of Government Version: 09/16/2020	Source: Department of Environmental Quality
Date Data Arrived at EDR: 11/10/2021	Telephone: 405-702-5100
Date Made Active in Reports: 02/01/2022	Last EDR Contact: 05/11/2022
Number of Days to Update: 83	Next Scheduled EDR Contact: 08/22/2022
	Data Release Frequency: No Update Planned

Lists of state and tribal landfills and solid waste disposal facilities

SWF/LF: Permitted Solid Waste Disposal & Processing Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 12/16/2021 Date Data Arrived at EDR: 12/17/2021 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 83 Source: Department of Environmental Quality Telephone: 405-702-5184 Last EDR Contact: 03/22/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Annually

Lists of state and tribal leaking storage tanks

LAST: Leaking Aboveground Storage Tanks List Leaking aboveground storage tank site locations.

Date of Government Version: 12/02/2021	Source: Oklahoma Corporation Commission
Date Data Arrived at EDR: 12/17/2021	Telephone: 405-522-4640
Date Made Active in Reports: 03/10/2022	Last EDR Contact: 03/22/2022
Number of Days to Update: 83	Next Scheduled EDR Contact: 07/04/2022
	Data Release Frequency: Varies

LUST: Leaking Underground Storage Tank List

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 12/02/2021 Date Data Arrived at EDR: 12/17/2021 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 83 Source: Oklahoma Corporation Commission Telephone: 405-521-3107 Last EDR Contact: 03/22/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85	Source: EPA Region 7 Telephone: 913-551-7003 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies
INDIAN LUST R8: Leaking Underground Storage LUSTs on Indian land in Colorado, Montana,	Tanks on Indian Land North Dakota, South Dakota, Utah and Wyoming.
Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85	Source: EPA Region 8 Telephone: 303-312-6271 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies
INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land LUSTs on Indian land in Arizona, California, New Mexico and Nevada	
Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85	Source: Environmental Protection Agency Telephone: 415-972-3372 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies
INDIAN LUST R10: Leaking Underground Storage LUSTs on Indian land in Alaska, Idaho, Oreg	
Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85	Source: EPA Region 10 Telephone: 206-553-2857 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies
INDIAN LUST R5: Leaking Underground Storage Leaking underground storage tanks located of	Tanks on Indian Land on Indian Land in Michigan, Minnesota and Wisconsin.
Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85	Source: EPA, Region 5 Telephone: 312-886-7439 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies
INDIAN LUST R6: Leaking Underground Storage LUSTs on Indian land in New Mexico and Ok	
Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85	Source: EPA Region 6 Telephone: 214-665-6597 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies
INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land A listing of leaking underground storage tank locations on Indian Land.	
Date of Government Version: 04/28/2021 Date Data Arrived at EDR: 06/11/2021 Date Made Active in Reports: 09/07/2021 Number of Days to Update: 88	Source: EPA Region 1 Telephone: 617-918-1313 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land	
LUSTs on Indian land in Florida, Mississippi and North Carolina.	

Date of Government Version: 05/28/2021	
Date Data Arrived at EDR: 06/22/2021	
Date Made Active in Reports: 09/20/2021	
Number of Days to Update: 90	

Source: EPA Region 4 Telephone: 404-562-8677 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

Lists of state and tribal registered storage tanks

FEMA UST: Underground Storage Tank Listing A listing of all FEMA owned underground storage tanks.

Date of Government Version: 10/14/2021	Source: FEMA
Date Data Arrived at EDR: 11/05/2021	Telephone: 202-646-5797
Date Made Active in Reports: 02/01/2022	Last EDR Contact: 04/04/2022
Number of Days to Update: 88	Next Scheduled EDR Contact: 07/18/2022
	Data Release Frequency: Varies

UST: Underground Storage Tank Listing

Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 12/02/2021 Date Data Arrived at EDR: 12/17/2021 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 83

Source: Oklahoma Corporation Commission Telephone: 405-521-3107 Last EDR Contact: 03/22/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Varies

AST: Aboveground Storage Tanks Registered Aboveground Storage Tanks.

> Date of Government Version: 12/02/2021 Date Data Arrived at EDR: 12/17/2021 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 83

Source: Oklahoma Corporation Commission Telephone: 405-521-3107 Last EDR Contact: 03/22/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 10/14/2021 Source: EPA, Region 1 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85

Telephone: 617-918-1313 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85

Source: EPA Region 7 Telephone: 913-551-7003 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85 Source: EPA Region 8 Telephone: 303-312-6137 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 10/12/2021	Source: EPA Region 9
Date Data Arrived at EDR: 11/15/2021	Telephone: 415-972-3368
Date Made Active in Reports: 02/08/2022	Last EDR Contact: 04/21/2022
Number of Days to Update: 85	Next Scheduled EDR Contact: 08/01/2022
	Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 05/28/2021 Date Data Arrived at EDR: 06/22/2021 Date Made Active in Reports: 09/20/2021 Number of Days to Update: 90 Source: EPA Region 4 Telephone: 404-562-9424 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85 Source: EPA Region 6 Telephone: 214-665-7591 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 04/06/2021	Source: EPA Region 5
Date Data Arrived at EDR: 06/11/2021	Telephone: 312-886-6136
Date Made Active in Reports: 09/07/2021	Last EDR Contact: 04/21/2022
Number of Days to Update: 88	Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 10/12/2021 Date Data Arrived at EDR: 11/15/2021 Date Made Active in Reports: 02/08/2022 Number of Days to Update: 85 Source: EPA Region 10 Telephone: 206-553-2857 Last EDR Contact: 04/21/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: Institutional Control Sites Sites with institutional controls in place.

> Date of Government Version: 01/25/2022 Date Data Arrived at EDR: 02/09/2022 Date Made Active in Reports: 05/09/2022 Number of Days to Update: 89

Source: Department of Environmental Quality Telephone: 405-702-5100 Last EDR Contact: 05/11/2022 Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: Quarterly

Lists of state and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015 Date Data Arrived at EDR: 09/29/2015 Date Made Active in Reports: 02/18/2016 Number of Days to Update: 142 Source: EPA, Region 1 Telephone: 617-918-1102 Last EDR Contact: 03/16/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 07/08/2021
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCP: Voluntary Cleanup Site Inventory

Investigations and cleanups by groups or individuals participating in the Voluntary Cleanup Program (VCP).

Date of Government Version: 01/25/2022 Date Data Arrived at EDR: 02/09/2022 Date Made Active in Reports: 05/09/2022 Number of Days to Update: 89 Source: Department of Environmental Quality Telephone: 405-702-5100 Last EDR Contact: 05/11/2022 Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: Quarterly

Lists of state and tribal brownfield sites

BROWNFIELDS: Brownfield Sites

Brownfields are defined by Oklahoma law as abandoned, idled or under used industrial or commercial facilities or other real property at which expansion or redevelopment of the real property is complicated by environmental contamination caused by regulated substances. This program provides a means for private parties and government entities to voluntarily investigate and if warranted, clean up properties that may be contaminated with hazardous wastes. The formal Brownfields Program provides specific state liability relief and protects the property from federal Superfund actions.

Date of Government Version: 09/07/2012 Date Data Arrived at EDR: 09/07/2012 Date Made Active in Reports: 10/10/2012 Number of Days to Update: 33 Source: Department of Environmental Quality Telephone: 405-702-5100 Last EDR Contact: 05/06/2022 Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: No Update Planned

BROWNFIELDS 2: Brownfields Public Record Listing

The Brownfields program provides a means for private parties and government entities to voluntarily investigate and if warranted, clean up properties that may be contaminated with hazardous wastes. The formal Brownfields Program provides specific state liability relief and protects the property from federal Superfund actions.

Telephone: 405-702-5100

Last EDR Contact: 05/09/2022

Date of Government Version: 01/25/2022 Date Data Arrived at EDR: 02/11/2022 Date Made Active in Reports: 05/09/2022 Number of Days to Update: 87

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 02/23/2022 Date Data Arrived at EDR: 03/10/2022 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 0 Source: Environmental Protection Agency Telephone: 202-566-2777 Last EDR Contact: 03/15/2022 Next Scheduled EDR Contact: 06/27/2022 Data Release Frequency: Semi-Annually

Source: Department of Environmental Quality

Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: Varies

Local Lists of Landfill / Solid Waste Disposal Sites

SWRCY: Recycling Facilities

A listing of recycling facility locations.

Date of Government Version: 07/10/2019 Date Data Arrived at EDR: 07/17/2019 Date Made Active in Reports: 08/29/2019 Number of Days to Update: 43 Source: Department of Environmental Quality Telephone: 405-702-5100 Last EDR Contact: 04/14/2022 Next Scheduled EDR Contact: 07/25/2022 Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands Location of open dumps on Indian land.

Date of Government Version: 12/31/1998	Source: Environmental Protection Agency
Date Data Arrived at EDR: 12/03/2007	Telephone: 703-308-8245
Date Made Active in Reports: 01/24/2008	Last EDR Contact: 04/21/2022
Number of Days to Update: 52	Next Scheduled EDR Contact: 08/08/2022
	Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985 Date Data Arrived at EDR: 08/09/2004 Date Made Active in Reports: 09/17/2004 Number of Days to Update: 39 Source: Environmental Protection Agency Telephone: 800-424-9346 Last EDR Contact: 06/09/2004 Next Scheduled EDR Contact: N/A Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009 Date Data Arrived at EDR: 05/07/2009 Date Made Active in Reports: 09/21/2009 Number of Days to Update: 137 Source: EPA, Region 9 Telephone: 415-947-4219 Last EDR Contact: 04/14/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land

A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014 Date Data Arrived at EDR: 08/06/2014	Source: Department of Health & Human Serivces, Indian Health Service Telephone: 301-443-1452
Date Made Active in Reports: 01/29/2015	Last EDR Contact: 04/28/2022
Number of Days to Update: 176	Next Scheduled EDR Contact: 08/08/2022
	Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 02/22/2022	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 02/23/2022	Telephone: 202-307-1000
Date Made Active in Reports: 05/10/2022	Last EDR Contact: 05/24/2022
Number of Days to Update: 76	Next Scheduled EDR Contact: 09/05/2022
	Data Release Frequency: No Update Planned

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 02/22/2022 Date Data Arrived at EDR: 02/23/2022 Date Made Active in Reports: 05/10/2022 Number of Days to Update: 76 Source: Drug Enforcement Administration Telephone: 202-307-1000 Last EDR Contact: 05/24/2022 Next Scheduled EDR Contact: 09/05/2022 Data Release Frequency: Quarterly

Local Lists of Registered Storage Tanks

HIST UST: Underground Storage Tank List, List II Version This underground storage tank listing includes tank information through March 2003. This listing is no longer updated by the Oklahoma Corporation Commission.

Date of Government Version: 03/21/2003 Date Data Arrived at EDR: 04/28/2003 Date Made Active in Reports: 05/27/2003 Number of Days to Update: 29 Source: Oklahoma Corporation Commission Telephone: 405-521-3107 Last EDR Contact: 01/19/2009 Next Scheduled EDR Contact: 04/19/2009 Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/05/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 26 Source: Environmental Protection Agency Telephone: 202-564-6023 Last EDR Contact: 06/01/2022 Next Scheduled EDR Contact: 07/11/2022 Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/15/2021	Source: U.S. Department of Transportation
Date Data Arrived at EDR: 12/16/2021	Telephone: 202-366-4555
Date Made Active in Reports: 03/10/2022	Last EDR Contact: 03/21/2022
Number of Days to Update: 84	Next Scheduled EDR Contact: 07/04/2022
	Data Release Frequency: Quarterly

OK COMPLAINT: Oklahoma Complaint System Database

Environmental complaints reported to the Oklahoma Corporation Commission.

Date of Government Version: 06/30/2021	Source: Oklahoma Conservation Commission
Date Data Arrived at EDR: 07/28/2021	Telephone: 405-521-4828
Date Made Active in Reports: 10/28/2021	Last EDR Contact: 05/06/2022
Number of Days to Update: 92	Next Scheduled EDR Contact: 08/22/2022
	Data Release Frequency: Annually

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 02/28/2022 Date Data Arrived at EDR: 03/02/2022 Date Made Active in Reports: 03/17/2022 Number of Days to Update: 15 Source: Environmental Protection Agency Telephone: 214-665-6444 Last EDR Contact: 04/06/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/01/2021 Date Data Arrived at EDR: 02/15/2022 Date Made Active in Reports: 05/10/2022 Number of Days to Update: 84 Source: U.S. Army Corps of Engineers Telephone: 202-528-4285 Last EDR Contact: 05/17/2022 Next Scheduled EDR Contact: 08/29/2022 Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 06/07/2021 Date Data Arrived at EDR: 07/13/2021 Date Made Active in Reports: 03/09/2022 Number of Days to Update: 239 Source: USGS Telephone: 888-275-8747 Last EDR Contact: 04/12/2022 Next Scheduled EDR Contact: 07/25/2022 Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 04/02/2018 Date Data Arrived at EDR: 04/11/2018 Date Made Active in Reports: 11/06/2019 Number of Days to Update: 574 Source: U.S. Geological Survey Telephone: 888-275-8747 Last EDR Contact: 04/05/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017 Date Data Arrived at EDR: 02/03/2017 Date Made Active in Reports: 04/07/2017 Number of Days to Update: 63 Source: Environmental Protection Agency Telephone: 615-532-8599 Last EDR Contact: 05/06/2022 Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 12/13/2021 Date Data Arrived at EDR: 12/17/2021 Date Made Active in Reports: 03/17/2022 Number of Days to Update: 90 Source: Environmental Protection Agency Telephone: 202-566-1917 Last EDR Contact: 03/21/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013 Date Data Arrived at EDR: 03/21/2014 Date Made Active in Reports: 06/17/2014 Number of Days to Update: 88 Source: Environmental Protection Agency Telephone: 617-520-3000 Last EDR Contact: 04/28/2022 Next Scheduled EDR Contact: 08/15/2022 Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017 Date Data Arrived at EDR: 05/08/2018 Date Made Active in Reports: 07/20/2018 Number of Days to Update: 73 Source: Environmental Protection Agency Telephone: 703-308-4044 Last EDR Contact: 05/06/2022 Next Scheduled EDR Contact: 08/15/2022 Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016SeDate Data Arrived at EDR: 06/17/2020TeDate Made Active in Reports: 09/10/2020LaNumber of Days to Update: 85No

Source: EPA Telephone: 202-260-5521 Last EDR Contact: 03/18/2022 Next Scheduled EDR Contact: 06/27/2022 Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2018	Source: EP
Date Data Arrived at EDR: 08/14/2020	Telephone:
Date Made Active in Reports: 11/04/2020	Last EDR C
Number of Days to Update: 82	Next Sched
	Data Dalaas

Source: EPA Telephone: 202-566-0250 Last EDR Contact: 05/20/2022 Next Scheduled EDR Contact: 08/29/2022 Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 01/19/2022 Date Data Arrived at EDR: 01/19/2022 Date Made Active in Reports: 04/11/2022 Number of Days to Update: 82 Source: EPA Telephone: 202-564-4203 Last EDR Contact: 04/20/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/05/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 26 Source: EPA Telephone: 703-416-0223 Last EDR Contact: 06/01/2022 Next Scheduled EDR Contact: 09/12/2022 Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/04/2022 Date Made Active in Reports: 05/10/2022 Number of Days to Update: 6

Source: Environmental Protection Agency Telephone: 202-564-8600 Last EDR Contact: 04/18/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995 Date Data Arrived at EDR: 07/03/1995 Date Made Active in Reports: 08/07/1995 Number of Days to Update: 35

Source: FPA Telephone: 202-564-4104 Last EDR Contact: 06/02/2008 Next Scheduled EDR Contact: 09/01/2008 Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 01/25/2022	Source: EPA
Date Data Arrived at EDR: 02/03/2022	Telephone: 202-564-6023
Date Made Active in Reports: 02/25/2022	Last EDR Contact: 06/01/2022
Number of Days to Update: 22	Next Scheduled EDR Contact: 08/15/2022
	Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 01/20/2022	
Date Data Arrived at EDR: 01/20/2022	
Date Made Active in Reports: 03/25/2022	
Number of Days to Update: 64	

Source: EPA Telephone: 202-566-0500 Last EDR Contact: 04/08/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016 Date Data Arrived at EDR: 11/23/2016 Date Made Active in Reports: 02/10/2017 Number of Days to Update: 79

Source: Environmental Protection Agency Telephone: 202-564-2501 Last EDR Contact: 03/31/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: Quarterly

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act) FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: No Update Planned

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act) A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2	009 Source: EPA
Date Data Arrived at EDR: 04/16/200	9 Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2	009 Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: No Update Planned

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/29/2021 Date Data Arrived at EDR: 08/24/2021 Date Made Active in Reports: 11/19/2021 Number of Days to Update: 87 Source: Nuclear Regulatory Commission Telephone: 301-415-7169 Last EDR Contact: 04/18/2022 Next Scheduled EDR Contact: 08/01/2022 Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2020	Source: Department of Energy
Date Data Arrived at EDR: 11/30/2021	Telephone: 202-586-8719
Date Made Active in Reports: 02/22/2022	Last EDR Contact: 06/02/2022
Number of Days to Update: 84	Next Scheduled EDR Contact: 09/12/2022 Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 01/12/2017 Date Data Arrived at EDR: 03/05/2019 Date Made Active in Reports: 11/11/2019 Number of Days to Update: 251 Source: Environmental Protection Agency Telephone: N/A Last EDR Contact: 05/25/2022 Next Scheduled EDR Contact: 09/12/2022 Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 09/13/2019	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/06/2019	Telephone: 202-566-0517
Date Made Active in Reports: 02/10/2020	Last EDR Contact: 05/06/2022
Number of Days to Update: 96	Next Scheduled EDR Contact: 08/15/2022
	Data Release Frequency: Varies

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/01/2019 Date Data Arrived at EDR: 07/01/2019 Date Made Active in Reports: 09/23/2019 Number of Days to Update: 84 Source: Environmental Protection Agency Telephone: 202-343-9775 Last EDR Contact: 03/28/2022 Next Scheduled EDR Contact: 07/11/2022 Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006 Date Data Arrived at EDR: 03/01/2007 Date Made Active in Reports: 04/10/2007 Number of Days to Update: 40 Source: Environmental Protection Agency Telephone: 202-564-2501 Last EDR Contact: 12/17/2007 Next Scheduled EDR Contact: 03/17/2008 Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2008
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 01/02/2020	Source: Department of Transporation, Office of Pipeline Safety
Date Data Arrived at EDR: 01/28/2020	Telephone: 202-366-4595
Date Made Active in Reports: 04/17/2020	Last EDR Contact: 04/26/2022
Number of Days to Update: 80	Next Scheduled EDR Contact: 08/08/2022
	Data Release Frequency: Quarterly

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2021 Date Data Arrived at EDR: 01/14/2022 Date Made Active in Reports: 03/25/2022 Number of Days to Update: 70	Source: Department of Justice, Consent Decree Library Telephone: Varies Last EDR Contact: 04/04/2022 Next Scheduled EDR Contact: 07/18/2022
Number of Days to Update: 70	Data Release Frequency: Varies
	· ·

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2019	S
Date Data Arrived at EDR: 03/02/2022	Т
Date Made Active in Reports: 03/25/2022	L
Number of Days to Update: 23	N

Source: EPA/NTIS Telephone: 800-424-9346 Last EDR Contact: 03/02/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014 Date Data Arrived at EDR: 07/14/2015 Date Made Active in Reports: 01/10/2017 Number of Days to Update: 546 Source: USGS Telephone: 202-208-3710 Last EDR Contact: 04/05/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 07/26/2021 Date Data Arrived at EDR: 07/27/2021 Date Made Active in Reports: 10/22/2021 Number of Days to Update: 87 Source: Department of Energy Telephone: 202-586-3559 Last EDR Contact: 04/28/2022 Next Scheduled EDR Contact: 08/15/2022 Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 08/30/2019 Date Data Arrived at EDR: 11/15/2019 Date Made Active in Reports: 01/28/2020 Number of Days to Update: 74 Source: Department of Energy Telephone: 505-845-0011 Last EDR Contact: 05/16/2022 Next Scheduled EDR Contact: 08/29/2022 Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 04/27/2022 Date Data Arrived at EDR: 05/05/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 26 Source: Environmental Protection Agency Telephone: 703-603-8787 Last EDR Contact: 09/01/2022 Next Scheduled EDR Contact: 07/11/2022 Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931 and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001 Date Data Arrived at EDR: 10/27/2010 Date Made Active in Reports: 12/02/2010 Number of Days to Update: 36 Source: American Journal of Public Health Telephone: 703-305-6451 Last EDR Contact: 12/02/2009 Next Scheduled EDR Contact: N/A Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016 Date Data Arrived at EDR: 10/26/2016 Date Made Active in Reports: 02/03/2017 Number of Days to Update: 100	Source: EPA Telephone: 202-564-2496 Last EDR Contact: 09/26/2017 Next Scheduled EDR Contact: 01/08/2018 Data Release Frequency: Annually
US AIRS MINOR: Air Facility System Data A listing of minor source facilities.	
Date of Government Version: 10/12/2016 Date Data Arrived at EDR: 10/26/2016 Date Made Active in Reports: 02/03/2017 Number of Days to Update: 100	Source: EPA Telephone: 202-564-2496 Last EDR Contact: 09/26/2017 Next Scheduled EDR Contact: 01/08/2018 Data Release Frequency: Annually
MINES VIOLATIONS: MSHA Violation Assessme Mines violation and assessment information.	nt Data Department of Labor, Mine Safety & Health Administration.
Date of Government Version: 03/21/2022 Date Data Arrived at EDR: 03/22/2022 Date Made Active in Reports: 03/25/2022 Number of Days to Update: 3	Source: DOL, Mine Safety & Health Admi Telephone: 202-693-9424 Last EDR Contact: 05/26/2022 Next Scheduled EDR Contact: 09/12/2022 Data Release Frequency: Quarterly
US MINES: Mines Master Index File Contains all mine identification numbers issu violation information.	ed for mines active or opened since 1971. The data also includes
Date of Government Version: 02/01/2022 Date Data Arrived at EDR: 02/23/2022 Date Made Active in Reports: 05/24/2022 Number of Days to Update: 90	Source: Department of Labor, Mine Safety and Health Administration Telephone: 303-231-5959 Last EDR Contact: 05/25/2022 Next Scheduled EDR Contact: 09/05/2022 Data Release Frequency: Semi-Annually
	al mines are facilities that extract ferrous metals, such as iron rous metal mines are facilities that extract nonferrous metals, such
Date of Government Version: 05/06/2020 Date Data Arrived at EDR: 05/27/2020 Date Made Active in Reports: 08/13/2020 Number of Days to Update: 78	Source: USGS Telephone: 703-648-7709 Last EDR Contact: 05/27/2022 Next Scheduled EDR Contact: 09/05/2022 Data Release Frequency: Varies
US MINES 3: Active Mines & Mineral Plants Datal Active Mines and Mineral Processing Plant o of the USGS.	base Listing operations for commodities monitored by the Minerals Information Team
Date of Government Version: 04/14/2011 Date Data Arrived at EDR: 06/08/2011 Date Made Active in Reports: 09/13/2011 Number of Days to Update: 97	Source: USGS Telephone: 703-648-7709 Last EDR Contact: 05/27/2022 Next Scheduled EDR Contact: 09/05/2022 Data Release Frequency: Varies

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 12/14/2021 Date Data Arrived at EDR: 12/15/2021 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 85 Source: Department of Interior Telephone: 202-208-2609 Last EDR Contact: 06/02/2022 Next Scheduled EDR Contact: 09/19/2022 Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 05/13/2022 Date Data Arrived at EDR: 05/18/2022 Date Made Active in Reports: 05/31/2022 Number of Days to Update: 13 Source: EPA Telephone: (214) 665-2200 Last EDR Contact: 05/18/2022 Next Scheduled EDR Contact: 09/12/2022 Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites A listing of unexploded ordnance site locations

> Date of Government Version: 12/31/2020 Date Data Arrived at EDR: 01/11/2022 Date Made Active in Reports: 02/14/2022 Number of Days to Update: 34

Source: Department of Defense Telephone: 703-704-1564 Last EDR Contact: 04/12/2022 Next Scheduled EDR Contact: 07/25/2022 Data Release Frequency: Varies

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 01/01/2022 Date Data Arrived at EDR: 01/04/2022 Date Made Active in Reports: 01/10/2022 Number of Days to Update: 6 Source: Environmental Protection Agency Telephone: 202-564-2280 Last EDR Contact: 04/05/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/06/2021Source: Environmental Protection AgencyDate Data Arrived at EDR: 05/21/2021Telephone: 202-564-0527Date Made Active in Reports: 08/11/2021Last EDR Contact: 05/19/2022Number of Days to Update: 82Next Scheduled EDR Contact: 09/05/2022Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 02/17/2022 Date Data Arrived at EDR: 02/17/2022 Date Made Active in Reports: 05/10/2022 Number of Days to Update: 82 Source: EPA Telephone: 800-385-6164 Last EDR Contact: 05/17/2022 Next Scheduled EDR Contact: 08/29/2022 Data Release Frequency: Quarterly

AIRS: Permitted AIRS Facility Listing

A listing of permitted AIRS facility locations.

Date of Government Version: 12/15/2021 Date Data Arrived at EDR: 12/15/2021 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 85	Source: Department of Environmental Quality Telephone: 405-702-4100 Last EDR Contact: 03/18/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly
ASBESTOS: Asbestos Notification Asbestos project site locations	
Date of Government Version: 12/29/2021 Date Data Arrived at EDR: 12/29/2021 Date Made Active in Reports: 03/21/2022 Number of Days to Update: 82	Source: Department of Labor Telephone: 405-521-6467 Last EDR Contact: 03/18/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Varies
PFAS: PFAS Contamination Site Location Listing A listing of sites where PFAS contaminants has	s been detected to date.
Date of Government Version: 06/23/2021 Date Data Arrived at EDR: 06/23/2021 Date Made Active in Reports: 12/14/2021 Number of Days to Update: 174	Source: Department of Environment Quality Telephone: 405-702-5100 Last EDR Contact: 03/28/2022 Next Scheduled EDR Contact: 07/11/2022 Data Release Frequency: Varies
DRYCLEANERS: Drycleaner Facilities A listing of drycleaner facility locations.	
Date of Government Version: 12/15/2021 Date Data Arrived at EDR: 12/15/2021 Date Made Active in Reports: 03/10/2022 Number of Days to Update: 85	Source: Department of Environmental Quality Telephone: 405-702-9100 Last EDR Contact: 03/18/2022 Next Scheduled EDR Contact: 07/04/2022 Data Release Frequency: Quarterly
Financial Assurance 1: Financial Assurance Informa Financial Assurance information.	tion Listing
Date of Government Version: 07/25/2014 Date Data Arrived at EDR: 11/06/2014 Date Made Active in Reports: 01/13/2015 Number of Days to Update: 68	Source: Department of Environmental Quality Telephone: 405-702-5105 Last EDR Contact: 05/11/2022 Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: No Update Planned
	e facilities. Financial assurance is intended to ensure that resources st-closure care, and corrective measures if the owner or operator
Date of Government Version: 12/10/2013 Date Data Arrived at EDR: 12/12/2013 Date Made Active in Reports: 01/24/2014 Number of Days to Update: 43	Source: Department of Environmental Quality Telephone: 405-702-5100 Last EDR Contact: 05/11/2022 Next Scheduled EDR Contact: 08/22/2022 Data Release Frequency: No Update Planned
TIER 2: Tier 2 Data Listing A listing of facilities which store or manufacture	hazardous materials and submit a chemical inventory report.
Date of Government Version: 12/31/2020 Date Data Arrived at EDR: 06/07/2021 Date Made Active in Reports: 08/31/2021 Number of Days to Update: 85	Source: Department of Environmental Quality Telephone: 405-702-1000 Last EDR Contact: 03/10/2022 Next Scheduled EDR Contact: 06/20/2022 Data Release Frequency: Annually

UIC: Underground Injection Wells Database Listing

Class I injection wells. CLASS I wells are used to inject liquid hazardous and non-hazardous wastes beneath the lower most Underground Sources of Drinking Water (USDW).

lower most enderground eedroes of ennining v	
Date of Government Version: 12/15/2021 Date Data Arrived at EDR: 01/12/2022 Date Made Active in Reports: 04/01/2022 Number of Days to Update: 79	Source: Department of Environmental Quality Telephone: 405-702-5188 Last EDR Contact: 04/13/2022 Next Scheduled EDR Contact: 07/25/2022 Data Release Frequency: Varies
PCS ENF: Enforcement data No description is available for this data	
Date of Government Version: 12/31/2014 Date Data Arrived at EDR: 02/05/2015 Date Made Active in Reports: 03/06/2015 Number of Days to Update: 29	Source: EPA Telephone: 202-564-2497 Last EDR Contact: 03/31/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: Varies
	on system that contains data on National Pollutant Discharge Elimination tracks the permit, compliance, and enforcement status of NPDES
Date of Government Version: 07/14/2011 Date Data Arrived at EDR: 08/05/2011 Date Made Active in Reports: 09/29/2011 Number of Days to Update: 55	Source: EPA, Office of Water Telephone: 202-564-2496 Last EDR Contact: 03/31/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: Semi-Annually
PCS INACTIVE: Listing of Inactive PCS Permits An inactive permit is a facility that has shut dow	<i>n</i> or is no longer discharging.
Date of Government Version: 11/05/2014 Date Data Arrived at EDR: 01/06/2015 Date Made Active in Reports: 05/06/2015 Number of Days to Update: 120	Source: EPA Telephone: 202-564-2496 Last EDR Contact: 03/31/2022 Next Scheduled EDR Contact: 07/18/2022 Data Release Frequency: Semi-Annually
MINES MRDS: Mineral Resources Data System Mineral Resources Data System	
Date of Government Version: 04/06/2018 Date Data Arrived at EDR: 10/21/2019 Date Made Active in Reports: 10/24/2019 Number of Days to Update: 3	Source: USGS Telephone: 703-648-6533 Last EDR Contact: 05/27/2022 Next Scheduled EDR Contact: 09/05/2022 Data Release Frequency: Varies
EDR HIGH RISK HISTORICAL RECORDS	

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A Date Data Arrived at EDR: N/A Date Made Active in Reports: N/A Number of Days to Update: N/A Source: EDR, Inc. Telephone: N/A Last EDR Contact: N/A Next Scheduled EDR Contact: N/A Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A Date Data Arrived at EDR: N/A Date Made Active in Reports: N/A Number of Days to Update: N/A Source: EDR, Inc. Telephone: N/A Last EDR Contact: N/A Next Scheduled EDR Contact: N/A Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A Date Data Arrived at EDR: N/A Date Made Active in Reports: N/A Number of Days to Update: N/A Source: EDR, Inc. Telephone: N/A Last EDR Contact: N/A Next Scheduled EDR Contact: N/A Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Quality in Oklahoma.

Date of Government Version: N/A Date Data Arrived at EDR: 07/01/2013 Date Made Active in Reports: 01/03/2014 Number of Days to Update: 186 Source: Department of Environmental Quality Telephone: N/A Last EDR Contact: 06/01/2012 Next Scheduled EDR Contact: N/A Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Quality in Oklahoma.

Date of Government Version: N/A Date Data Arrived at EDR: 07/01/2013 Date Made Active in Reports: 01/20/2014 Number of Days to Update: 203 Source: Department of Environmental Quality Telephone: N/A Last EDR Contact: 06/01/2012 Next Scheduled EDR Contact: N/A Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Oklahoma Corporation Commission in Oklahoma.

Date of Government Version: N/A Date Data Arrived at EDR: 07/01/2013 Date Made Active in Reports: 12/27/2013 Number of Days to Update: 179 Source: Oklahoma Corporation Commission Telephone: N/A Last EDR Contact: 06/01/2012 Next Scheduled EDR Contact: N/A Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 12/03/2021	Source: Department of Energy & Environmental Protection
Date Data Arrived at EDR: 02/11/2022	Telephone: 860-424-3375
Date Made Active in Reports: 05/06/2022	Last EDR Contact: 05/09/2022
Number of Days to Update: 84	Next Scheduled EDR Contact: 08/22/2022
	Data Release Frequency: No Update Planned
V MANIEEST. Excility and Manifort Data	

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 01/01/2019 Date Data Arrived at EDR: 10/29/2021 Date Made Active in Reports: 01/19/2022 Number of Days to Update: 82 Source: Department of Environmental Conservation Telephone: 518-402-8651 Last EDR Contact: 04/28/2022 Next Scheduled EDR Contact: 08/08/2022 Data Release Frequency: Quarterly

WI MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 05/31/2018 Date Data Arrived at EDR: 06/19/2019 Date Made Active in Reports: 09/03/2019 Number of Days to Update: 76 Source: Department of Natural Resources Telephone: N/A Last EDR Contact: 06/03/2022 Next Scheduled EDR Contact: 09/19/2022 Data Release Frequency: Annually

Oil/Gas Pipelines

Source: Endeavor Business Media

Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by Endeavor Business Media. This information is provided on a best effort basis and Endeavor Business Media does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of Endeavor Business Media.

Electric Power Transmission Line Data

Source: Endeavor Business Media

This map includes information copyrighted by Endeavor Business Media. This information is provided on a best effort basis and Endeavor Business Media does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of Endeavor Business Media.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:

Source: American Hospital Association, Inc.

Telephone: 312-280-5991

The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing

Source: Centers for Medicare & Medicaid Services

Telephone: 410-786-3000

A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services,

a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes

Source: National Institutes of Health

Telephone: 301-594-6248

Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools

Source: National Center for Education Statistics

Telephone: 202-502-7300

The National Center for Education Statistics' primary database on elementary

and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools

Source: National Center for Education Statistics Telephone: 202-502-7300

The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Day Care Centers

Source: Department of Human Services Telephone: 405-521-3561

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.

Source: FEMA Telephone: 877-336-2627 Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Current USGS 7.5 Minute Topographic Map Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

 \hat{A} © 2015 TomTom North America, Inc. All rights reserved. This material is proprietary and the subject of copyright protection and other intellectual property rights owned by or licensed to Tele Atlas North America, Inc. The use of this material is subject to the terms of a license agreement. You will be held liable for any unauthorized copying or disclosure of this material.

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CHEROKEE NATION TAHLEQUAH HOSPITAL 100 SOUTH BLISS AVE TAHLEQUAH, OK 74464

TARGET PROPERTY COORDINATES

Latitude (North):	35.91118 - 35 ^ 54' 40.25"
Longitude (West):	94.950168 - 94 57 0.60"
Universal Tranverse Mercator:	Zone 15
UTM X (Meters):	324024.2
UTM Y (Meters):	3975653.8
Elevation:	895 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	14238152 TAHLEQUAH, OK
Version Date:	2019

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

- 1. Groundwater flow direction, and
- 2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

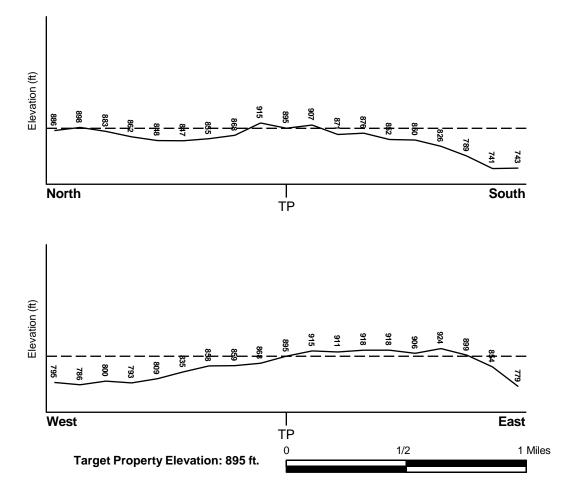
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General West

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
40021C0265D	FEMA FIRM Flood data
Additional Panels in search area:	FEMA Source Type
40021C0275D	FEMA FIRM Flood data
NATIONAL WETLAND INVENTORY	NWI Electronic
<u>NWI Quad at Target Property</u> NOT AVAILABLE	Data Coverage YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID Not Reported LOCATION FROM TP GENERAL DIRECTION GROUNDWATER FLOW

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

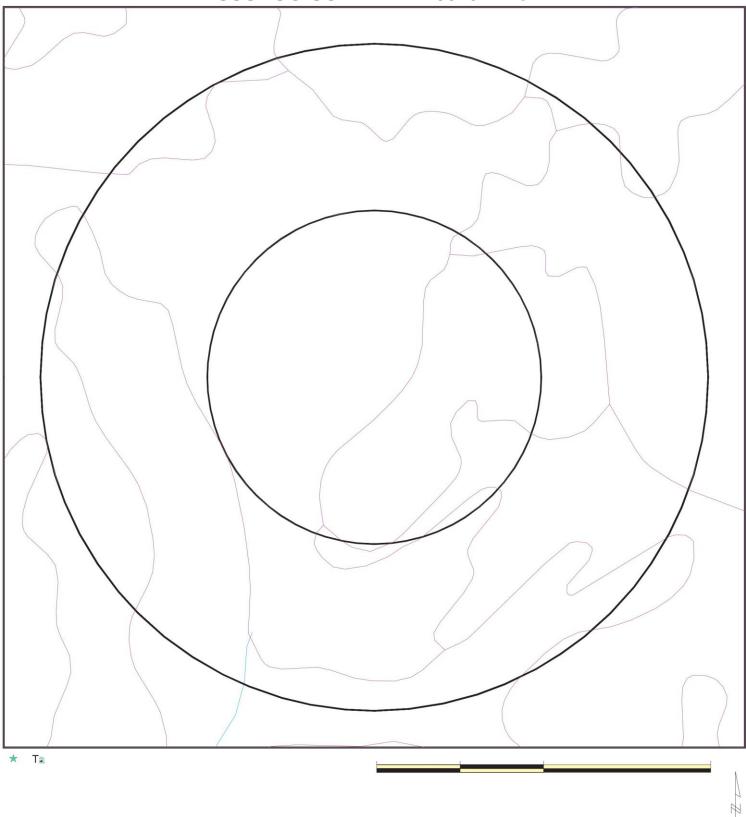
GEOLOGIC AGE IDENTIFICATION

Era:	Paleozoic	Category:	Stratified Sequence
System: Series:	Mississippian Osagean and Kinderhookian Series		
Genes.	Osagean and Kindemookian Genes		

Code: M1 (decoded above as Era, System & Series)

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 7007844.2s



ADDRESS: 100 South Bliss Ave Tahlequah OK 74464	CLIENT: Eagle Env. Consulting Inc. CONTACT: Sean T Vq &iw INQUIRY#: 7007844.2s DATE: June 06, 2022 8:23 pm
--	---

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1	
Soil Component Name:	Clarksville
Soil Surface Texture:	stony silt loam
Hydrologic Group:	Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
Soil Drainage Class:	Somewhat excessively drained
Hydric Status: Not hydric	
Corrosion Potential - Uncoated Steel:	Low
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

	Soil Layer Information								
	Bou	ndary		Classification		Saturated hydraulic			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	conductivity micro m/sec			
1	0 inches	9 inches	stony silt loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5.5 Min: 3.6		
2	9 inches	40 inches	very gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5.5 Min: 3.6		
3	40 inches	59 inches	very gravelly silty clay	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5.5 Min: 3.6		

Soil Map ID: 2	
Soil Component Name:	Tonti
Soil Surface Texture:	gravelly silt loam
Hydrologic Group:	Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.
Soil Drainage Class:	Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 61 inches

	Soil Layer Information									
	Bou	ndary		Classification		Saturated hydraulic				
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	conductivity micro m/sec				
1	0 inches	9 inches	gravelly silt loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5 Min: 3.5			
2	9 inches	22 inches	gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5 Min: 3.5			
3	22 inches	29 inches	very gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5 Min: 3.5			
4	29 inches	65 inches	very gravelly silty clay	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5 Min: 3.5			

Soil Map ID: 3	
Soil Component Name:	

Soil Component Name:	Clarksville
Soil Surface Texture:	very gravelly silt loam
Hydrologic Group:	Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
Soil Drainage Class:	Somewhat excessively drained
Hydric Status: Not hydric	
Corrosion Potential - Uncoated Steel:	Low
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

	Soil Layer Information								
	Bou	ndary		Classif	ication	Saturated hydraulic			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)		
1	0 inches	9 inches	very gravelly silt loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5.5 Min: 3.6		

	Soil Layer Information								
	Boundary			Classification		Saturated hydraulic			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	conductivity micro m/sec	Soil Reaction (pH)		
2	9 inches	40 inches	very gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5.5 Min: 3.6		
3	40 inches	59 inches	very gravelly silty clay	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 5.5 Min: 3.6		

Soil Map ID: 4	
Soil Component Name:	Captina
Soil Surface Texture:	silt loam
Hydrologic Group:	Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.
Soil Drainage Class:	Moderately well drained
Hydric Status: Not hydric	
Corrosion Potential - Uncoated Steel:	Moderate
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 46 inches

	Soil Layer Information								
	Bou	Indary		Classification		Saturated hydraulic			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	conductivity micro m/sec	Soil Reaction (pH)		
1	0 inches	7 inches	silt loam	Not reported	Not reported	Max: 1.4114 Min: 0.4233	Max: 6 Min: 3.6		
2	7 inches	22 inches	silty clay loam	Not reported	Not reported	Max: 1.4114 Min: 0.4233	Max: 6 Min: 3.6		
3	22 inches	37 inches	silty clay loam	Not reported	Not reported	Max: 1.4114 Min: 0.4233	Max: 6 Min: 3.6		
4	37 inches	61 inches	gravelly silty clay loam	Not reported	Not reported	Max: 1.4114 Min: 0.4233	Max: 6 Min: 3.6		

Soil Map ID: 5

Soil Component Name:	Britwater
Soil Surface Texture:	gravelly silt loam
Hydrologic Group:	Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
Soil Drainage Class:	Well drained
Hydric Status: Not hydric	
Corrosion Potential - Uncoated Steel:	Moderate
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

	Soil Layer Information									
Boundary				Classification		Saturated hydraulic				
Layer	Layer Upper Lower		Soil Texture Class	AASHTO Group	Unified Soil	conductivity micro m/sec	Soil Reaction (pH)			
1	0 inches	18 inches	gravelly silt loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 6 Min: 4.5			
2	18 inches	31 inches	gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 6 Min: 4.5			
3	31 inches	62 inches	very gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 6 Min: 4.5			

Soil Map ID: 6	
Soil Component Name:	Britwater
Soil Surface Texture:	silt loam
Hydrologic Group:	Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
Soil Drainage Class:	Well drained
Hydric Status: Not hydric	
Corrosion Potential - Uncoated Steel:	Moderate
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

	Soil Layer Information							
Boundary			Classification		Saturated hydraulic			
Layer	Upper Lower		Soil Texture Class	AASHTO Group	Unified Soil	conductivity micro m/sec		
1	0 inches	18 inches	silt loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 6 Min: 4.5	
2	18 inches	31 inches	gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 6 Min: 4.5	
3	31 inches	62 inches	very gravelly silty clay loam	Not reported	Not reported	Max: 14.114 Min: 4.233	Max: 6 Min: 4.5	

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

		LOCATION
MAP ID	WELL ID	FROM TP
19	USGS40000974300	1/2 - 1 Mile SSE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
31	OK1021701	1/2 - 1 Mile East

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

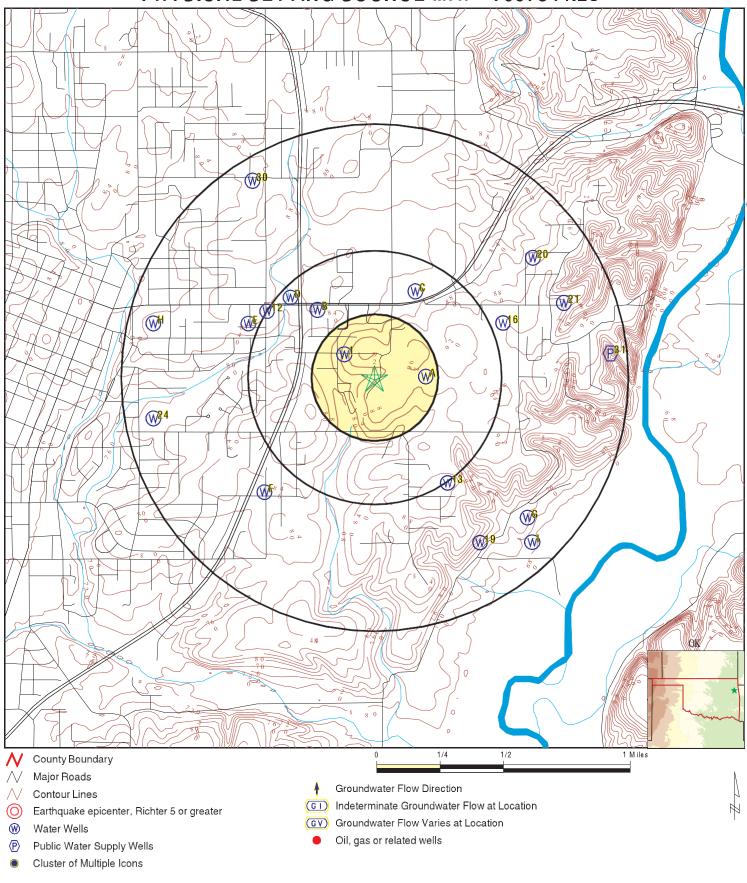
MAP ID	WELL ID	LOCATION FROM TP
1	OK7000000034202	1/8 - 1/4 Mile NW

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	OK700000143012	1/8 - 1/4 Mi
A3	OK700000149353	1/8 - 1/4 Mi
A4	OK700000149480	1/8 - 1/4 Mi
B5	OK700000186189	1/4 - 1/2 Mi
B6	OK700000192283	1/4 - 1/2 Mi
C7	OK700000172480	1/4 - 1/2 Mi
C8	OK700000172481	1/4 - 1/2 Mi
C9	OK700000172482	1/4 - 1/2 Mi
D10	OK700000189010	1/4 - 1/2 Mi
D11	OK700000190600	1/4 - 1/2 Mi
12	OK700000136408	1/4 - 1/2 Mi
13	OK700000106954	1/2 - 1 Mile
E14	OK700000121760	1/2 - 1 Mile
E15	OK700000165425	1/2 - 1 Mile
16	OK700000017955	1/2 - 1 Mile
F17	OK700000186829	1/2 - 1 Mile
F18	OK700000203588	1/2 - 1 Mile
20	OK700000014079	1/2 - 1 Mile
21	OK700000066209	1/2 - 1 Mile
G22	OK700000034203	1/2 - 1 Mile
G23	OK700000103151	1/2 - 1 Mile
24	OK700000028372	1/2 - 1 Mile
H25	OK700000121756	1/2 - 1 Mile
H26	OK700000121757	1/2 - 1 Mile
H27	OK700000166662	1/2 - 1 Mile
128	OK700000170919	1/2 - 1 Mile
129	OK700000170920	1/2 - 1 Mile
30	OK700000083876	1/2 - 1 Mile

ROM	TP
/8 - 1	1/4 Mile East
	/4 Mile East
	/4 Mile East
	/2 Mile NW
	/2 Mile NW
/4 - 1	/2 Mile NNE
	/2 Mile NNE
/4 - 1	/2 Mile NNE
/4 - 1	/2 Mile NW
/4 - 1	/2 Mile NW
/4 - 1	/2 Mile WNW
/2 - 1	Mile SE
	Mile WNW
/2 - 1	Mile WNW
	Mile ENE
/2 - 1	Mile SW
/2 - 1	Mile SW
/2 - 1	Mile NE
/2 - 1	I Mile ENE
/2 - 1	Mile SE
/2 - 1	Mile SE
/2 - 1	Mile West
/2 - 1	Mile WNW
/2 - 1	Mile WNW
	Mile WNW
/2 - 1	Mile SE
/2 - 1	Mile SE
/2 - 1	Mile NNW

PHYSICAL SETTING SOURCE MAP - 7007844.2s



ADDRESS:	100 South Bliss Ave Tahlequah OK 74464	CONTACT: INQUIRY #:	Eagle Env. Consulting Inc. Sean T Votaw 7007844.2s June 06, 2022 8:23 pm
		Copyrig	ght © 2022 EDR, Inc. © 2015 TomTom Rel. 2015.

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

Distance Elevation			Database	EDR ID Number
IW /8 - 1/4 Mile ower			OK WELLS	OK700000034202
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	34423 Not Reported 0 175 0 Not Reported	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Groundwate DARRELL (Domestic 0 09-APR-96 Not Reporte	COFFMAN
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=34423		
2 ast /8 - 1/4 Mile ligher			OK WELLS	OK7000000143012
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	161544 Not Reported 0 40 0 Not Reported	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Geotechnic WWW Hast Soil Evaluat 0 23-JUN-14 Not Reporte	ings Hospital tion
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=161544		
3 ast /8 - 1/4 Mile igher			OK WELLS	OK7000000149353
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	161545 Not Reported 0 120 0 Not Reported	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Geotechnic WWW Hast Soil Evaluat 0 23-JUN-14 Not Reporte	ings Hospital tion
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=161545		
4 ast 8 - 1/4 Mile igher			OK WELLS	OK7000000149480
Well ID: Permit #: Elevation: Total Well Depth:	161546 Not Reported 0 40	Well Type: Well Owner: Water Use: Date to First Water:	Geotechnic WWW Hast Soil Evaluat 0	ings Hospital

Approximate Yield:

Aquifer Code:

0

Not Reported

23-JUN-14

Construction Date:

Basin Code:

http://www.owrb.ok.gov/wd/reporting/printreport.php?siteid=161546

URL:

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction				
Distance Elevation			Database	EDR ID Number
B5 NW 1/4 - 1/2 Mile Lower			OK WELLS	OK700000186189
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL:	201607 Not Reported 0 15.5 0 Not Reported http://www.owrb.ok.gov/wd/rep	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: porting/printreport.php?siteid=201607	Monitoring V Terry D. Big Site Assess 0 29-JUL-20 Not Reporte	ıby ment
36 NW /4 - 1/2 Mile Lower			OK WELLS	OK7000000192283
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL:	202942 Not Reported 0 0 Not Reported http://www.owrb.ok.gov/wd/rep	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: porting/printreport.php?siteid=202942	Monitoring V Terry D. Big Site Assess 0 Not Reporte Not Reporte	jby ment ed
C7 NNE I/4 - 1/2 Mile			OK WELLS	OK7000000172480
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL:	94928 Not Reported 0 0 Not Reported http://www.owrb.ok.gov/wd/rep	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: porting/printreport.php?siteid=94928	Monitoring V EZ Mart Water Quali 0 23-JUN-05 Not Reporte	ty
C8 INE /4 - 1/2 Mile _ower			OK WELLS	OK7000000172481
Well ID: Permit #: Elevation: Total Well Depth:	94929 Not Reported 0 0	Well Type: Well Owner: Water Use: Date to First Water: Construction Date:	Monitoring V EZ Mart Water Quali 0	

Approximate Yield:

Aquifer Code:

0

Not Reported

23-JUN-05

Construction Date:

Basin Code:

http://www.owrb.ok.gov/wd/reporting/printreport.php?siteid=94929

URL:

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

Distance Elevation			Database	EDR ID Number
C9 NNE 1/4 - 1/2 Mile Lower			OK WELLS	OK7000000172482
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	94931 Not Reported 0 0 Not Reported	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Monitoring V EZ Mart Water Qual 0 23-JUN-05 Not Reporte	ity
URL:	http://www.owrb.ok.gov/wd/rep	orting/printreport.php?siteid=94931		
D10 NW 1/4 - 1/2 Mile Lower			OK WELLS	OK7000000189010
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	168478 Not Reported 0 0 0 Not Reported	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Monitoring V Caseys Ma Site Assess 0 Not Reporte Not Reporte	rketing Company sment ed
URL:	http://www.owrb.ok.gov/wd/rep	oorting/printreport.php?siteid=168478		
D11 NW 1/4 - 1/2 Mile Lower			OK WELLS	OK7000000190600
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	166357 Not Reported 0 20 0 Not Reported	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Monitoring V Caseys Ma Site Assess 0 18-MAR-15 Not Reporte	rketing Company ment
URL:	http://www.owrb.ok.gov/wd/rep	oorting/printreport.php?siteid=166357		
12 WNW 1/4 - 1/2 Mile Lower			OK WELLS	OK700000136408
Well ID: Permit #: Elevation: Total Wall Dopth:	165412 Not Reported 0 11 5	Well Type: Well Owner: Water Use:	Geotechnic Marys Lique Soil Evalua	or Store

Total Well Depth: Approximate Yield: Aquifer Code:

11.5 0 Not Reported

Water Use: Date to First Water: Construction Date: Basin Code:

Soil Evaluation 0 28-JAN-15

Not Reported

http://www.owrb.ok.gov/wd/reporting/printreport.php?siteid=165412

URL:

GEOCHECK®- PHYSICAL SETTING SOURCE MAP FINDINGS

Distance Elevation			Database	EDR ID Number	
3 E /2 - 1 Mile ligher			OK WELLS	OK7000000106954	
Well ID:	148604	Well Type:	Groundwate		
Permit #:	Not Reported	Well Owner:	Robert Walker		
Elevation:	0	Water Use:	Domestic		
Total Well Depth:	340	Date to First Water:	130		
Approximate Yield:	2.5	Construction Date:	17-JAN-13		
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	ed	
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=148604			
14					
/NW /2 - 1 Mile ower			OK WELLS	OK700000012176	
Well ID:	73816	Well Type:	Geotechnic		
Permit #:	Not Reported	Well Owner:	City of Tahl	equah c/o Gary Dot	
Elevation:	0	Water Use:	Soil Evalua	tion	
Total Well Depth:	20	Date to First Water:	0		
Approximate Yield:	0	Construction Date:	20-AUG-02		
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	ed	
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=73816			
15 VNW /2 - 1 Mile .ower			OK WELLS	OK7000000165425	
Well ID:	73813	Well Type:	Monitoring	Well	
Permit #:	Not Reported	Well Owner:		equah c/o Gary Dot	
Elevation:	0	Water Use:	Water Qual		
Total Well Depth:	34	Date to First Water:	0	,	
Approximate Yield:	0	Construction Date:	20-AUG-02		
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	ed	
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=73813			
6 NE /2 - 1 Mile ligher			OK WELLS	OK70000001795	
Well ID:	23228	Well Type:	Groundwate	er Well	
Permit #:	Not Reported	Well Owner:	Tony Halum		
Elevation:	0	Water Use:	Domestic		
	0		Domestic		

Elevation: Total Well Depth: Approximate Yield: Aquifer Code: Not Reported 0 150 0 Not Reported

Water Use: Date to First Water: Construction Date: Basin Code:

Groundwater Well Tony Halum Domestic 0 04-OCT-83 Not Reported http://www.owrb.ok.gov/wd/reporting/printreport.php?siteid=23228

URL:

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

istance levation			Database	EDR ID Number
17 W /2 - 1 Mile ower			OK WELLS	OK7000000186829
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL:	191262 Not Reported 0 0 Not Reported http://www.owrb.ok.gov/wd/reporting/g	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Monitoring EPP-AVP A Site Assess 0 Not Reporte Not Reporte	acquisition, LLC sment
18 W			OK WELLS	OK700000203588
/2 - 1 Mile ower				01100000203300
Well ID:	185527	Well Type:	Monitoring	
Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	Not Reported 0 16 0 Not Reported	Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	EPP-AVP A Site Assess 0 09-FEB-18 Not Reporte	
Permit #: Elevation: Total Well Depth: Approximate Yield:	0 16 0	Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Site Assess 0 09-FEB-18	sment
Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	0 16 0 Not Reported	Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Site Assess 0 09-FEB-18	sment
Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL: 9 SE /2 - 1 Mile	0 16 0 Not Reported	Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Site Assess 0 09-FEB-18 Not Reporte FED USGS USG Well 11110 Not F Jnts: Not F	USGS40000974300 USGS40000974300 S Oklahoma Water Science Cen 0103 Reported Reported Reported re Formation
Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL: 9 SE 2 - 1 Mile ower Organization ID: Monitor Location: Description: Drainage Area: Contrib Drainage Area: Aquifer: Aquifer Type: Well Depth:	0 16 0 Not Reported http://www.owrb.ok.gov/wd/reporting/p USGS-OK 17N-22E-34 DDD 1 Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported 88 88	Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: orintreport.php?siteid=185527 Organization Name: Type: HUC: Drainage Area Units: Contrib Drainage Area U Formation Type: Construction Date: Well Depth Units:	Site Assess 0 09-FEB-18 Not Reporte FED USGS USG Well 11110 Not F Jnts: Not F Boon 1962 ft	USGS40000974300 USGS40000974300 S Oklahoma Water Science Cen 0103 Reported Reported Reported e Formation
Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL: URL: Organization ID: Monitor Location: Description: Drainage Area: Contrib Drainage Area: Aquifer: Aquifer Type: Well Depth: Well Hole Depth: Well Hole Depth: Ground water levels,Num Feet below surface: Note:	0 16 0 Not Reported http://www.owrb.ok.gov/wd/reporting/p USGS-OK 17N-22E-34 DDD 1 Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported 88 88	Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: orintreport.php?siteid=185527 Organization Name: Type: HUC: Drainage Area Units: Contrib Drainage Area U Formation Type: Construction Date: Well Depth Units: Well Hole Depth Units:	Site Assess 0 09-FEB-18 Not Reporter FED USGS USG Well 1111 Not F Jonts: Not F Boon 1962 ft ft 11962	USGS40000974300 USGS40000974300 S Oklahoma Water Science Cen 0103 Reported Reported Reported e Formation
Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL: 9 SE 2 - 1 Mile ower Organization ID: Monitor Location: Description: Drainage Area: Contrib Drainage Area: Aquifer: Aquifer Type: Well Depth: Well Hole Depth: Ground water levels,Num Feet below surface:	0 16 0 Not Reported http://www.owrb.ok.gov/wd/reporting/p USGS-OK 17N-22E-34 DDD 1 Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported Not Reported 88 88 88	Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: orintreport.php?siteid=185527 Organization Name: Type: HUC: Drainage Area Units: Contrib Drainage Area U Formation Type: Construction Date: Well Depth Units: Well Hole Depth Units:	Site Assess 0 09-FEB-18 Not Reporter FED USGS USG Well 11110 Not F Jonts: Not F Boon 1962 ft ft 1962 Not F	USGS40000974300 USGS40000974300 S Oklahoma Water Science Cen 0103 Reported Reported Reported Reported

16706 Not Reported 0 395

Well	G
Туре:	r
W	0
e	u
1	n
1	d
0	W
W	а
n	t
е	е
r	r
: W	W
	е
а	I
t	I
е	Р
r	е
U	g
S	g g
е	У
:	Р
Date to	h
First	i
Water:	I
	р
	0
	t
	t
	D
	0

D o m e s t i

> с 115

Approximate Yield: Aquifer Code:	2 Not Reported	Construction Date: Basin Code:	15-DEC-82 Not Reporte	d
URL:	http://www.owrb.ok.gov/wd/rep			
21 ENE I/2 - 1 Mile Higher			OK WELLS	OK700000006620
Well ID:	99143	Well Type:	Groundwate	r Well
Permit #: Elevation:	Not Reported 0	Well Owner: Water Use:	Bob Lee Domestic	
Total Well Depth: Approximate Yield:	440 7	Date to First Water: Construction Date:	0 31-JAN-06	
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	d
URL:	http://www.owrb.ok.gov/wd/rep	orting/printreport.php?siteid=99143		
322 SE 1/2 - 1 Mile			OK WELLS	OK70000003420
.ower Well ID:	34424	Well Type:	Groundwate	r Well
Permit #:	Not Reported	Well Owner:	JEFF HALL	
Elevation: Total Well Depth:	0 275	Water Use: Date to First Water:	Domestic 240	
Approximate Yield:	1.5	Construction Date:	22-MAR-96	
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	d
URL:	http://www.owrb.ok.gov/wd/rep	orting/printreport.php?siteid=34424		
323 SE			OK WELLS	 OK700000010315
I/2 - 1 Mile ₋ower				
Well ID:	203307	Well Type:	Groundwate	
Permit #: Elevation:	Not Reported 0	Well Owner: Water Use:		d & Jenny Hall
Total Well Depth:	300	Date to First Water:	Domestic 120	
Approximate Yield:	4.5	Construction Date:	12-AUG-20	
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	d
URL:	http://www.owrb.ok.gov/wd/rep	orting/printreport.php?siteid=203307		
24 Nest I/2 - 1 Mile			OK WELLS	OK70000002837
Lower				
	Total	Annrovinata		
Well ID: Permit #:	Total Well	: Approximate Yield: Aquifer	24668 Not Reporte	ad 0

TC7007844.2s Page A-23

0 Not Reported

Well G Type: r W o e u I n I d O w W a n t e e r r i W W a n t e e r r i W W e a I t I e B r o U b s R e o U b s N O b Date e t O D n rutt N O D n o Date m Basin		
W o e u I n I d O w W a n t e e r r : W W e a I t t e B r o U b s R e o U b s R e o Closte e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i	Well	G
e u I n I d O w W a n t e e r r : W W e a I t I e B r O U b s R e o U b s R e o : b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i	Туре:	r
I n I d O w W a n t e e r r : W W e a I t I e B r O U b s R e o U b s R e o Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i		0
I d I d Q w W a n t e e r r : W W e a I t I e B r O U b s R e O U b s R e O Date e to r First t Water s : O Date m ructio D n o Date: m Basin e Code: s t i		u
O w W a n t e e r r : W W e a I t I e B r O U b s R e o U b s R e o Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i	-	
W a n t e e r r : W W e a I t I e B r O U b s R e o U b s R e o Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i		d
n t e e r r : W W e a I t I e B r O U b s R e o U b s O Date e to r First t Water s : O Const n ructio D n o Date: m Basin e Code: s t i		w
e r r r : W W e a I t I e B r O U b s R e O U b s R e O Date e to r First t Water s : O Const n ructio D n O Date: m Basin e Code: s t i	w	а
e r r r : W W e a I t I e B r O U b s R e O U b s R e O Date e to r First t Water s : O Const n ructio D n O Date: m Basin e Code: s t i	n	t
r r : W W e a I t I e B r o U b s R e o : b Date e to r First t Water s : o Const n n o Date: m Basin e Code: s t i	е	е
: W W e a t e R F 0 U b s R e 0 : b Date 0 to 7 First t Water 5 : 0 Const 7 First 0 Const 7 First 0 Const 7 First 0 Const 7 First 1 Water 5 Const 7 First 1 V Const 7 First 1 V	r	
a I t I e B r O U b s R e O Date e to r First t Water s : O Const n ructio D n O Date: m Basin e Code: s t i	:	W
a I t I e B r O U b s R e O Date e to r First t Water s : O Const n ructio D n O Date: m Basin e Code: s t i	W	
t I e B r 0 U b s R e 0 : b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t t	а	
e B r 0 U b s R e 0 : b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i	t	I
r o U b s R e o : b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t	е	
s R e o : b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i	r	
s R e o : b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i	U	
e o : b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i		R
: b Date e to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i		
DateetorFirsttWaters:oConstnructioDnoDate:mBasineCode:sti	:	
to r First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i		
First t Water s : o Const n ructio D n o Date: m Basin e Code: s t i	to	
Waters:oConstnructioDnoDate:mBasineCode:sti	First	
: o Const n ructio D n o Date: m Basin e Code: s t i		
ConstnructioDnoDate:mBasineCode:sti		
ructio D n o Date: m Basin e Code: s t i	Const	n
n o Date: m Basin e Code: s t i		D
Date: m Basin e Code: s t i		
Basin e Code: s t i		
Code: s t i		
t i		
i		
		i
		с
0		

u 18-JUN-84 Not Reported

URL:

http://www.owrb.ok.gov/wd/reporting/printreport.php?siteid=24668

H25 WNW 1/2 - 1 Mile Lower			OK WELLS	OK7000000121756
Well ID:	73803	Well Type:	Geotechnic	al Boring
Permit #:	Not Reported	Well Owner:		equah c/o Gary Dot
Elevation:	0	Water Use:	Soil Evaluat	
Total Well Depth:	20	Date to First Water:	0	
Approximate Yield:	0	Construction Date:	05-SEP-02	
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	d
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=73803		
H26 WNW 1/2 - 1 Mile Lower			OK WELLS	OK7000000121757
Well ID:	73804	Well Type:	Geotechnic	al Boring
Permit #:	Not Reported	Well Owner:		equah c/o Gary Do
Elevation:	0	Water Use:	Soil Evaluat	
Total Well Depth:	17	Date to First Water:	0	
Approximate Yield:	0	Construction Date:	05-SEP-02	
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	d
Aquilor Occub.	NorNopoliou		Not Reporte	
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=73804		
H27 MNW 1/2 - 1 Mile Lower			OK WELLS	OK7000000166662
Well ID:	75779	Well Type:	Monitoring \	Vell
Permit #:	Not Reported	Well Owner:	NBR	-
Elevation:	0	Water Use:	Water Quali	tv
Total Well Depth:	15.5	Date to First Water:	0	
Approximate Yield:	0	Construction Date:	09-DEC-02	
Aquifer Code:	Not Reported	Basin Code:	Not Reporte	d
URL:	http://www.owrb.ok.gov/wd/rep	porting/printreport.php?siteid=75779		
28 5E 1/2 - 1 Mile			OK WELLS	OK7000000170919
Lower				
Well ID:	89118 Not Deported	Well Type:	Monitoring \	

Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:

Not Reported 0 8 0 Not Reported Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: Monitoring Well EZ Mart, Inc. #548 c/o Jones Site Assessment 0 04-AUG-04 Not Reported

TC7007844.2s Page A-25

http://www.owrb.ok.gov/wd/reporting/printreport.php?siteid=89118

URL:

Map ID Direction				
Distance Elevation			Database	EDR ID Number
I29 SE 1/2 - 1 Mile Lower			OK WELLS	OK7000000170920
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code: URL:	89119 Not Reported 0 10 0 Not Reported http://www.owrb.ok.gov/wd/reporting/	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code: /printreport.php?siteid=89119	Monitoring V EZ Mart, Ind Site Assess 0 04-AUG-04 Not Reporte	c. #548 c/o Jones ment
30 NNW 1/2 - 1 Mile Lower			OK WELLS	OK700000083876
Well ID: Permit #: Elevation: Total Well Depth: Approximate Yield: Aquifer Code:	148267 Not Reported 0 150 10 Not Reported	Well Type: Well Owner: Water Use: Date to First Water: Construction Date: Basin Code:	Groundwate Rita Bergm Agriculture 0 21-DEC-12 Not Reporte	an (non irr)
URL:	http://www.owrb.ok.gov/wd/reporting/	/printreport.php?siteid=148267		
31 East 1/2 - 1 Mile Lower			FRDS PWS	OK1021701
Epa region: Pwsid: Cityserved: Zipserved: Status: Pwssvcconn: Pwstype: Contact: Contactphone: Contactaddress2: Contactstate: Pwsactivitycode: Pwsid: Facname: Factype: Trtobjective:	06 OK1021701 Not Reported Active 3000 CWS TAHLEQUAH PWA 918-456-2564 101 N. COLLEGE OK A OK1021701 TAHLEQUAH WTP (ILLIONC Treatment_plant other	State: Pwsname: Stateserved: Fipscounty: Retpopsrvd: Psource longname: Owner: Contactorgname: Contactoddress1: Contactcity: Contactcity: Contactzip: Facid: NS RIVER) Facactivitycode: Trtprocess:	OK 4002 1445 Surfa Loca TAHI KELL	8 ce_water _Govt .EQUAH PWA .Y ROSS, CHAIRMAN .EQUAH 4
Factypecode:	TP OK1021701	Facid:	1107)
Facname:	TAHLEQUAH WTP (ILLIONC	DIS RIVER)	C7007844.00 Do	

Factype: Trtobjective: Factypecode:

Treatment_plant disinfection TP Facactivitycode: Trtprocess:

A gaseous chlorination, post

Pwsid:	OK1021701	Facid:	11070
Facname: Factype: Trtobjective: Factypecode:	TAHLEQUAH WTP (ILLIONOIS RIV Treatment_plant particulate removal TP	/ER) Facactivitycode: Trtprocess:	A coagulation
Pwsid:	OK1021701	Facid:	11070
Facname: Factype: Trtobjective: Factypecode:	TAHLEQUAH WTP (ILLIONOIS RIV Treatment_plant particulate removal TP	/ER) Facactivitycode: Trtprocess:	A sedimentation
Pwsid:	OK1021701	Facid:	11070
Facname: Factype: Trtobjective: Factypecode:	TAHLEQUAH WTP (ILLIONOIS RIV Treatment_plant particulate removal TP	/ER) Facactivitycode: Trtprocess:	A filtration, rapid sand
Pwsid:	OK1021701	Facid:	11070
Facname: Factype: Trtobjective: Factypecode:	TAHLEQUAH WTP (ILLIONOIS RIV Treatment_plant disinfection TP	/ER) Facactivitycode: Trtprocess:	A gaseous chlorination, pre
Pwsid:	OK1021701	Facid:	26413
Facname: Factype: Trtobjective: Factypecode:	TAHLEQUAH WTP (LAKE TENKILL Treatment_plant particulate removal TP	ER) Facactivitycode: Trtprocess:	A filtered
Pwsid:	OK1021701	Facid:	26413
Facname: Factype: Trtobjective: Factypecode:	TAHLEQUAH WTP (LAKE TENKILL Treatment_plant disinfection TP	ER) Facactivitycode: Trtprocess:	A gaseous chlorination, post
PWS ID: Address: City: Zip: Source code:	OK1021701 PO BOX 29 TAHLEQUAH 74465 Surface water	PWS name: Care of: State: Owner: Population:	TAHLEQUAH PWA Not Reported OK TAHLEQUAH PWA 9300
PWS ID: PWS name: PWS city: PWS zip: PWS type code:	Contact: Contact address: Contact state: Contact telephone:	OK1021701 Not Reported Not Reported Not Reported C TAHLEQUAH PWA PO	BOX 29 OK 918-456-2123

TC7007844.2s Page A-29

PWS type: PWS address: PWS name: Retail population served: Contact address: Contact city: Contact zip:	N o t R e p o o r t e d N o t r t e e p o o r t t e e p o o r t t R e e p o o r t t R e e p o o r t t R e e p o o r t t R e e p o o r t t R e e p o o r t t R e e f f o t t R e e f f o t t R e e f f o t t t R e e f f o t t t R e f f f o t t t R e f f f o t t t R e f f f o t t t R e f f f o t t t R e f f f o t t t R e f f f o t t t R e f f f o t t t R e f f f f f f f f f f f f f f f f f f		
PWS ID: Date system activated: Retail population: System address: System city: System zip:	OK1021701 Not Reported 00009300 Not Reported TAHLEQUAH 74465	Activity status: Date system deactivated: System name: System address: System state:	Active Not Reported TAHLEQUAH PWA PO BOX 29 OK
Population served:	5,001 - 10,000 Persons	Treatment:	Treated
Latitude:	355445	Longitude:	0945600

Latitude:	355445	Longitude:	0945600
State:	OK	Latitude degrees:	35
atitude minutes:	54	Latitude seconds:	45.0000
Longitude degrees:	94	Longitude minutes:	56
Longitude seconds:	0.0000	0	
Violation id:	327110	Orig code:	S
State:	OK	Violation Year:	2009
Contamination code:	3100	Contamination Name:	Coliform (TCR)
/iolation code:	22	Violation name:	MCL, Monthly (TCF
Rule code:	110	Rule name:	TCR
/iolation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	09/01/2009
Cmp edt:	09/30/2009		
WS currently has or had major	violation(s) or enforcement:Yes		
/iolation ID:	9400320	Violation source ID:	Not Reported
PWS telephone:	Not Reported	Contaminant:	Not Reported
/iolation type:	Treatment Technique (SWTR)		
/iolation start date:	110193	Violation end date:	113093
/iolation period (months):	001	Violation awareness date:	122093
Major violator:	Not Reported	Maximum contaminant level:	Not Reported
Number of required samples:	Not Reported	Number of samples taken:	Not Reported
Analysis method:	Not Reported	Analysis result:	Not Reported
PWS telephone: /iolation type:	Not Reported Treatment Technique (SWTR)	Contaminant:	Not Reported
/iolation start date:	020194	Violation end date:	022894
/iolation period (months):	001	Violation awareness date:	Not Reported
Major violator:	Not Reported	Maximum contaminant level:	Not Reported
Number of required samples:	Not Reported	Number of samples taken:	Not Reported
Analysis method:	Not Reported	Analysis result:	Not Reported
/iolation ID:	327110	Orig Code:	S
Enforcemnt FY:	2009 St Compliance achieved	Enforcement Action:	09/30/2009
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
/iolation ID:	327110	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	12/14/2009
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
/iolation ID:	327110	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	01/13/2010
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
/iolation ID:	327110	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	12/14/2009
Enforcement Detail:	St Violation/Reminder Notice		
Enforcement Category:	Informal		
PWS name:	TAHLEQUAH PWA	Population served:	14458
PWS type code:	C	Violation ID:	327108
Contaminant:	2456	Violation type:	27
Compliance start date:	10/1/2008 0:00:00	Compliance end date:	12/31/2008 0:00:00
Enforcement date:	No Enf Action as of	Enforcement action:	7/8/2009 0.00.00

No Enf Action as of

Not Reported

Enforcement date: Violation measurement: 7/8/2009 0:00:00

Enforcement action:

PWS name: PWS type code: Contaminant: Compliance start date: Enforcement date: Violation measurement:

TAHLEQUAH PWA

C CARBON, TOTAL-ORGANIC 1/1/2008 0:00:00 No Enf Action as of Not Reported Population served: Violation ID: Violation type: Compliance end date: Enforcement action: 14458 327109 27 3/31/2008 0:00:00 7/8/2009 0:00:00

AREA RADON INFORMATION

State Database: OK Radon

Radon Test Results

Zipcode	Num Tests	# > 4 pCi/L	Maximum	Average
74464	29	8	110.9	7.596

Federal EPA Radon Zone for CHEROKEE County: 2

Note: Zone 1 indoor average level > 4 pCi/L.

: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.

: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 74464

Number of sites tested: 12

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	4.500 pCi/L	67%	33%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)

Source: United States Geologic Survey

EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.

Source: FEMA Telephone: 877-336-2627 Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System

Source: EDR proprietary database of groundwater flow information

EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit

Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database

Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)

The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database

Source: Department of Agriculture, Natural Resources Conservation Service (NRCS) Telephone: 800-672-5559

SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems

Source: EPA/Office of Drinking Water

Telephone: 202-564-3750

Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data

Source: EPA/Office of Drinking Water

Telephone: 202-564-3750

Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS) This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Reported Well Locations in Oklahoma Source: Oklahoma Water Resources Board Telephone: 405-530-8800

OTHER STATE DATABASE INFORMATION

Oil and Gas Well Listing Source: Oklahoma Corporation Commission Telephone: 405-521-3636 Oil and gas well locations in the state.

Oil and Gas Well Listing Source: Osage Nation Environmental and Natural Resources Telephone: 918-287-5333 Oil and gas well locations.

RADON

State Database: OK Radon Source: Department of Environmental Quality Telephone: 405-702-5100 Radon Information

Area Radon Information Source: USGS Telephone: 703-356-4020 The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones Source: EPA Telephone: 703-356-4020 Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

OTHER

Airport Landing Facilities: Private and public use landing facilities Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

STREET AND ADDRESS INFORMATION

© 2015 TomTom North America, Inc. All rights reserved. This material is proprietary and the subject of copyright protection and other intellectual property rights owned by or licensed to Tele Atlas North America, Inc. The use of this material is subject to the terms of a license agreement. You will be held liable for any unauthorized copying or disclosure of this material.

Appendix F

Qualifications



Educatio	on	
	1992	Post Graduate Studies in Environmental Science Program Oklahoma State University, Stillwater, OK
B.S.	1988	Fisheries Management and Wildlife Biology Northeastern State University, Tahlequah, OK

Professional Experience

1999 – Present President Eagle Environmental Consulting, Inc.

1991-1999 Senior Regulatory Project Manager, Regulatory Branch U.S. Army Corps of Engineers

1989 – 1991 Park Ranger, Buckhorn Lake, Kentucky U.S. Army Corps of Engineers

1987-1989 Fisheries Technician Oklahoma Department of Wildlife Conservation

1999 to Present:

Founder and President of Eagle Environmental Consulting, Inc. (EEC), Mr. Votaw is responsible for coordinating the daily business operations, project management, field surveys, report development, and quality assurance. Some of the primary focus operations of EEC include biological and ecological services including environmental impact assessments, National Environmental Policy Act (NEPA) document preparation, endangered species surveys, biological assessment, fish and wildlife habitat assessments, wetland delineations, Phase I Environmental Assessments, regulatory permitting, compliance, compensatory wetland and waterway mitigation design & development, traffic noise studies and sound barrier design. Mr. Votaw has served as project manager and/or lead scientist on a myriad of diverse projects within the states of Oklahoma, Texas, Arkansas, Kansas, Louisiana, and Missouri.



Previous Employment:

1989 to 1999:

Senior Project Manager in the Regulatory Branch of the Tulsa District Corps of Engineers. Mr. Votaw's responsibilities included Section 404 of the Clean Water Act permit evaluations, compliance, enforcement and surveillance, mitigation, and delineations. Critical components of his permit evaluation responsibilities included application and assessment of the Section 404(b)(1) guidelines for each Standard Permit issued. Each project required an in depth and attentive Alternatives Analysis in order to determine the least environmentally damaging practicable alternative. Public presentations, meetings, and coordination was an integral part of his duties as well as maintaining near constant coordination and cooperation with State and Federal resource and regulatory agencies.

1989-1991:

Park Ranger, Buckhorn Lake, Kentucky with the U.S. Army Corps of Engineers. Primary responsibilities included natural resource management, visitor assistance, patrol, project coordination, assessment management, boundary establishment surveys, timber management point of contact, coal mine liaison, and special projects manager.

1987 to 1989:

Fisheries Technician with the Oklahoma Department of Wildlife Conservation. Primary responsibilities included data collection and evaluation, completing standardized fisheries sampling techniques, preparing fisheries management reports for lakes, ponds, and streams. Public coordination and involvement was an integral part of overall position requirements.

Training and Certifications (course length 40 hours unless otherwise noted) USFWS Endangered species survey and consultation methodology workshop (8 hours) NEPA and the Transportation Decision Process Environmental Laws and Regulations Environmental Impact Assessment of Projects Regulatory I - U.S. Army Corps of Engineers Regulatory Program Introduction Course Regulatory II - USACE Regulatory Program Secondary Course Regulatory Program IV - Wetland Delineation Hydric Soils Determination (Advanced Course) Conflict Management Skills to Resolve Highway/Wetland Issues Contract Administration Leadership Education and Development Archaeology for Managers Handling Difficult People (8 hours) Learning Styles (8 hours)



Traffic Noise Modeling (TNM 1.0)

Professional Affiliations and Appointments

Society of Wetland Scientists National Regulatory Conference Task Force Lead Author & Assessment Team Leader for USACE HGM Lacustrine Fringe National Wetland Guidebook Development Review Panel Member for Riparian Area Management Handbook Regional Farm Pond Management Coordinator - OK Department Wildlife Conservation National and Oklahoma Chapter - American Fisheries Society National and Oklahoma Chapter - The Nature Conservancy

Professional Certification and Nominations

Wetland Delineation Instructor National Regulator of the Year - 1994, 1996 Southwestern Division Regulator of the Year - 1995, 1997

Publications

Votaw, Steven R., "Federal Permits for Wetlands and other Environmental Concerns." *Proceedings of Industrial Minerals Symposium.* Oklahoma Geological Survey, August 1993.

Votaw, Steven R., et. al., "A Regional Guidebook for Application of Hydrogeomorphic Assessments to Lacustrine Fringe Wetlands." 2000.

Scientific Reports

Numerous Wetland Delineation, Threatened & Endangered Species, Wildlife Habitat Management Reports of Survey and Plans. 1999 to present.

Designed and developed multiple wetland and waterway compensatory mitigation plans using creation, restoration, enhancement, & preservation.

Standardized Sampling Procedures Fisheries Management Report for Chelsea City Lake. OK Dept. of Wildlife Cons. 1989.

Standardized Sampling Procedures Fisheries Management Report for Bixhoma Lake. OK Dept. of Wildlife Cons. 1989.

Upland Bird Management Plan for the Diamond Bar D Ranch. 1996.

Fish and Wildlife Management Plan for the Rock Creek Ranch. 1996.

Wildlife Management Plan for the West Ranch. 1995.

Wildlife Management Plan for the Sitterly Ranch. 1993.



SUMMARY OF 30 YEARS OF PROFESSIONAL EXPERIENCE

- National Environmental Policy Act (NEPA) Documentation
- Categorical Exclusion (CE) Documentation
- Environmental Assessment (EA) Documentation
- Environmental Impact Statement (EIS) Documentation
- Environmental Information Documentation (Oklahoma)
- Federal and State Agency Coordination
- Native American Tribal Coordination
- Phase 1 Environmental Site Assessments
- Traffic Noise Assessments
- Section 404 Permitting
- Public Involvement
- Biological Assessments
- American Burying Beetle Surveys
- Waters of the United States Delineations
- Compensatory Mitigation Plan Development & Design

NEPA Documentation

Frankoma Road Sanitary Sewer Extension, City of Sapulpa, Creek County, OK	2018
Environmental Information Documentation	
Reviewing Agency: Oklahoma Water Resources Board	
Principal Investigator and Primary Author	

The project involved the proposed installation of approximately 1,000 feet of a new 18-inch diameter gravityflow main line, a new lift station and installation of a new 6-inch diameter force main line approximately 1.7 miles in length to connect to the existing City of Sapulpa sanitary sewer collection system.

Extreme Recreational Vehicle Resort, Eufaula, McIntosh County, OK
Environmental Assessment Update
Reviewing Agency: U.S. Army Corps of Engineers
Principal Investigator and Primary Author

The proposed project required a real estate lease instrument documentation to assess the environmental impacts of the project. In response to this change in use on USACE land, a Supplemental Environmental Assessment was prepared to provide additional information for USACE review and subsequent approval of the RV Resort. Responsible for preparation of environmental assessment and supporting technical reports.

Bridgeview Resort and Marina Improvements Environmental Assessment Reviewing Agency: U.S Army Corps of Engineers 2017-2018

2018

4



Principal Investigator and Primary Author

The proposed project would involve development of multiple features within the requested 139-acre lease expansion area adjacent to their existing lease area on Lake Texoma. The EA has been prepared in the preferred format for the U.S. Army Corps of Engineers review. The proposed project area is situated on USACE property and includes both terrestrial and aquatic areas on Lake Texoma, near Aylesworth, Marshall County, Oklahoma. Responsible for preparation of environmental assessment and supporting technical reports.

7th Street Bridge Replacement Project, Excelsior Road to EW 280 Road, Craig County, OK 2017 Categorical Exclusion

Reviewing Agency: Cherokee Nation/Oklahoma Turnpike Authority Principal Investigator and Primary Author

The Federal Highway Administration Office of Tribal Transportation in cooperation with the Oklahoma Turnpike Authority and the Cherokee Nation proposes the replacement of the 7th Street Bridge that crosses I-44 (Will Rogers Turnpike) in Craig County, Oklahoma. Responsible for categorical exclusion documentation and supporting technical reports.

Proposed Delaware Tribe of Indians Casino, Leavenworth, Kansas Delaware Tribe of Indians Reviewing Agency: Bureau of Indian Affairs Principal Investigator and Primary Author

The proposed project was prepared on behalf of the Delaware Tribe of Indians to facilitate the Bureau of Indian Affairs review of potential environmental impact assessment associated with a proposed casino for the Tribe. Once approved, the property will be converted from Fee to Trust status. Responsible for preparation of environmental assessment and supporting technical reports.

Chimney Rock Reservoir Improvements Phase 2, Mayes County, OK 2016 Categorical Exclusion

Reviewing Agency: Cherokee Nation/FHWA Central Federal Lands Highway Division Principal Investigator and Primary Author

The Federal Highway Administration in cooperation with the Cherokee Nation, proposes to reconstruct and improve an approximate 4-mile long section of Chimney Rock Reservoir Road near Salina in Mayes County, OK. The project is funded, in part, by Title 23 funds through the Tribal Transportation Program (TTP). TTP funds are provided to the Cherokee Nation in accordance with the Tribal Transportation Program Agreement between the Cherokee Nation and the United States Department of Transportation. Responsible for categorical exclusion documentation and supporting technical reports.

Port of Muskogee Rail Expansion, Muskogee County, OK Environmental Assessment Reviewing Agency: Port of Muskogee/U.S. DOT 2016

2016-2017

President

Steven R. Votaw

Principal Investigator and Primary Author

The purpose of the proposed project is to modernize the existing rail connection to the Port of Muskogee at Milepost 500.02 of the Union Pacific Railroad Company's Cherokee Subdivision No. 2 and to provide additional capacity for manifest and unit train service by extending the Port of Muskogee Railcar Marshaling Yard for review by the U.S. Department of Transportation Federal Railroad Administration. Responsible for preparation of environmental assessment and supporting technical reports.

White Oak Road (NS4340) Improvements, Craig County, OK2015Environmental AssessmentReviewing Agency: Cherokee Nation/ FHWA Central Federal Lands Highway DivisionPrincipal Investigator and Primary Author

The Federal Highway Administration, in cooperation with the Cherokee Nation, proposed to reconstruct and improve NS 4340 in Craig County, OK. The project is funded, in part, by Title 23 funds through the Tribal Transportation Program (TTP). TTP funds are provided to the Cherokee Nation in accordance with the Tribal Transportation Program Agreement between the Cherokee Nation and the United States Department of Transportation. Responsible for categorical exclusion documentation and supporting technical reports.

Cutoff Dredging and Spoil Pond Construction, Johnston's Port 33, Rogers County, OK 2014 Environmental Assessment Reviewing Agency: U.S. Army Corps of Engineers

Reviewing Agency: U.S. Army Corps of Engineers Principal Investigator and Co-Author

For review and approval by the U.S. Army Corps of Engineers, the purpose of the proposed action was to access areas along the McClellan-Kerr Arkansas River Navigation System for additional barge fleeting space for Johnston's Port 33. Responsible for environmental assessment preparation.

North 193rd East Avenue Improvements, Rogers County, Oklahoma Categorical Exclusion

Reviewing Agency: Oklahoma Department of Transportation Principal Investigator and Primary Author

Categorical exclusion prepared for the North 193rd East Avenue Improvements. The proposed improvement project is approximately 2.13 miles in length and extends from State Highway 266 (Port Road) north to East 76th Street North. North 193rd East Avenue contains two 12-foot wide travel lanes, one in each direction with no shoulders. The purpose and need for this proposed project along this section of North 193rd East Avenue is to improve safety to a heavily travelled local roadway through a residential area that has no shoulders. Responsible for categorical exclusion documentation and supporting technical reports.

Bauman Abandoned Mine Land Project, Rogers County, OK Environmental Assessment Reviewing Agency: Oklahoma Conservation Commission 2012

2013





Principal Investigator and Primary Author

This environmental assessment was prepared for the Oklahoma Conservation Commission concerning reclamation of abandoned mine land. The proposed action would consist of filling the water filled pits and drainage ditch with mine spoil from the project area to the original contour and then be re-vegetated to prevent erosion. Responsible for preparation of environmental assessment and supporting technical reports.

2011 Northeastern State 166/160 Abandoned Mine Lands Project, Wagoner County, OK **Environmental Assessment**

Reviewing Agency: Oklahoma Conservation Commission Principal Investigator and Primary Author

This environmental assessment was prepared for the Oklahoma Conservation Commission concerning reclamation of abandoned mine land. The proposed action includes the reclamation of abandoned mine land located to the immediate north of the Northeastern State University and west of the Creek Turnpike in Broken Arrow, Wagoner County, Oklahoma. Responsible for preparation of environmental assessment and supporting technical reports.

Proposed Natural Gas Pipeline Project, Marshall and Bryan Counties, OK **Environmental Assessment Reviewing Agency: U.S. Army Corps of Engineers**

2011

Principal Investigator and Co-Author

An environmental assessment was prepared to identify and address any potential impacts associated with a proposed 2.9-mile 8-inch diameter steel pipeline on United States Army Corps of Engineers controlled land near Lake Texoma in Oklahoma. Responsible for preparation of environmental assessment and supporting technical reports.

Pawnee Nation 4 th Street Improvements, Pawnee, OK	2010
Pawnee Nation, 9th Street Improvements, Pawnee, OK	2010
Campus Improvements and Cemetery Improvements	2010
Categorical Exclusions	
Reviewing Agency: FHWA Central Federal Lands Highway Division	

Primary Investigator and Author

The Pawnee Nation, in corporation with the Federal Highway Administration Central Federal Lands Highway Division, proposed to improve 4th Street 9th Street, in additional to, campus and cemetery roadway improvements. Responsible for categorical exclusion documentation, supporting technical reports and coordination with Central Federal Lands Highway Division.



Aylesworth 2D Seismic Survey, Marshall County, OK Environmental Assessment Reviewing Agency: U.S. Army Corps of Engineers Principal Investigator and Primary Author 2010

Chesapeake Energy Corporation proposed to conduct a two dimensional (2D) seismic survey on United States Army Corps of Engineers Land at Lake Texoma in Marshall County, Oklahoma. Five seismic lines and access routes to access these lines on COE property were assessed.

Additional NEPA document preparation includes:

- Osage Nation Fee to Trust Application EA to BIA, Bartlesville, OK
- Osage Nation Fee to Trust Application EA to BIA, Pawhuska, OK
- Delaware Tribe Fee to Trust Application EA to BIA, Leavenworth, KS
- Kialegee Tribal Town Fee to Trust Application EA to BIA, Broken Arrow, OK
- Port of Muskogee Rail Spur Project, EA in Muskogee, OK
- Chimney Rock Road Improvement Project CE, Mayes County, OK
- White Oak Road Improvement Project CE, Craig County, OK
- U.S. Highway 60 Improvement Project, Bartlesville, OK, to Vinita, OK
- U.S. 75 Improvement Project, Weleetka, OK, to North Canadian River Bridge
- S.H. 10 Improvement Project, Miami, OK
- 86th Street North Improvement Project, Owasso, OK
- Covell Road and MacArthur Blvd Improvements, Oklahoma City, OK
- Mustang Road Widening, City of Yukon, OK
- Southeast 15th St. Improvements, Midwest City, OK
- South Western Avenue Improvements, Cleveland County
- I-235/Harrison Avenue Interchange Improvements, Oklahoma City
- 193rd East Avenue Improvements, Rogers County, OK
- 4th Street Improvements, Pawnee County, OK
- 9th Street Improvements, Pawnee County, OK
- Pawnee Nation Campus Improvements, Pawnee County, OK
- Bridge 72 Over Wickcliffe Creek Replacement, Mayes County, OK
- NS 4340 Road Improvements, Craig County, OK
- Aylesworth 2D Seismic Survey, Marshall County, OK
- Baumann Abandoned Mine Lands Project, Rogers County, OK
- Boomerang #1H Well Site, Grayson County, TX
- Brianna #1-3 Well Site, Caddo County, OK
- HooDoo #14 and #17 Well Site, Osage County, OK
- North Kaw Lake 8-1 Well Site, Kay County, OK
- Maxim 34-1 and USA 4-1 Well Site, Osage County, OK
- Northeastern State 166/160, Broken Arrow, Wagoner County, OK
- Jetta J&M 1H and Cannon 1H Pipeline Connections, Grayson County, TX
- Natural Gas Pipeline Project, Marshall and Bryan Counties, TX



- Southland 1H Well, Grayson County, TX
- Clinton 4-3H Well Site, Washita County, OK

Phase 1 Environmental Assessments

Coordinated and/or prepared multiple site assessments on over 1,000 acres of property in Oklahoma, Kansas, and Arkansas.

Traffic Noise Assessments

Prepared or coordinated assessments for projects throughout Oklahoma. Responsibilities included obtaining ambient noise readings, creation of noise models and report preparation. Noise models were prepared and approved for the following projects:

- Eastern Oklahoma County Turnpike Interchange at I-40, OK, 17 miles
- John Kilpatrick Turnpike and Interstate 40 Interchange Improvements, OK
- U.S. 69 Interchange Construction at Kinkead Road, McAlester, OK, 1 mile
- N. Western Avenue Widening, Oklahoma County, OK, 1.4 miles
- West 81st Street South Improvements, Creek County, OK 1.25 miles
- U.S. 270 over Caston Creek, Leflore County, OK 1 mile.
- S.H. 10 Improvement Project, Miami, OK, 4 miles
- 86th Street North Improvement Project, Owasso, OK, 4 miles
- Covell Road and MacArthur Blvd Improvements, Oklahoma City, OK, 1 mile
- Mustang Road Widening, City of Yukon, OK, 1 mile
- Southeast 15th St. Improvements, Midwest City, OK, 1.25 miles
- South Western Avenue Improvements, Cleveland County, 3 miles
- I-235/Harrison Avenue Interchange Improvements, Oklahoma City
- 193rd East Avenue Improvements, Rogers County, OK, 1.2 miles.
- NW 10th Street, Oklahoma City, OK
- North Western Avenue, Oklahoma County, OK
- 96th Street and 129th East Avenue, Owasso, OK
- West 81st Street, Sapulpa, OK
- State Highway 51 Improvement Project, Wagner to Tahlequah, OK,
- Gilcrease Northwest Expressway Extension Project, Tulsa, Osage County, 4.5 miles.
- 86th Street North Improvement Project, Owasso, Tulsa County, 4 miles.
- State Highway 10 Improvement Project, Miami, Ottawa County, 4 miles.
- U.S. Highway 70 Bridge Viaduct Project, Durant, Bryan County, 1 mile.
- NW 150th Street Improvements, Oklahoma County, 1 mile.
- I-40 Improvement Project, 1-240 to Choctaw Road, Oklahoma County, 2 miles.
- South Western Avenue, SW 134th to SW 179th Street, Cleveland County, 3 miles.



Wetland Mitigation/Reforestation Plans

- 10.5-acre wetland and waterway mitigation design plan, Coweta, OK
- 10 acre wetland, waterway, & pond mitigation design plan, Owasso, OK
- 5.5 acre wetland mitigation area, Durant, OK
- 12 & 5 acre wetland mitigation area plans, Broken Arrow, OK
- 5 acre wetland mitigation area plan, Muskogee, OK
- 25 acre bottomland hardwood wetland, Verdigris, OK
- 18-acre wetland mitigation plan. Tulsa County, OK.
- 10-acre wetland mitigation plan. Cleveland County, OK.
- 3-acre bottomland hardwood reforestation plan. McClain County, OK.
- Wetland Mitigation Bank in Oklahoma (80 acres). Tulsa County, OK.
- 5-acre wetland & waterway compensatory mitigation plan using 3 wetland areas and a 1,500 linear foot creek channel, Broken Arrow, OK.
- Designed, developed, and provided construction oversight of a 2 acre wetland and a 1,900 linear foot creek channel mitigation project, Washington County, OK.
- Developed a conceptual wetland mitigation plan for a 200+acre turnpike extension project in southeastern OK.
- Developed and designed a wetland and waterway mitigation plan for a school sports facility expansion project, Owasso, OK.
- Developed a 2-acre wetland mitigation plan got a golf course expansion project.
- Development of a mitigation area modification plan to address a creek channel relocation project.
- Developed EPA and USACE enforcement related mitigation plans to restore and return affected waters of the United States to former condition, function, and capacity.

Wetland and Waterway Delineation Studies

- Comprehensive Wetland delineations conducted on approximately 80 acres of previously disturbed lands involving over 100 trackhoe trenches and 150 sample sites.
- 156-acre commercial/residential development, Coweta, OK
- Wetland delineations on a 1,000-acre industrial park and Report of Survey for submittal to the Corps of Engineers. The largest wetland impact and mitigation project in the Tulsa District.
- Wetland Delineations and Section 404 Permit Acquisition for a proposed Limestone Quarry and Industrial Park Development on 46th Street North (Port Road) in Rogers County, OK. The project also required the development of a 200-acre wetland mitigation design plan to offset a proposed 90-acre impact project. The Mitigation Area is located in the southwest corner of 46th Street North and 193rd East Avenue near the Port of Catoosa entrance.
- Wetland delineations, Section 404 of the Clean Water Act permit acquisition and developments of a compensatory mitigation plan for the proposed O'Brien Park Improvement Project at 66th Street North and Lewis Avenue, Tulsa County, Oklahoma.
- Wetland Delineation and GPS Survey for a 165-acre power generation plant development, Warner, OK.
- Multiple residential development projects in Oklahoma City, Norman, Tulsa, and Broken Arrow, OK, ranging in size from 10 to 300 acres.



- River floodplain commercial development project, Norman, OK on 275 acres.
- Hospital construction project, Owasso, OK. 320 acres.
- Public school development project, Owasso, OK 20 acres.
- 86th and 96th Street Widening Projects, Owasso, OK 1 mile sections each.
- State Highway 10 Wetland Finding, Miami, OK 6.5 miles.
- U.S. Highway 70 Wetland Finding, Durant, OK 2.5 miles.
- Gilcrease Expressway Construction Project, Tulsa, OK 8 miles.
- Multiple road/bridge/highway improvement projects across the State of OK for ODOT.
- Municipal Airport Runway Extension Projects in Bartlesville, OK & Rogers, AR.
- EPA enforcement case in disturbed wetlands on 800-acre parcel of land in Tyler, TX.
- Multiple utility line alignments for Florida Power & Light, Forney, TX.
- 10-mile transmission line in Okmulgee County, OK.
- 11-mile highway project in McAlester, OK.
- 13-acre commercial development project, Tulsa, OK.
- Wetland & Waterway Surveys for the U.S. Highway 60 Improvement Project between Bartlesville and Pawhuska, Oklahoma.
- Wetland and Waterway delineations for the 47-mile Muskogee Turnpike extension, Southeast Oklahoma.
- Delineated wetlands along a 36.6-mile gas pipeline corridor and prepared the Report of Survey for submission to FERC.

Section 404 Permits

- Facilitated hundreds of 404 permit acquisitions in Ft. Worth, Little Rock, Kansas City, and Tulsa Districts acting as the agent for the project proponents.
- Coweta Crossing Commercial Development, Coweta, OK
- Owasso Sports Park Detention, Owasso, OK
- North Tulsa Sports Complex in Tulsa County, OK. The proposed project consisted of 26 soccer fields and associated parking areas.
- Wal-Mart Mechanical Distribution Center in Ochelata, OK. Permitting required the design of a 1-acre wetland & 2,000 linear-foot reestablished creek channel mitigation plan,
- Agent responsible for acquiring all 404 permits regarding the Creek East Turnpike Extension Project for the Oklahoma Transportation Authority.
- Facilitated the Section 404 permit acquisition for the East Extension of the Creek Turnpike in Broken Arrow and Catoosa, OK.
- Agent responsible to the City of Bixby for preparing a joint 404 permit application for the Haikey Creek Local Flood Protection and Haikey Creek Diversion Channel Improvement Projects.

Threatened and Endangered Species Assessments

- Performed hundreds of biological assessments, Determinations of Effect, and Consultation with the USFWS including:
 - Multiple residential development projects
 - Multiple commercial developments



- Rock quarries
- o 11 mile transmission line, Taney County, MO
- o 9 mile transmission line, Cherokee County, OK
- 0 15 mile transmission line, Pawnee & Lincoln Counties, OK
- 5 mile transmission line, Payne County, OK
- 4 mile transmission line, Payne County, OK
- 6 mile transmission line, Payne County, OK
- 8 mile transmission line, Osage County, OK
- o 12 mile transmission line, Dallas & Webster County, MO
- o 16 mile transmission line, Benton County, MO
- 2 mile transmission line, Barry County, MO
- Chimney Rock Road Improvement Project, Mayes County, OK
- White Oak Road Project, Craig County, OK
- o CR 4410 Improvement Project, Craig County, OK
- o 6 Gaming Facility Projects in Osage County, OK
- Hundreds of Oil and Gas Development Projects, OK & TX
- Acoustic Bat Surveys:
 - 11-mile Transmission Line, Taney Co., MO
 - Utility Line Installation Project, Broken Arrow, OK
 - o Residential Development Project, Broken Arrow, OK
 - County Rd NS 4410 Improvement Project, Craig County, OK
 - Communication Tower, Carroll Co., AR
 - 5-mile Transmission Line, Cherokee Co., OK
 - o Rail Spur & Siding Expansion, Muskogee, OK
 - Stevedoring Slip Development, Wagoner County, OK
 - 9-mile Transmission Line, Cherokee County, OK
 - Transmission Line, Pittsburg County, OK
- Performed hundreds of ABB surveys in OK, TX, KS, AR including:
 - Ft. Smith Airport
 - o Hartford Mine Project
 - City of Owasso Garnett Road
 - Sports Park Detention Facility, Owasso, OK
 - Multiple Communication Towers in OK
 - Multiple Roadway projects, OK
 - Multiple Transportation Corridors, OK
 - Transmission line corridors, OK
 - Numerous Oil and Gas Development Projects, OK, AR, KS, TX
 - Multiple Tribal Development Projects, OK
- ABB presence/absence survey and bait away effort for an 11 mile pipeline replacement project through Logan and Franklin Counties, AR.
- State Highway 10 Improvement Project, Miami, OK (6 mile section)
- U.S. Highway 60 Improvement Project, Pawhuska to Vinita, OK 60+ miles



Steven R. Votaw President

- Arkansas River Corridor Study Flora and Fauna Inventory, Tulsa Co., OK 42 miles
- Performed American Burying Beetle Presence/Absence surveys in Southeastern OK and Northern TX associated with a 150-mile long natural gas pipeline.
- Provided endangered species surveys for an 8-mile water and transmission line corridor, Forney, TX.
- American Burying Beetle Surveys associated with proposed utility projects for the Cities of Bartlesville, Boswell, Calera, Claremore, Durant, Sand Springs, and Tulsa.
- Interior Least Tern Presence surveys, Canadian River, Haskell Co., OK.
- Habitat Identification Surveys for the Interior Least Tern, Bald Eagle, and American Burying Beetle in 3 counties in Southeastern OK.
- American Burying Beetle Presence/Absence surveys, Keystone Lake. Grand Lake, Eufaula Lake, and Hugo Lake.
 - Endangered Species Surveys for the 47-mile Muskogee Turnpike Extension Project, Southeast Oklahoma.
 - ABB Surveys for multiple highway and county roadway/bridge improvement projects in Oklahoma.

GPS/GIS Mapping

- EEC utilizes GPS information and GIS to develop, prepare and display all types of mapping, resource, and asset location information.
- EEC has prepared thousands of maps and exhibits for project related information and resource display and presentation purposes.
- GPS and GIS data acquisition and presentation is utilized for every EEC project.
- Performed GPS trail positioning and location effort along with GIS presentation of a 9.1mile primitive trail development along the Arkansas and Grand Rivers in Northeastern Oklahoma.
- Provided GIS information graphical synthesis for the Three Forks Inland Harbor project adjacent to the Arkansas River, Muskogee, OK.
- T&E Habitat Assessments and Sensitive Habitat Area delineations and mapping.
- Arkansas River Corridor Study Baseline Inventory Project sample site locations



Sean T. Votaw

P.O. Box 335 Vinita, OK 74301 (918)244-9595 sean@eagle-env.com

<u>Experience</u>

FIELD BIOLOGIST EAGLE ENVIRONMENTAL CONSULTING VINITA, OKLAHOMA - 2010- PRESENT

- Performed endangered species surveys, habitat evaluations, and biological assessments
- Performed waters of the US field surveys and wetland delineations
- Conducted Phase I Environmental Site Assessments
- Conducted Wetland mitigation area monitoring
- Conducted Reforestation area monitoring surveys
- Performed Bat surveys (acoustic and mist netting)
- Soil surveys
- · Plant identification
- · Landscaping/ tree removal
- Operation and maintenance of equipment, vehicles, and heavy machinery
- · Wildlife habitat inventory and assessment
- Operated GPS data collection technology for multiple survey types
- Data analysis using for spreadsheet data and mapping information

• Orienteering by map and GPS equipment to navigate, find, and conduct surveys in remote areas

RANCH MANAGEMENT PHEASANT HILL RANCH; 2008-PRESENT

- · Conducted land and resource management
- · Operation of Farm equipment and machinery
- Performed fence building/repair
- Performed livestock operations & herd management
- · Assisted with hay production/harvest
- Pecan harvesting operations
- · Performed equipment maintenance
- · Conducted landscaping activities

<u>Education</u>

- Northeastern State University; Biology (fish & wildlife management) 2016-2019
- Arkansas Baptist College; Associate of Arts Degree - 2015-2016
- University of Arkansas at Little Rock; Undergraduate - 2014-2015



Sean T. Votaw

P.O. Box 335 Vinita, OK 74301 (918)244-9595 sean@eagle-env.com

Awards, Selections, Certificates:

ASTM 1527-13 Phase I Environmental Site Assessment Training

Scholarship – Oklahoma Chapter of the Wildlife Society

Chancellor's Scholarship Program University of Arkansas Little Rock

Division I NCAA Baseball U. Arkansas Little Rock and Pine Bluff

Arkansas Baptist College Baseball Scholarship



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

December 5, 2022

Childers Architect 142 Howell Street, Suite 170 Dallas, Texas 75207

- Attn: Mr. Matthew Thomas, Associate AIA Email: <u>mthomas@childersarchitect.com</u>
- RE: All Geotechnical Engineering Documents Combined W.W. Hastings Replacement Hospital Tahlequah, Oklahoma PPI Project Number: 277340 & 280212

Dear Mr. Thomas:

As requested by you, the purpose of this letter was to combine all Geotechnical Engineering Documents prepared by PPI for the above referenced project for bidding purposes. The documents attached to this letter include the following:

- Initial Geotechnical Engineering Report dated February 9, 2022 (PPI Proj. No. 277340);
- Addendum No. 1 to Geotechnical Engineering report dated August 18, 2022 (PPI Proj. No. 277340);
- Addendum No. 2 to Geotechnical Engineering report dated November 9, 2022 (PPI Proj. No. 277340); and
- Pier Pre-Drilling Results Summary Letter dated November 4, 2022 (PPI Proj. No. 280212).

We appreciate this opportunity to be of service and if you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC. By:

Brandon R. Parrish, P.E. Vice President

(417) 561-8395

3500 East 13th Street Joplin, MO 64801 Ph: (417) 624-2005



INITIAL GEOTECHNICAL ENGINEERING REPORT DATED: 02/09/2022

GEOTECHNICAL ENGINEERING REPORT W.W. HASTINGS REPLACEMENT HOSPITAL & PARKING GARAGE TAHLEQUAH, OKLAHOMA

Prepared for:

CHILDERS ARCHITECT 142 Howell Street, Suite 170 Dallas, Texas 75207

Prepared by:



Springfield, MO 4168 W. Kearney Springfield, MO 65803 Call 417.864.6000 Fax 417.864.6004 www.ppimo.com

PPI PROJECT NUMBER: 277340

February 9, 2022



February 9, 2022

Childers Architect 142 Howell Street, Suite 170 Dallas, Texas 75207

- Attn: Mr. Matthew Thomas, Associate AIA Email: <u>mthomas@childersarchitect.com</u>
- RE: Geotechnical Engineering Report W.W. Hastings Replacement Hospital & Parking Garage Tahlequah, Oklahoma PPI Project Number: 277340

Dear Mr. Thomas:

Attached, please find the report summarizing the results of the Geotechnical Investigation conducted for the above referenced project. We appreciate this opportunity to be of service and if you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC. By:

PALMERTON & PARRISH, INC By: OSS PARRI

Shane M. Rader, P.E. Geotechnical Engineer

Brandon R. Parrish, P.E. Vice President

Submitted: One (1) Electronic .pdf Copy

BRP/SMR/brp

02/09/22



TABLE OF CONTENTS

EXECUTIVE SUMMARY	1	, 2 & 3
1.0 INTRODUCTION		4
2.0 PROJECT DESCRIPTI	ON	5
	MATION	
5.0 SUBSURFACE INVES	ΓΙGATION	6
5.2 Laboratory Testing.		7
5.3 Corrosion Testing		10
7.0 GENERAL SITE & SUE	SURFACE CONDITIONS	11
7.1 Limestone & Shale.		11
7.2 Groundwater		13
8.0 EARTHWORK		13
8.1 Fill Material Types		15
	terial	
•	ements	
8.4 Site Drainage		16
0		
•		
, , , , , , , , , , , , , , , , , , ,		
	S	
	of Shallow Foundations	
	onsiderations for Shallow Foundations	
	ement	
•		
	ign Recommendations	
	pring – Zone 1	
	Zone 2	
	for Drilled Piers	
	struction Recommendations	
	d Test	-
	Due to Voids	
	Criteria & Pre-Boring	
	struction Observation & PDA Testing	
	s for Driven Piles	
	TIONS	
	e Reaction	
	S	
	fill & Drainage	
12.1 INGLAITING WAII DAU	ann a brainage	



13.0 PAVEMENT	
13.1 Flexible Pavement	
13.2 Rigid Pavement	
13.3 Pavement Subgrade CBR	
13.4 Pavement Thickness	
14.0 CONSTRUCTION OBSERVATION & TESTING	
15.0 REPORT LIMITATIONS	

FIGURES

FIGURE 1	_	BORING & MASW LOCATION PLAN
FIGURE 2	-	BORING LOCATION & SUBSURFACE ZONE PLAN
FIGURE 3	_	HOSPITAL BORINGS SUBSURFACE DIAGRAM
FIGURE 4	_	SHEAR WAVE VELOCITY VS. DEPTH MODEL

APPENDICES

APPENDIX I	-	BORING LOGS & KEY TO SYMBOLS
APPENDIX II	_	GENERAL NOTES
APPENDIX III	_	ROCK CORE PHOTOGRAPHS
APPENDIX IV	_	IMPORTANT INFORMATION REGARDING YOUR
		GEOTECHNICAL REPORT

EXECUTIVE SUMMARY

A Geotechnical Investigation was performed at the site planned for construction of the new Cherokee Nation W.W. Hastings Replacement Hospital and Parking Garage located directly east of the recently constructed Cherokee Nation Outpatient Health Center in Tahlequah, Oklahoma. This project is anticipated to include construction of a new Hospital, Parking Garage and Central Energy Center. The new hospital is anticipated to be up to eight (8) stories in height with many areas only one (1) to five (5) stories in height, steel framed, utilize a slab-on-grade floor system, exhibit light to heavy foundation loads, and measure approximately 100,000 sq. ft. in plan view. In addition to the hospital, a new ten (10) level parking garage with 1,526 parking spaces and a two

(2) story, free standing central energy center measuring 12,800 sq. ft. are planned at the site. The parking garage is anticipated to exhibit heavy foundations loads, with column loads in excess of 1,000 kips. Previous grading has been performed at the site. Approximately 2 to 6 ft. of additional fill is anticipated to be required within the Replacement Hospital footprint, while +/- 1 ft. of cut/fill is anticipated within the footprint of the parking garage and central energy center.

A total of twenty-six (26) geotechnical borings were drilled within the proposed development footprint. Thirteen (13) borings were located within the proposed hospital footprint, while nine (9) borings were located within the proposed parking garage. An additional four (4) borings were drilled within the proposed central energy center footprint. All borings were discontinued in <u>natural</u> overburden soils, chert, limestone or shale at depths ranging from 25.2 ft. to 50.0 ft. below the existing ground surface.

Based upon the information obtained from the borings and subsequent laboratory testing, the site is suitable for construction of the proposed new W.W. Replacement Hospital, Parking Garage and associated infrastructure. Important geotechnical considerations for the project are summarized below. However, users of the information contained in the report must review the entire report for specific details pertinent to geotechnical design considerations.

• The project site primarily consists of a gently sloping, concrete paved parking lot with grass covered islands, serving for the existing Outpatient Health Center;

EXECUTIVE SUMMARY (CONTINUED)

- Thin topsoil (~2 inches or less) was encountered in the borings drilled within the parking lot islands. Concrete pavement ranging in thickness from 4 to 6-inches underlain by aggregate baserock was encountered within the remaining borings drilled;
- Overburden soils generally consisted of chert gravels and sands, gravelly clays or fat clays as is typical in the Tahlequah area. These soils were primarily logged as stiff to very stiff or dense to very dense and sometimes exhibited significant drilling difficulty when using standard drilling methods. Bedrock consisting of shale or limestone was encountered within the southeast half to two-thirds of the proposed hospital footprint. The remaining borings within the hospital and all other areas generally consisted of more typical clayey gravels and solid chert. The bedrock consisting of shale and limestone was <u>not</u> encountered during design and construction of the adjacent Outpatient Health Center;
- Foundation loads for the new Replacement Hospital and Central Energy Center may be supported upon shallow foundations bearing upon stiff or dense natural overburden soils, or controlled fill. However, the magnitude of the foundation loads may prohibit the use of shallow foundations. These recommendations are further discussed in Section 9.0 of this report;
- Foundation loads for the Replacement Hospital, Central Plant and Parking Garage may also be supported upon deep foundations bearing in very stiff/very dense natural overburden soils/chert or bedrock, although only one (shallow or deep) foundation type is recommended per structure unless structure design allows for some differential movement. Deep foundation recommendations are further discussed in Sections 9.2 and 9.3 of this report;
- Voids were noted in Borings 1 and 2 at depths of 21.8 and 21.9 ft. below the ground surface. Drilled piers or driven piles in this area should bear through the void areas and bear on competent bedrock or chert. Additionally, deep

EXECUTIVE SUMMARY (CONTINUED)

foundations surrounding Borings 1 and 2 should be proof-tested as described in Section 9.2 for drilled piers or Section 9.3 for driven piles;

- Due to the stiff and/or dense nature of the existing subgrade soils, sufficient support is anticipated to be provided for any slabs or pavements if subgrades are prepared in accordance with Section 8.0;
- The project site classifies as a Site Class C in accordance with Section 1613 of the 2018 International Building Code (IBC), as determined by on-site shear wave velocity testing;
- All foundation recommendations presented in this report are based upon Allowable Stress Design (ASD) methodology using unfactored loads;
- Excavation and mass earth moving at this project site is anticipated to generally be difficult and variable. Excavation difficulty and rippability of the existing overburden soils at the site is further discussed in Section 8.6 of this report; and
- Palmerton & Parrish, Inc. should be retained for construction observation and construction materials testing. Close monitoring of subgrade preparation work is considered critical to achieve adequate foundation and subgrade performance.



GEOTECHNICAL ENGINEERING REPORT W.W. HASTINGS REPLACEMENT HOSPITAL & PARKING GARAGE TAHLEQUAH, OKLAHOMA

1.0 INTRODUCTION

This is the report of the Geotechnical Investigation performed at the site planned for construction of the new Cherokee Nation W.W. Hastings Replacement Hospital and Parking Garage in Tahlequah, Oklahoma. This investigation was authorized by Mr. J. Breck Childers, Managing Principal, representing Childers Architect. The approximate site location is shown below for reference.



The purpose of the Geotechnical Investigation was to provide recommendations for foundation design and construction planning, and to aid in site development. Palmerton & Parrish Inc.'s (PPI) scope of services included field and laboratory investigation of the subsurface conditions in the vicinity of the proposed project site, engineering analysis of



the collected data, development of recommendations for foundation design and construction planning, and preparation of this engineering report.

2.0 PROJECT DESCRIPTION

Item	Description
Site Layout	See Figure 1: Boring Location Plan
New Replacement Hospital	 Up to eight (8) stories in height with many areas only one (1) to five (5) stories; Steel framed; Moderate to heavy foundation loads anticipated; Slab-on-grade floor system w/ no basement; Finish Floor Elevation = 919.0; and Measure approximately 100,000 sq. ft. in plan view.
New Parking Garage	 Up to ten (10) levels in height; 1,526 parking spaces; Pre-cast concrete construction; Bottom level to approximately conform to existing elevations; and Heavy foundation loads anticipated.
Central Energy Center	 Up to two (2) stories in height; 12,800 sq. ft. in plan view; Steel framed; Consist of a Generator, Cooling Towers, Water Tower & other structures; and Light to moderate foundation loads anticipated.
Anticipated Grading	Previous grading has been performed at the site. Approximately 2 to 6 ft. of fill is anticipated to be required within the Replacement Hospital footprint, while +/- 1 ft. of cut/fill is anticipated within the footprint of the parking garage.

3.0 SITE DESCRIPTION

ltem	Description
Township/Range/Section	17N/22E/34
County	Cherokee
Latitude/Longitude (± Center of Project Site)	35.911599° / -94.945351°
Available Historic Aerial Photography	The project site consisted of grass/wooded areas since prior to 1995 to 2017. In 2017 earthwork for the Outpatient Health Center began. Once complete, the area has been a concrete paved parking lot.
Current Ground Cover	Concrete pavement with grass covered islands.
Existing Topography	Gently sloping to the south.
Drainage Characteristics	Fair.



4.0 BACKGROUND INFORMATION

PPI performed the geotechnical investigation for existing Cherokee Nation Outpatient Health Center located to the west of the proposed project site. During this investigation, only minor voids at significant depth were noted in the borings drilled, similar to the borings drilled for this project. However, during mass grading for the Outpatient Health Center project, significant voids were noted to the south and southeast of the proposed project site during construction of Hospital and Visitors Drive. This condition and the potential for voids in the subsurface at the Replacement Hospital/Parking Garage site is discussed in later sections of this report.

5.0 SUBSURFACE INVESTIGATION

Subsurface conditions were investigated through completion of subsurface borings and subsequent laboratory testing.

5.1 Subsurface Borings

A total of twenty-six (26) borings were drilled at the project site. Borings were identified as presented in the following table and are shown on Figure 1: Boring Location Plan. Boring locations were selected by the Design Team and staked in the field by PPI.

Borings	Location
1 thru 13	Replacement Hospital
20 thru 28	Parking Garage
29, 30, 32 & 33	Central Energy Center

Borings were discontinued in chert, shale or limestone or <u>natural</u> overburden soils at depths ranging from 25.2 ft. to 50 ft. below the existing ground surface. The Oklahoma One-Call System, as well as hospital maintenance personnel, were notified prior to the investigation to assist in locating buried public and private utilities, respectively. Logs of the borings showing descriptions of soil and rock units encountered, as well as results of field and laboratory tests and a "Key to Symbols" are presented in Appendix I. Surface elevations for each boring are noted on each boring log. Surface elevations were determined in the field using RTK GPS units



and referencing on-site benchmark LLS-3104. Surface elevations are anticipated to be within an accuracy of 0.5 ft. or less.

Borings were drilled between December 1 and 22, 2021 using 4.25-inch I.D. hollow stem augers or a 3.625-inch tricone with wash rotary methods. All borings were drilled by an ATV-mounted CME-1050 or track-mounted CME-55 drill-rig. Soil samples were collected at 2.5 to 10-ft. centers during drilling, depending upon the material encountered. Soil samples were collected using either a split spoon sampler while performing the Standard Penetration Test (SPT) in general accordance with ASTM D1586, or thin-walled Shelby tubes pushed hydraulically in advance of drilling in accordance with ASTM D 1587.

When bedrock was encountered within borings 1 thru 6, 8, 9 and 13, rock coring was performed using a wireline core barrel and a diamond impregnated core bit. The rock core obtained was placed in core boxes in the order of recovery. Borings 2 and 9 encountered conditions of bedrock over chert and clayey gravels. Where this was encountered, rock coring procedures were terminated and advancement with rotary drilling techniques with sampling were implemented.

The percentage of core retrieved from each coring interval or "run" is recorded on the log forms. In addition, the rock quality designation (RQD) of the rock core was determined. "RQD" is determined by dividing the sum of the length of all individual pieces of rock core 4 in. or longer by the length cored in a single run. Bedrock with RQD values of 90 percent or more is termed excellent, 75 to 90 percent good, 50 to 75 percent fair, 25 to 50 percent poor, and 0 to 25 percent very poor. Please refer to Appendix II for general notes regarding boring logs and additional soil sampling information. Rock core photographs are attached as Appendix IV.

5.2 Laboratory Testing

Collected samples from the borings were sealed and transported to the laboratory for further evaluation and visual examination. Laboratory soil testing included the following:

• Moisture Content (ASTM D2216);



- Percent Passing No. 200 sieve (ASTM D6913);
- Atterberg Limits (ASTM D4318);
- Unconfined Compressive Strength (ASTM D2166);
- Swell Test (ASTM D4546); and
- Pocket Penetrometers.

Laboratory soil test results are shown on each boring log in Appendix I and are summarized in the following tables.

Soil Labo	Soil Laboratory Testing Results								
Boring	Depth (ft.)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (Pl)	Moisture Content (%)	USCS Symbol	% Passing No. 200 Sieve	Dry Density (pcf)	Cohesion (psf)
1	6-8	-	-	-	20.9	СН	-	105.6	10,179
2	3.5-5	47	15	32	12.4	CL-CH	-	-	-
3	3.5-5	33	15	18	18.3	CL	-	-	-
4	6-7.5	40	14	26	20.7	CL	-	-	-
4	8-10	-	-	-	26.4	СН	-	95.9	2,142
7	3.5-5	-	-	-	8.8	GC	14	-	-
8	3-5	33	15	18	12.0	CL	-	122.1	10,134
8	8.5-10	-	-	-	35.4	CL-CH	-	87.3	1,461
9	6	33	12	21	16.1	CL	65	-	-
9	8	61	18	43	21.8	СН	-	101.5	2,778
9	18	-	-	-	22.6	СН	-	103.5	1,848
10	3.5	34	15	19	21.5	CL	-	-	-
11	3.5	49	15	34	26.9	CL-CH	-	-	-
11	13	-	-	-	17.1	CL-CH	-	110.5	3,230
12	8.5	-	-	-	16.8	СН	-	108.9	2,669
13	6	41	14	27	16.6	CL	-	-	-
20	3.5	-	-	-	12.0	GC	41	-	-
21	8	-	-	-	20.2	СН	-	108.9	5,135
23	6	56	18	38	23.3	СН	-	-	-
24	3	-	-	-	17.5	GC	29	-	-
29	18	-	-	-	25.3	SC	35	-	-
33	3	-	-	-	27.3	CL	53	-	-

Swell testing was performed on select samples at the project site. The table below summarizes the results of the swell testing performed. Based upon the swell testing



results below, the existing shallow soils are generally anticipated to exhibit a low swell potential.

Swell Test Results								
Boring Depth (ft.) Moisture Content (%) Dry Unit Weight (pcf) Swell (%) Swell Pressu (TSF)								
8	3 to 4.6	14.1	120.7	1.46	2.00			
9	8 to 10	25.7	99.6	0.77	1.00			

Laboratory tests performed upon the rock core retrieved included the following:

• Unconfined Compressive Strength of Intact Rock Core (ASTM D7012).

Laboratory rock core test results are summarized in the table below.

Rock Core Testing Results							
Boring	Depth (ft.)	Rock Unconfined Compressive Strength (psi)	Relative Rock Hardness	Rock Type			
	19.5	6,580	Medium Hard	Argillaceous Limestone			
1	23.8	8,830	Moderately Hard	Argillaceous Limestone			
	32.3	6,800	Medium Hard	Cherty Limestone			
2	21.8	9,173	Moderately Hard	Argillaceous Limestone			
3	31.7	15,542	Hard	Limestone			
4	26.8	8,909	Moderately Hard	Cherty Limestone			
5	11.0	7,887	Moderately Hard	Argillaceous Limestone			
6	13.4	7,051	Medium Hard	Argillaceous Limestone			
0	19.2	9,565	Moderately Hard	Argillaceous Limestone			
8	16.3	12,893	Moderately Hard	Argillaceous Limestone			
0	21.5	3,662	Medium Hard	Shale			
13	23.5	4,449	Medium Hard	Argillaceous Limestone			
10	27.8	4,164	Medium Hard	Cherty Limestone			



5.3 Corrosion Testing

Corrosion testing was performed on the samples in the upper 7.5 feet of the subsurface exploration. Samples were sent to Midwest Laboratories to be performed. Below is a list of samples with their results for corrosion testing:

Corrosion Testing Results								
Boring	Depth (ft.)	Oxidation Reduction Potential (mV)	Resistivity (ohm/cm)	Sulfides	Chloride (mg/L)	Sulfate (mg/L)	Conductivity (µS/cm)	pH S.U.
2	3.5 to 7.5	342	7,090	Absent	9.6	N.D.*	141	5.69
11	3.5 to 5	316	4,500	Absent	7.6	10.6	222	6.66
*Not Detected (N.D.)								

Based on the results of the corrosion laboratory testing, the average corrosive potentials and degradation potentials of the soils are summarized in the tables below.

Corrosion Potential of Steel								
Boring	Depth (ft.)	Resistivity (ohm/cm)	Chloride (ppm)	pH S.U.	Corrosion Potential			
2	3.5 to 7.5	7,090	9.6	5.69	Mild to Moderate			
11	3.5 to 5	4,500	7.6	6.66	Mild to High			

Degradation Potential of Concrete				
Boring	Depth (ft.)	Sulfate (ppm)	Exposure	Special Cement Type
2	3.5 to 7.5	N.D.	Mild	None
11	3.5 to 5	10.6	Mild	None

6.0 SITE GEOLOGY

According to the United States Geologic Survey's Geological Map of Oklahoma, the general site is underlain at depth by the Keokuk and Reeds Spring formation and the St. Joe Group. Within the site area, the primary rock type is chert with other rock types consisting of limestone, shale, and marlstone. Overburden soils at the site are typically residual having developed through chemical and physical weathering of the underlying parent bedrock, consisting primarily of chert fragments, boulders and clay layers. The



boundary between overburden soils and relatively unweathered limestone is usually abrupt.

7.0 GENERAL SITE & SUBSURFACE CONDITIONS

Based upon subsurface conditions encountered within the borings drilled at the project site, generalized subsurface conditions for the approximate northern ½ of the site are fairly consistent across the project site, and similar to typical overburden soils found within the Tahlequah area. Surficial materials primarily consist of thin topsoil or pavement consisting of concrete over aggregate baserock, overlying very stiff to very dense lean or fat clays. Oftentimes the percentage of clay is less than 50 percent, and the soils classify as chert gravels or sands. Zones of relatively chert free very stiff fat clays were encountered, but are believed to be isolated.

However, subsurface conditions within the approximate southern half of the project, i.e. Borings 1 thru 4, 8, 9 and 13, consist of the same soil types above except that the soils contain a reduced gravel percentage and that limestone or shale is encountered at depth, sometimes relatively shallow. **In general, subsurface conditions vary widely across the site.**

These conditions are presented on each boring log attached in Appendix I. Soil stratification lines on the boring logs indicate approximate boundary lines between different types of soil and rock units based upon observations made during drilling. Insitu transitions between soil and some rock types are typically gradual.

7.1 Limestone & Shale

Argillaceous limestone, chert and/or shale was encountered within several of the borings located within the approximate southern half of the project site. The table below summarizes depth to argillaceous limestone/shale/chert, surface elevation, core recovery and rock quality designation (RQD), if rock coring was performed.



Boring	Surface El.	Approx. Depth to Top of Rock / Rock Type (ft.)	Rock Core Retrieved (ft.)	<u>Recovery (%)</u> RQD (%)	Clay Seams or Voids (ft.)
1	917.0	18.2 / Shale 31.8 / Limestone	15	<u>80-100-100</u> 75-58-67	21.9 to 22.9 (Void)
2	914.2	21.7 / Shale 24.0 / Shale 24.5 / Chert 33.0 / Shale 35.0 / Chert	2.3	<u>50</u> 50	21.8 to 24.0 (Clay Seam)
3	912.6	23.0 / Shale 28.0 / Limestone	9.8	<u>100-100-100</u> 100-72-40	-
4	917.2	23.5 / Limestone	10.0	<u>100-97-100</u> 32-78-44	-
5	914.9	6.0 / Shale	15.4	<u>100-100-100-100</u> 34-60-95-56	-
6	915.5	9.0 / Limestone 10.1 / Shale 12.5 / Limestone	16.8	<u>77-100-97-100</u> 44-93-95-92	-
7	917.4	23.5 / Chert	None	N/A	-
8	915.8	13.0 / Limestone 20.3 / Shale 27.0 / Chert	14.9	<u>100-100-100-100</u> 97-98-58-71	-
9	917.3	22.8 / Chert 25.4 / Limestone 29.7 / Chert	11.3	<u>100-52-65</u> 0-30-18	Below 34.1 (Clayey Gravel or Gravelly Clay)
10	917.5	19.0 / Chert	None	N/A	-
11	916.1	15.0 / Chert	None	N/A	-
12	918.0	18.0 / Chert	None	N/A	32.0 to 36.0 (Clam Seam)
13	919.5	23.5 / Shale 25.3 / Limestone	7.5	<u>100-100-83</u> 100-45-71	-
20	916.8	9.0 / Chert	None	N/A	Below 23.0 (Clayey Gravel)
21	916.5	None	None	N/A	-
22	919.4	30.0 / Chert	None	N/A	-
23	916.5	30.0 / Chert	None	N/A	-
24	917.4	None	None	N/A	-
25	920.4	30.0 / Chert	None	N/A	-
26	918.7	10.0 / Chert	None	N/A	-
27	920.1	15.0 / Chert	None	N/A	Below 23.0 (Clayey Gravel)



Boring	Surface El.	Approx. Depth to Top of Rock / Rock Type (ft.)	Rock Core Retrieved (ft.)	Recovery (%) RQD (%)	Clay Seams or Voids (ft.)
28	921.9	18.0 / Chert	None	N/A	Below 32.5 (Clayey Gravel)
29	916.8	None	None	N/A	-
30	916.0	11.5 / Chert	None	N/A	Below 18.5 (Clayey Gravel)
32	917.5	20.5 / Chert	None	N/A	-
33	917.1	16.0 / Chert	None	N/A	Below 24.0 (Clayey Gravel)

7.2 Groundwater

Shallow groundwater was not observed within the borings on the date drilled. It should be noted that water-based drilling fluid was used during field drilling. As a result, obtaining groundwater levels was not possible. Based upon previous borings drilled within the general site area, groundwater is not anticipated to be encountered. It should be noted that during wet periods, perched groundwater may be encountered at the limestone/shale/chert and overburden soil contact. Groundwater levels should be expected to fluctuate with changes in site grading, precipitation, and regional groundwater levels. Groundwater may be encountered at shallower depths during wetter periods.

8.0 EARTHWORK

As previously mentioned, a final grading plan has not been prepared for this site, however, based upon discussions with the Project Civil Engineer, approximately 2 to 6 ft. of fill is anticipated to be required within the Replacement Hospital footprint, while +/- 1 ft. of cut/fill is anticipated within the footprint of the parking garage. The finish floor elevation of the Replacement Hospital is anticipated to match that of the existing Outpatient Health Clinic at El. 919 ft. In addition, the lowest level of the parking garage is anticipated to be within +/- 1 ft. of existing grades.

The initial phase of site preparation should include the following:



- The initial phase of site preparation should include removal of all concrete paving and baserock, if present. In addition, clearing and grubbing of all vegetative matter and topsoil, if present, should be performed within non-paved areas. All vegetative matter, including trees/root bulbs and topsoil should be removed from areas scheduled to receive new fill and/or slab/pavement construction;
- Topsoil/vegetative matter stripping on the order of 4-inches or less should be anticipated in non-paved areas. Topsoil should either be hauled off-site or stockpiled for reuse in lawn and landscape areas <u>only;</u>
- Concrete and baserock removed during site stripping may be reused as controlled fill, if concrete material is reduced in size to conform with Section 8.1 below; and
- Areas scheduled to receive <u>controlled</u> fill should be proof-rolled and <u>approved</u> in accordance with the following section of this report.

After the initial phase is complete, it is recommended that all building, pavement and undercut bottoms be proof-rolled to assure a stable subgrade. Proof-rolling consists essentially of rolling the ground surface with a loaded tandem axle dump truck or similar heavy rubber-tired construction equipment and noting any areas which rut or deflect during rolling. All soft subgrade areas, if any, identified during proof-rolling should be undercut and replaced with compacted fill as outlined below. Proof-rolling, undercutting and replacement should be monitored by a representative of PPI. **The depth and areal extent of undercutting soft subgrade areas will be largely dependent upon the time of year and related soil moisture conditions. If construction is initiated during or immediately following wetter months, the requirement for undercutting soft surficial soils below planned cut depths should be anticipated and reflected in the contract documents, but anticipated to be minimal.**

After evaluation by proof-rolling and approval, the subgrade should be scarified to a depth of at least 8 inches, adjusted to within the optimum moisture content ranges



and compacted to specified density, provided below (See Section 8.3). Placement of controlled fill may then proceed.

8.1 Fill Material Types

Fill Type ¹	USCS Classification	Acceptable Location for Placement	
On-Site Soils / Imported Fill	GC, SC, SW or GW	Required beneath building footprint (below foundation elements), extending outside perimeter walls a horizontal distance equal to the height of fill embankment. Also acceptable for all other areas/elevations not requiring LVC material.	
Low Volume Change (LVC) Engineered Fill ²	CL, GC, or SC (LL < 50)	Required beneath slabs for a depth of 2 ft., CL materials should be placed above foundation elements only . May be used below foundations if classifying as a GC or SC <u>only</u> . Acceptable for all other areas/elevations outside the building footprint as well.	
On-Site Natural Soils	СН	Should not be placed within the upper 2 ft. beneath foundations, floor slabs and pavements.	
1. Controlled, compacted fill should consist of approved materials that are free of organic matter			

Controlled, compacted fill should consist of approved materials that are free of organic matter and debris and contain maximum rock size of 12 inches, or the lift thickness, whichever is less. Frozen material should not be used and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to its use.

^{2.} Low plasticity cohesive soil or granular soil having a liquid limit of less than 50%, contain at least 15% fines retained on the No. 200 sieve, and preapproved by the Geotechnical Engineer.

8.2 Acceptable LVC Material

LVC material is recommended below floor slabs, above footing bottom elevation. Potential sources of LVC material are as follows:

- Import from an off-site borrow area complying with Table 8.1; and
- On-site soils, classifying as CL, SC or GC may be segregated during footing or floor slab undercutting procedures or general earthwork procedures.

Most soil types present at the project site classify as LVC fill material. Topsoil

strippings or material containing organics should <u>not</u> be used as LVC material.



8.3 Compaction Requirements

Item	Description	
Subgrade Scarification Depth	At least 8 inches	
Fill Lift Thickness	12-inches (loose) using the minimum compactor referenced below.	
Compaction Requirements ¹	 Building Area – <u>Below Foundation Bearing Elevation</u> – Six (6) passes (3 each direction) minimum using a self-propelled vibratory compactor with a minimum drum diameter of 48- inches, or 100% Standard Proctor Density (ASTM D698), whichever is applicable; Building Area – <u>Above Foundation Bearing Elevation & Below Floor Slabs</u> – Three (3) passes of the compactor referenced above, or 95% Standard Proctor Density (ASTM D698), whichever is applicable; Pavements, Sidewalks & Exterior Slabs – Same as Building Area above foundations; and 	
	 Non-Structural Areas – 90% Standard Proctor Density (ASTM D698). 	
Moisture Content	± 2% optimum moisture for CL, SC, GC, GW & SW Soil Types; and 0 to 4% <u>above</u> optimum for CH Soil Types.	
Field Density Testing Frequency	 Building Areas – One (1) test every 2500 sq. ft. per fill lift; Pavement Areas – One (1) test every 5000 sq. ft. per fill lift; and No less than three (3) tests per each fill lift. 	
We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be		

specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

8.4 Site Drainage

Discharge from roof downspouts should be collected and diverted well away from the building perimeter. Rapid, efficient runoff away from the building should also be provided. In addition, landscaping requiring frequent watering should be prohibited adjacent to building foundations.

8.5 Excavations

Based upon the subsurface conditions encountered during this investigation, the on-site soils typically classify as Type B in accordance with OSHA regulations. Temporary excavations in soils classifying as Type B with a total height of less than 20 ft. should be cut no steeper than 1H:1V in accordance with OSHA guidelines. **Confirmation of soil classification during construction, as well**



as construction safety (including shoring, if required), is the responsibility of the contractor.

8.6 Rippability

As mentioned throughout this report, the overburden soils at the project site primarily consist of very dense clayey gravels with chert cobbles and boulders with isolated areas consisting of clays with a reduced chert content. Significant difficulty was experienced when drilling the geotechnical borings within this chert laden material. Based upon this information, the overburden soils are anticipated to be rippable with dozers, but with difficulty. In addition, areas resistant to ripping consisting of large chert boulders, requiring other removal methods (pneumatic breakers or blasting, if allowed) should be anticipated. The Earthwork Contractor should review the attached boring logs when assessing excavation difficulty at this site. Mass grading at this site is anticipated to occur at a slower rate as compared to sites where overburden soils are primarily fine grained (silts and clays).

8.7 Expansive Soils

Due to the overburden soils primarily consisting of clayey gravels and gravelly clays, significant shrink/swell behavior is not anticipated. Additionally, swell testing performed on the fat clays at the subject site exhibited low swell potential. <u>If</u> relatively chert free fat clay zones are encountered at footing bottom and finish subgrade elevation, they should be undercut 2 ft., or to gravelly clays/clayey gravels, whichever is shallower, and replaced with LVC fill material. Although <u>isolated</u> zones of fat clays were encountered during drilling, they are not the primary material anticipated within footing, floor slab and pavement subgrades. In any event, soil subgrades should not be allowed to become frozen, dry and desiccate prior to concrete placement.

8.8 Utility Trenches

Existing utility trenches are present within the proposed building footprint. If not completely removed during site grading, existing utility trenches should be relocated, and new trenches should be sited outside of the proposed structure footprints. If



existing utility pipes cannot be removed, it is recommended that they be plugged with grout to reduce the potential for moisture migration into the soil subgrade, as well as future collapse.

New utility trenches servicing the new structures are anticipated to be required. These trenches are often times sources of moisture migration into the structure. A relatively impervious material (clay with little rock, etc.) should be placed within the utility trench, surrounding the utility immediately outside the structure to reduce the potential for moisture migration into the structure via utility trenches. The "trench plug" should extend out from the structure a minimum of 5 ft. horizontally, and be placed in a controlled manner in accordance with Section 8.3 above.

9.0 FOUNDATIONS

Due to the variability of the subsurface conditions across the subject site and variability in structure height and loading, PPI has provided the following summary table providing foundation options for each structure anticipated.

Anticipated Loading	Anticipated Structures	Suitable Foundations	Allowable Shallow Foundation Bearing Capacity (if selected)
Lightly to Moderately Loaded Structure	Central Energy Structure	 Shallow Foundations bearing on soils; Drilled Piers bearing in soils/chert; or Driven Piles bearing in soil/chert. 	5,000 psf
Light to Heavily Loaded Structure	Hospital Building	 Shallow Foundations bearing on soils/chert or rock fill; Drilled Piers bearing in soils/chert or bedrock; or Driven Piles bearing in soil/chert or bedrock. 	3,500 psf on Natural Soils & 5,000 psf on 5-ft. Geogrid Reinforced Rock Fill (min.)
Heavily Loaded Structure	Parking Garage	 Shallow Foundations bearing on soils/chert or rock fill; Drilled Piers Bearing in soils/chert. 	4,000 psf on Natural Soils & 5,000 psf on 5- ft. Geogrid Reinforced Rock Fill (min.)

Recommendations for both shallow foundations and deep foundations are provided in the following sections. Due to primarily dense/stiff consistency of the existing overburden soils, both foundation systems may be utilized for light and heavy



foundation loads. In order to increase the allowable bearing pressure for the hospital and/or parking garage foundations, existing soils may be undercut sufficient to provide a minimum 5 ft. depth below foundation bottom elevation and replaced with a compacted rock fill. Rock fill, if selected, should consist of 6-inch minus crushed limestone, or engineer approved equal, placed in lifts no greater than 1 ft. and compacted by a minimum of five (5) passes of a large, self-propelled vibratory compactor. A layer of Tensar TX-7 should be placed between the rock fill and overburden soils below the footprint of the proposed footing location, with the rock fill and geogrid extending a minimum of 5 ft. horizontally beyond footing perimeters.

Only one foundation type per structure is recommended to reduce the potential for differential settlement or structures designed to accommodate some differential settlement between foundation types.

9.1 Shallow Foundations

Foundation loads at this project site may be supported upon stiff or dense natural overburden soils or controlled fill placed in accordance with Section 8.0 of this report. Recommendations for shallow foundation design and construction are provided in the following tables. A separate table has been provided for each of the 3 structures anticipated at the site.

Shallow Foundations – <u>Central Energy Center</u>		
Description	Mat or Spread Footing	Continuous Footing
Net Allowable Bearing Pressure – Central Energy Structures <u>ONLY¹</u>	5,000 psf	5,000 psf
Minimum Dimensions	2.5 ft.	1.5 ft.
Recommended Bearing Depth (Natural Soils or Controlled Fill) ²	Depth sufficient to a protection	chieve minimum frost
Minimum Embedment Below Finished Grade for Frost Protection & Variation in Soil Moisture ³	. 2.0 ft.	
Allowable Passive Pressure ⁴	230 pcf (equivalent fluid pressure)	
Coefficient of Sliding Friction ⁵	0.50 (natural soils or controlled fill)	
Modulus of Subgrade Reaction ⁶	175 pci	

^{1.} The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers that all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed.

- ^{2.} PPI should be retaining to observe footing bottoms prior to placing concrete.
- ^{3.} For perimeter footings and footings beneath unheated areas.
- ^{4.} Allowable passive pressure value considers a Factor of Safety of about 2. Passive pressure value applies to undisturbed native clay or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density. Passive resistance should be neglected for the upper 2.5 ft. of the soil below the final adjacent grade due to strength loss from freeze/thaw and shrink/swell.
- ^{5.} Coefficient of friction value is an allowable value assuming a Factor of Safety equal to approximately 2. This value is applicable for on-site clayey gravels and gravelly clays.
- ^{6.} Foundation may be designed as a large mat footing due to the unknown exact location of the foundation loads in this area.



Shallow Foundations – <u>Replacement Hospital</u>		
Description	Column (Spread Footing) Continuous Foo	
Net Allowable Bearing Pressure – Replacement Hospital <u>ONLY¹</u> (<i>Bearing in Existing Soils/Soil</i> <i>Fill</i>)	3,500 psf	3,000 psf
Net Allowable Bearing Pressure – Replacement Hospital ¹ (Bearing on 5 ft. Min. Geogrid Reinforced Rock Fill)	5,000 psf	5,000 psf
Minimum Dimensions	2.5 ft.	1.5 ft.
Recommended Bearing Depth (Natural Soils or Controlled Fill) ²	Depth sufficient to a protection	chieve minimum frost
Minimum Embedment Below Finished Grade for Frost Protection & Variation in Soil Moisture ³	r 2.0 ft.	
Allowable Passive Pressure ⁴	230 pcf (equivalent fluid pressure)	
Coefficient of Sliding Friction ⁵	0.50 (natural soils or controlled fill)	

^{1.} The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers that all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed.

- ^{2.} PPI should be retaining to observe footing bottoms prior to placing concrete.
- ^{3.} For perimeter footings and footings beneath unheated areas.
- ^{4.} Allowable passive pressure value considers a Factor of Safety of about 2. Passive pressure value applies to undisturbed native clay or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density. Passive resistance should be neglected for the upper 2.5 ft. of the soil below the final adjacent grade due to strength loss from freeze/thaw and shrink/swell.
- ^{5.} Coefficient of friction value is an allowable value assuming a Factor of Safety equal to approximately 2. This value is applicable for on-site clayey gravels and gravelly clays.



Shallow Foundations – Parking Garage		
Description	Column (Spread Footing)	Continuous Footing
Net Allowable Bearing Pressure – Parking Garage ¹ (Bearing in Existing Soils/Soil Fill)	4,000 psf	4,000 psf
Net Allowable Bearing Pressure – Parking Garage ¹ (Bearing on 5 ft. Min. Geogrid Reinforced Rock Fill)	5,000 psf	5,000 psf
Minimum Dimensions	2.5 ft.	1.5 ft.
Recommended Bearing Depth (Natural Soils or Controlled Fill) ²	Depth sufficient to a protection	chieve minimum frost
Minimum Embedment Below Finished Grade for Frost Protection & Variation in Soil Moisture ³	2.0 ft.	
Allowable Passive Pressure ⁴	230 pcf (equivalent fluid pressure)	
Coefficient of Sliding Friction ⁵	0.50 (natural soils or controlled fill)	

^{1.} The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers that all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed.

- ^{2.} PPI should be retaining to observe footing bottoms prior to placing concrete.
- ^{3.} For perimeter footings and footings beneath unheated areas.

^{4.} Allowable passive pressure value considers a Factor of Safety of about 2. Passive pressure value applies to undisturbed native clay or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density. Passive resistance should be neglected for the upper 2.5 ft. of the soil below the final adjacent grade due to strength loss from freeze/thaw and shrink/swell.

^{5.} Coefficient of friction value is an allowable value assuming a Factor of Safety equal to approximately 2. This value is applicable for on-site clayey gravels and gravelly clays.

9.1.1 Uplift Capacity of Shallow Foundations

Resistance of shallow spread footings to uplift (Up) may be based upon the dead weight of the concrete footing structure (W_c) and the weight of soil backfill contained in an inverted cone or pyramid directly above the footings (W_s). The following parameters may be used in design:

Description	Weights
Weight of Concrete (W _c)	150 pcf
Weight of Soil Resistance (Ws)	100 pcf

The base of the cone or pyramid should be the top of the footing and the pyramid or cone sides should form an angle of 30 degrees with the vertical. Allowable



uplift capacity (U_p) should be computed as the lesser of the two (2) equations listed below:

$$U_P = (W_S/2.0) + (W_C/1.25) \text{ or } U_P = (W_S + W_C)/1.5$$

9.1.2 Construction Considerations for Shallow Foundations

It is essential that footing bottoms should not be allowed to become dry and desiccate prior to concrete placement to help reduce the potential for shrink/swell behavior. Footings should be clean and free of standing water, debris, and loose soil at the time of concrete placement. Footing/mat excavations should be observed by a representative of PPI prior to placement of reinforcing steel and concrete placement.

9.1.3 Ground Improvement

Due to the dense to very dense overburden soils at the project site, ground improvement using aggregate piers is not believed to be an economical foundation system, nor provide appreciable additional foundation capacity. Due to the significant drilling difficulties associated with very dense and large size chert, installation of aggregate piers is anticipated to be costly, as well as time consuming and provide little increase in allowable bearing capacity.

9.2 Deep Foundations

Deep foundations are also considered a viable foundation alternate. Several methods of deep foundation support were evaluated for this site. However, due to the varying site conditions across the 3 structure types, only two (2) deep foundation alternates have been recommended. The two (2) deep foundation system alternates include:

Drilled piers bearing in dense <u>natural</u> overburden soils/chert or limestone/shale bedrock; orpredrilled driven piling bearing in dense <u>natural</u> overburden soils/chert or limestone/shale bedrock.



9.2.1 Drilled Piers

As previously mentioned, subsurface explorations at the subject site encountered variable bearing materials. Soils noted in the north half (**Zone 1**) of the site generally consisted of shallow clays over chert gravels and boulders with variable amounts of clay and no indications of bedrock, i.e. limestone or shale. However, borings on the south half (**Zone 2**) of the subject site consisted of clay overburden with reduced amounts of gravel terminating on bedrock material. Rock coring was performed where encountered bedrock was suitable for coring procedures. Bedrock was noted in Borings 1, 2, 3, 4, 5, 6, 8, 9, and 13. Top of bedrock within these borings ranged from 6 ft. to 24 ft. below the ground surface and consisted of shale and argillaceous limestone and cherty areas noted. **Refer to Figure 2 where Zones 1 and 2 have been generally delineated.**

Due to the highly variable subsurface conditions at the subject site, as explained above, deep foundation recommendations have been provided for the 2 distinct subsurface conditions, which sometimes change within a building footprint. The Owner and Design Team should recognize that the recommendations provided in this section are subdivided into two (2) zones and these zones were selected based upon the widespread geotechnical borings drilled. As discussed throughout this report, highly variable subsurface conditions were found during field drilling. It is considered possible that during deep foundation installation, differing subsurface conditions may be encountered requiring redesign of certain drilled pier locations. It is difficult to determine areas that have higher potential than others, but the Owner and Design Team should recognize the possibility.

Based on PPI's past experience on projects near the subject site, the subsurface may contain isolated areas of small voids within the subsurface soils and bedrock. This condition was encountered in Borings 1 and 2 at depths of 21.8 to 21.9 ft. below the ground surface. If the bedrock embedment depths recommended below are achieved, drilled piers within this area should bear below the voids encountered in Borings 1 and 2. If additional voids are encountered during the drilled pier installation, drilled piers should extend



through the voids and bear a minimum of 1 foot into competent bedrock below the void.

9.2.2 Drilled Pier Design Recommendations

Description	Value		
Foundation Type	Straight shaft dr	illed piers.	
	Zone 1	Dense to very dense natural clayey chert or very stiff cherty clay overburden soils.	
Bearing Material ¹	Zone 2	Competent limestone, shale or chert, which is anticipated in Borings 1-6, 8, 9 and 13.	
	Zone 1	Min. 25 ft. below <u>existing</u> ground surface or deeper (do not stop in soft soils)	
Minimum Pier Penetration	Zone 2	Min. 5 ft. rock socket into competent bedrock consisting of limestone, shale or solid chert.	
Maximum Net Allowable Bearing Pressure ²	Zone 1	20 ksf w/out proof testing. Much higher bearing pressures are possible at certain locations IF proof testing is performed.	
	Zone 2	100 ksf w/ Proof Testing (50 ksf w/out)	
Investigative Boring - Proof-Testing	Zone 1	See Section 9.2.3 for additional information if Net Allowable Bearing Pressure is desired to be increased.	
	Zone 2	See Section 9.2.4 for additional information for proof-testing.	
Maximum Allowable Skin Friction – Axial	Zone 1	0.75 ksf (clayey gravel/gravelly clay) – Full Pier Depth	
Compression ³	Zone 2	Ignore Overburden Soils1.5 ksf (shale, limestone or solid chert)	
	Zone 1	- 0.75 ksf (clayey gravel/gravelly clay) - Full Pier Depth	
Maximum Allowable Skin Friction – Uplift ⁴	Zone 2	 0.5 ksf (overburden soils) 1.5 ksf (shale, limestone or solid chert)	
Group Effects – Axial Capacity	least 2.5 pier dia the total capaci individual per ca	installed with a center-to-center spacing of at ameters. Group effects can be neglected and ty of the pier group taken as the sum of the apacities, provided that the adjacent piers are 2.5 pier diameters (center-to- center).	



Description	Value		
Group Effects – Lateral Capacity	When piers are installed close together, the lateral capacity of of the group is not equivalent to the lateral capacity of isolated individual pier times the number of piers in the gro Only those piers that are unobstructed by the other pier the direction of the force develop full capacity. For pier gro with a pier spacing of 2.5 pier diameters center- to-center multiplier of 0.8 should be used for the lead row of piers, for the 2 nd row and 0.3 for the 3 rd and subsequent rows. efficiency of the pier group is dependent upon the pier lay in the group, but would typically be on the order of 75 per of a single pier for a pier spacing of 2.5 pier diameters. pier group effect increases significantly for closer space resulting in lower efficiency.		
Minimum Shaft Diameter⁵	30-inches		
Minimum Grade Beam Bearing Depth	24-inches below final exterior adjacent grade		
Estimated Total Settlement	Zone 1	0.5-inches or less	
	Zone 2	Negligible	
Estimated Differential Settlement	Zone 1	0.25-inch or less	
Estimated Differential Settlement	Zone 2	Negligible	

Due to variations in the depth and quality of the dense to very dense overburden soils across the site, the Geotechnical Engineer or his representative should be present during pier drilling to verify that unsuitable bearing strata is <u>not</u> present within the pier bottom.

^{2.} This is the pressure at the base of the foundation in excess of the adjacent overburden pressure. The allowable bearing pressure has a Factor of Safety of approximately 3.

^{3.} The allowable skin friction has a Factor of Safety of approximately 2.

^{4.} The allowable skin friction values have a Factor of Safety of approximately 2.

^{5.} Sufficient steel reinforcement should be placed to provide adequate structural integrity.

9.2.3 Investigative Boring – Zone 1

Due to the varying subsurface conditions and the planned heavy foundation loads for these structures, to possibly increase pier allowable end bearing pressures and possibly eliminate or reduce the need for deep foundation groups and large pile caps, the Owner and Design Team may desire to perform pier pre- drilling. By predrilling a specific column/pier location, this will allow PPI to determine precise insitu conditions at each location and allow specific testing to be performed at that location typically resulting in a decrease in drilled pier construction cost. Pre-drilling is often completed by augering to bedrock and coring several feet of the underlying bedrock to determine if clay seams and/or voids are present. However, due to the varying geology and soil conditions present at this site, the overburden soils will be required to be sampled for



strength characteristics, as well as rock coring if bedrock is encountered. If investigative coreholes are desired, PPI would be happy to coordinate with the project Structural Engineer to determine specific column loads and target borehole depths.

9.2.4 Proof-testing – Zone 2

The allowable end bearing pressure provided in the table in Section 9.2.2 is considered a higher end bearing pressure for limestone/shale/chert bedrock and will require additional field inspection during or before drilled pier installation to determine if voids or soft clay seams are located immediately below the pier bottom. In order for designers to use the allowable end bearing provided, each drilled pier bottom should be evaluated by a 2-inch diameter probe hole being drilling in the bottom of the pier to a depth of 1.5 times the pier diameter or 5 ft, whichever is deeper and scratch tested by a representative of PPI. In the event clay seams or voids are detected in the probe hole, the pier bottom should be deepened below the discontinuity and reevaluated by another probe hole. Recommended clay seam/void criteria is as follows:

- No clay seams or voids in the upper 3 ft.;
- No individual seam or void greater than ¼ inch in the next 3 ft.; and
- Total accumulation of clay seam or voids should not exceed ½ inch.

A second alternative to evaluating each drilled shaft is pre-drilling using NQ tooling. Prior to construction and once plan pier bottom elevation is determined, a geotechnical rig drills a 2-inch diameter test hole 10 ft below planned pier bottom elevation. The rock core is logged by an Engineer or Geologist to confirm design parameters, as well as set revised pier bottom elevation based upon discontinuities, if any, encountered in the test hole. PPI has performed pre-drilling on several hospital projects where higher end bearing pressures are desired, as well as construction schedules are accelerated. PPI can perform these services for this project, if desired.



9.2.5 Lateral Loading for Drilled Piers

It is anticipated that resistance of the foundations to lateral loading and the associated lateral deflection will be evaluated using finite difference computer models based on the horizontal modulus of subgrade reaction (K_h). The following values may be used in the analysis for this site.

Please note that the table states to ignore lateral support for the depth of 0 to 1 pier diameter or 2.5 ft., whichever is shallower. This notation is intended to account for the fact that near surface soils are significantly disturbed during drilled shaft excavation, which generally reduces the lateral support provided. Designers should use their judgment and make an appropriate reduction of soil strength parameters in this zone.

Values summarized in the table below are based upon published correlations and field and laboratory data collected during this subsurface investigation. Values shown below are ultimate values representative of in-situ soil properties, and do not include a Factor of Safety. These values may be used to compute resistance to lateral loading of the overburden soils. The appropriate Factor of Safety should be chosen by the designer.

Deep Foundations – Lateral Loading – <u>Zone 1</u>						
Stratum (Soil Type)	Applicable Depth (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Gravelly Clay / Clayey Gravel (Stiff Clay w/out Free Water)	*Ground Surface to 1 Pier Diameter	Ignore	Ignore	-	-	-
Gravelly Clay / Clayey Gravel (Stiff Clay w/out Free Water)	*1 Pier Diameter to Bottom of Pier	125	2,000	1000	400	0.005
*Lateral parameters for the upper 1 pier diameter, or 2.5 ft., whichever is shallower, should be ignored.						



Deep Foundations – Lateral Loading – <u>Zone 2</u>					
Applicable Depth (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
*0-1 Pier Diameter	Ignore	Ignore	-	-	-
*1 Pier Diameter to Top of Bedrock	125	2,000	1000	400	0.005
Top of Bedrock to Bottom of	140	Unconfined Compressive Strength (psi)	-	-	-
(Strong Rock) Pier 4,000 *Lateral parameters for the upper 1 pier diameter, or 2.5 ft., whichever is shallower, should be ignored.					
	Applicable Depth (ft.) *0-1 Pier Diameter *1 Pier Diameter to Top of Bedrock Top of Bedrock to Bottom of Pier	Applicable Depth (ft.)Unit Weight (pcf)*0-1 Pier DiameterIgnore*1 Pier Diameter to Top of Bedrock125Top of Bedrock to Bottom of Pier140	Applicable Depth (ft.)Unit Weight (pcf)Cohesion (psf)*0-1 Pier DiameterIgnoreIgnore*1 Pier Diameter to Top of Bedrock1252,000Top of Bedrock to Bottom of Pier140Unconfined Compressive Strength (psi)	Applicable Depth (ft.)Unit Weight (pcf)Cohesion (psf)Static Kh (pci)*0-1 Pier DiameterIgnoreIgnoreIgnore-*1 Pier Diameter to Top of Bedrock1252,0001000Top of Bedrock to Bottom of Pier140Unconfined Compressive Strength (psi)-	Applicable Depth (ft.)Unit Weight (pcf)Cohesion (psf)Static Kh (pci)Cyclic Kh (pci)*0-1 Pier DiameterIgnoreIgnoreIgnore*1 Pier Diameter to Top of Bedrock1252,0001000400Top of Bedrock to Bottom of Pier140Unconfined Compressive Strength (psi)

The above values were measured or based upon published correlations with anticipated soil strength and classification tests.

9.2.6 Drilled Pier Construction Recommendations

Drilled piers bearing in soil should have a straight shaft and should be founded at the depths recommended above. **Overburden soils/chert and limestone are considered very resistant to typical auger methods.** In any event, the drilled pier contractor should anticipate the use of rock augers, rock core barrels and potentially down the hole hammers with a heavy-duty drill rig in order to excavate the drilled piers to the minimum depths specified.

Based upon the results of this investigation, the drilled pier contractor should be prepared to mobilize casing due to potential caving gravel and boulder sidewalls, although most piers are not anticipated to require temporary casing. Casing may be extracted as the shaft concrete is placed, if required. Drilled pier bottoms should be well cleaned of all loose soil and rock fragments at the time of concrete placement. No more than 2 to 3 inches of water should be present in the bottom of piers when concrete is introduced into the shaft. **The drilled pier contractor**



should also anticipate minor to moderate concrete loss in small voids/cracks within the boulders and cobbles within the overburden soils. Concrete overrun related to sloughing or caving of the shaft sidewalls is possible and unit prices should be established for these items in the contract documents, if required.

9.2.7 Drilled Pier Load Test

An on-site load test of a production drilled pier is not considered a requirement. Isolated piers or pier groups may encounter differing conditions as compared to this report. It is recommended that the contractor bid form include a cost to perform such a load test in the event differing subsurface conditions are encountered during drilled pier installation. Pier load tests, if required, should be performed in accordance with ASTM D1143 and ASTM D3689 for compressive and tensile capacity.

9.2.8 Concrete Loss Due to Voids

Although not anticipated to be significant, concrete volume loss during drilled pier construction is possible. Some small voids were identified during this investigation and have been identified at this site. Some concrete loss during drilled pier installation should be anticipated and included in contract documents. If large voids are encountered, PPI should be contacted for additional consultation.



9.3 Driven Piles

Another deep foundation alternate considered applicable at the project site is driven piling. Design recommendations for driven H-Piles are presented in the table below.

Deep Foundations – Driven Piles – Zones 1 & 2			
Description	Value		
Foundation Type ¹	Steel H Piles w/End Protection.		
Bearing Material	Dense to very dense or stiff natural overburden soils/chert. If bedrock is encountered, driven piles may bear on competent bedrock materials.		
Minimum Pile Penetration ²	25 ft. below existing ground surface or to the depth of competent bedrock.		
Allowable Pile Capacity – Axial Compression	If driven to practical refusal, the allowable stress of the pile cross section controls the pile capacity. Compressive stress developed in the steel section should <u>not</u> exceed 9 kips per square inch (ksi) for 36 ksi grade steel and 12.5 ksi for 50 ksi grade steel sections.		
Allowable Skin Friction – Uplift ³	0.4 ksf (overburden soils/backfill)		
Group Effects – Axial Capacity	Driven piles should be installed with a center- to-center spacing of at least three (3) pile widths. Group effects can be neglected and the total capacity of the pile group taken as the sum of the individual pile capacities provided that adjacent piles are spaced at least three (3) pile widths (center-to-center). Design of the piling as structural members should be in accordance with applicable building codes.		
Group Effects – Lateral Capacity	When piles are installed close together, the lateral capacity of the group is <u>not</u> equivalent to the lateral capacity of an isolated individual pile times the number of piles in that group. Only those piles that are unobstructed by the other piles in the direction of the force develop full capacity. For pile groups with a pile spacing of three (3) pile widths center-to- center, a multiplier of 0.8 should be used for the lead row of piles, 0.4 for the 2 nd row, and 0.3 for the 3 rd and consecutive rows. The efficiency of the pile group is dependent upon the pile layout in the group, but would typically be on the order of 75 percent of a single pile for a pile spacing of three (3) pile widths. The pile group effect increases significantly for closer spacing, resulting in a lower efficiency.		
Minimum Pile Cap & Grade Beam Bearing	24-inches below final exterior adjacent grade.		



Deep Foundations – Driven Piles – Zones 1 & 2			
Description	Value		
Estimated Total Settlement	 Negligible (Bedrock) 0.5-inch or less (Clayey Gravels) 		
Estimated Differential Settlement	0.25-inch or less (Clayey Gravels)		

^{1.} Because of the relatively high driving resistance expected from the overburden soils/chert, steel Hpiles with end protection are recommended so that the anticipated high driving stresses can be endured. Driven piles will develop their capacity from end bearing and side resistance in the very dense overburden soils below the pre-bore depth.

^{2.} The pile should be driven to practical refusal, which should occur after penetrations of 1 to several feet into very dense overburden soils. We recommend that the pile installation be monitored by a representative of PPI.

^{3.} The allowable skin friction has a Factor of Safety of approximately 2 and applies to the non-pre- bored depth <u>only</u>. Skin friction within the pre-bore depth should be ignored.

9.3.1 <u>H-Pile Driving Criteria & Pre-Boring</u>

Specifications for end bearing H-Piles should clearly state that end-bearing piles should be driven to refusal. Prior to driving structural steel piles, the contractor should review the boring logs to determine the depth at which impenetrable overburden soils may be anticipated. In addition, the contractor should submit a hammer wave equation to be evaluated and used during PDA testing (see below). The contractor should be attentive to the physical conditions associated with pile refusal. Pile refusal should be determined by on-site PDA testing. Pile refusal depth is anticipated to be highly variable. Pile refusal is anticipated to occur within approximately 5 ft. or less below the prebore depth due to very dense gravels encountered within the borings.

As stated above, pile driving refusal should be defined during PDA testing with an approved hammer. An approved hammer shall be defined as a hammer that develops the minimum hammer energy that is no less than any of the following:

- 1. 3.0 ft-lb/lb times the total pile weight in pounds, including mandrel, if used;
- 32 ft-lb/kip times the minimum nominal axial compressive resistance in kips, divided by the pile batter factor, β, if applicable; and
- 3. 8,000 ft-lb.

In order to achieve full pile development and to ensure the pile reaches the intended very dense bearing stratum, pre-boring pile locations to a minimum



depth of 25 ft. minimum is recommended; however, if competent bedrock is encountered within the pre-boring, the pile may be shortened to bear in the competent bedrock material. The pre-bored hole may be filled with sand prior to or following pile driving.

As discussed in Section 9.2.1, possible voids were noted in Borings 1 and 2 within the bedrock. It is recommended that pre-boring for driven piles be extended a minimum of 25 ft. in this area to identify the presence of possible voids to limit bearing failures of driven piles.

9.3.2 Driven Pile Construction Observation & PDA Testing

Construction surveillance activities should be provided throughout pile installation. Specific information regarding pile driving should be maintained in daily log form. The daily log form should include hammer type, energy, operating characteristics, driving time, delays, and other pertinent information. Complete pile driving records should be kept for the Project. Care should be exercised to monitor pile hammer operation to verify actual hammer energy.

In addition, PDA Testing (or dynamic load testing using a Pile Driving Analyzer) is recommended to confirm that damage to the pile has not occurred during driving, **and that the pile will carry the design load**. It is possible for piles to be driven down the side of a large chert boulder, resulting in pile deflection and subsequent damage. PDA testing would be especially useful in this case. A minimum of five (5) PDA tests or piles within a footprint of 50,000 sq. ft. is recommended spread over the structure footprint prior to production pile installation. A firm that has significant experience in PDA testing and that PPI has significant work experience with is listed below for your use, if desired.

Foundation Testing & Consulting, LLC

Mr. Casey Jones, P.E., P.G. – Technical Director 16500 Lucille Street Overland Park, Kansas 66062 Ph: 913-626-8499



Email: cj@FTandC.com

9.3.3 Lateral Loadings for Driven Piles

The lateral loading parameters provided in Section 9.2.3 above may be used during foundation design utilizing driven piling.

9.4 Settlement Potential

Due to the overburden soils primarily consisting of dense to very dense chert sands, gravels, and occasional gravelly clays, settlement potential of the natural overburden soils is anticipated to be minimal. To essentially eliminate the potential for foundation settlement, foundations should bear in bedrock. However, due to the sometimes deep depth of limestone bedrock anticipated at this site, bearing upon bedrock is not considered practical for all structures and areas of the site. If shallow foundations are constructed using the above foundation design parameters provided, total settlements on the order of 0.5-inches or less are anticipated. If deep foundations are constructed using the above foundation design parameters on the order of 0.5-inches or less are anticipated. If deep foundations are constructed using the above foundation design parameters on the order of 0.5-inches or less and differential settlements on the order of 0.5-inches or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements on the order of 0.5-inch or less and differential settlements or less are anticipated.

10.0 SEISMIC CONSIDERATIONS

	Code Used	Site Classification		
	2018 International Building Code (IBC) ¹	C ²		
1.	1. In general accordance with the 2018 International Building Code, Section 1613			
2.	2. Based upon an average Shear Wave Velocity of 2,170 feet per second within the top 100 ft. of depth computed during site shear wave velocity testing performed on 11/22/21 by PPI.			

According to the 2018 IBC, the Mapped Spectral Response Acceleration parameters for short period (F_a) and the 1-second period (F_v) for the project site are presented below.



Mapped Spectral Response Parameter	Fa	Fv
Value	1.2	1.7
Values are based upon a Site Class C, $S_s = $ from ASCE 7-10	15.3%, S ₁ = 8.1% using	g Tables 11.4 (1 & 2)

The seismic site classification presented above was determined using shear wave velocity testing. Shear wave velocity testing was performed along one (1) array, or line, situated within the southeast corner of the proposed building footprint. Shear wave velocity testing was performed in substantial conformance with industry standards using surface seismic methods, more specifically Multi-Channel Analysis of Surface Waves (MASW).

Surface waves are a type of seismic wave whose propagation is confined to the near surface medium. The depth of subsurface penetration of a surface wave is directly proportional to its wavelength. In a non-homogeneous medium, surface waves are dispersive, meaning each wavelength has a characteristic velocity resulting from subsurface heterogeneities.

MASW Combined Active and Passive method was utilized to obtain the average shear wave velocity for the top 100 ft. (Vs 100) at the project site. This method was selected to increase the range of frequency to be analyzed therefore increasing the depth of investigation. Active method captures a dispersion curve at relatively higher frequencies than the Passive method. Combing the dispersion curves for each method allows for a more reliable identification of the fundamental mode dispersion curve utilized in calculating the shear wave velocity. Please refer to Figure 3 for the graphical shear wave velocity vs. depth output.

11.0 FLOOR SLABS

A slab-on-grade or slab-on-fill floor system is considered appropriate at the site based upon subsurface conditions encountered and future site grading. Listed below are key considerations for design purposes of the floor slab.



- Prior to placement of <u>controlled</u> fill, if any, natural soils should be scarified, moisture content adjusted and re-compacted in accordance with Sections 8.0 of this report;
- Fat clays containing little to no sand/gravel content present at slab subgrade elevation, if present, should be undercut and replaced in accordance with Section 8.7 above; and
- Prior to slab placement, soil moisture should be adjusted and maintained within the parameters specified in Section 8.0 of this report.

Placement of 4 or more inches of compacted free-draining granular base course below slabs that are <u>not</u> below grade is recommended to limit moisture rise through slabs and to improve slab support, particularly at joints. An impervious moisture barrier consisting of 6-mil plastic sheeting or equivalent should be provided in accordance with the 2012 IBC. Use of a 10-mil vapor barrier is recommended below all slab areas with an intended use sensitive to slab moisture.

11.1 Modulus of Subgrade Reaction

The floor slab by be designed with the modulus of subgrade reaction presented in the table below.

Bearing Material	Bearing Material Thickness (inches)	Modulus of Subgrade Reaction (pci)
LVC Fill Material and Natural Soils	N/A	175
Dense Graded Aggregate Base	6	275
Dense Graded Aggregate Base	12	350
Dense Graded Aggregate Base	18	425

12.0 BELOW GRADE SLABS

<u>All</u> slabs that are below exterior grade are considered below grade slabs. The ground floor slab set at Elevation 919.0 is not considered a below grade slab, based upon the project grading plan. However, any elevator pits, recessed mats, floor depressions, etc., are considered below grade slabs and the following recommendations do apply to these areas.



Although shallow groundwater was not encountered within the borings drilled, site earthwork can, and often does, manipulate the shallow groundwater regime. In view of the possibility for perched groundwater at the project site, it is recommended that any portions of the structure below exterior grade, as described above, be designed and constructed recognizing the possibility of shallow groundwater. A French drain system should be installed under the below grade floor slabs to limit hydrostatic pressure below the slab. A drainage system constructed with coarse free-draining gravel with a minimum 6-inch thickness and perforated pipes wrapped in filter fabric and installed on 30-ft. centers below the free draining gravel is considered adequate. Groundwater collected by these perforated pipe drains should be removed to free discharge by gravity flow. If gravity flow cannot be provided a sump and pump system consisting of a wet well with a duplex pump arrangement is recommended. At least one (1) pump should turn on when groundwater levels are more than 24-inches below finish floor elevation.

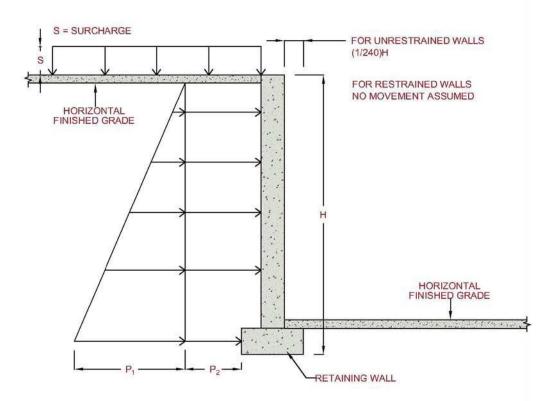
A French drain should be installed underneath <u>all</u> below grade slabs. Lateral drain pipes installed on 30-ft. centers should be at least 4-inches in diameter, with perimeter collector pipes at least 6-inches in diameter. An impervious moisture barrier consisting of 6-mil. plastic sheeting or equivalent should be provided below all slab areas. A minimum 10-mil plastic sheeting is recommended beneath all slab areas with an intended use sensitive to slab moisture. Soil moisture should not be allowed to dry and desiccate or be saturated by inundation prior to slab placement.

12.1 Retaining Wall Backfill & Drainage

A foundation drain is recommended to be installed around the portion of the perimeter where the below grade slab is at or below exterior grade level in accordance with the 2018 IBC. Below grade wall backfill should consist of free- draining crushed stone or alternatively, may consist of lean clay. Crushed stone, if selected, must be imported from a quarry source whereas on-site soils suitable for wall backfill could probably be segregated and stockpiled during excavation. Depending upon the type of backfill selected and degree of wall restraint, the following table of lateral earth pressures are considered appropriate for wall design.



If a building floor slab is planned over the wall backfill, use of an imported free draining stone should be separated from the earth face of the excavation by using a nonwoven filter fabric.



EQU	JIVALENT FLUID	PRESSURES, P1 (I	Drained Backfill Or	nly)				
	Level	Backfill	Sloped Backfill (2H:1V)*					
Type of Backfill	Restrained Walls	Unrestrained Walls	Restrained Walls	Unrestrained Walls				
	(Using K₀)	(Using Ka)	(Using K₀)	(Using K _a)				
Compacted On-Site GC, GW, SC & CL Soils	70 pcf 45 pcf		80 pcf	55 pcf				
Clean Crushed Stone	50 pcf 35 pcf		60 pcf	45 pcf				
Rock Fill (Free- Draining)	50 pcf	45 pcf						
*For backfill sloped other than 2H:1V, interpolate between values presented above for level a sloped backfill. NOTE: Structural design of unrestrained walls should permit wall rotation at top of wall equal 1/240th of wall height.								



SURCHARGE PI	RESSURE, P ₂	
	Leve	l Backfill
Type of Backfill	Restrained Walls	Unrestrained Walls
	(Using K _o)	(Using K _a)
Compacted On-Site GC, GW, SC & CL Soils	0.58 (S)	0.38 (S)
Clean Crushed Stone	0.42 (S)	0.29 (S)
Rock Fill (Free-Draining)	0.42 (S)	0.29 (S)

If crushed stone backfill is selected and wall design in accordance with the above equivalent fluid pressures, the crushed stone backfill should be placed within a boundary projecting 30 degrees from the vertical commencing at a point 1 ft. out from the base of wall. Regardless of the backfill type selected; an impervious moisture barrier should be applied to the below grade wall. In addition, if lean clay backfill is selected, a geosynthetic drainage mat should be applied to the wall to assure removal of subsurface water. A perforated pipe should be laid at the base of wall to collect and remove subsurface water either from free-draining crushed stone or drainage mats. Flow line of the perforated pipe should be laid below partial basement finished floor. Again, groundwater collected should be removed by gravity flow to free discharge. If this is not possible, groundwater may be removed by pumping. An exterior sump pit with dual pumping arrangement is recommended.

Please refer to Section 9.1 above for retaining wall foundation design parameters constructed in <u>natural</u> overburden soils or <u>controlled</u> fill material placed in accordance with Section 8.0 of this report. These parameters apply to below grade foundation walls <u>and</u> site retaining walls.

13.0 PAVEMENT

It is anticipated that any new pavements associated with this project will be constructed of either an asphaltic concrete wearing surface placed over a base or a rigid Portland Cement Concrete pavement over a granular base. Prior to pavement placement,



preparation of the pavement subgrade should be performed in accordance with Section 8.0 of this report.

13.1 Flexible Pavement

If asphaltic paving is selected, the aggregate base may be a granular compacted crushed limestone with a gradation and quality conforming to the requirements of the Oklahoma Department of Transportation (ODOT), Standard Specification 703.01 for Type A aggregate. The maximum lift thickness for the granular base is 4 in. Granular base thicknesses in excess of 4 inches should be placed in multiple lifts with each lift being of approximately equal thickness. The granular base should be compacted to at least 100% of Standard Proctor Compaction (ASTM D-698).

Asphaltic concrete, both base and surface, should conform to the applicable requirements of ODOT Standard Specification 708. Asphaltic concrete should be compacted to 92 to 96% of Maximum Theoretical Specific Gravity (ASTM D-2041). Substitution of an appropriate Superpave Mix Design, SP 190C or SP 250C, can be used in place of the bituminous base. SP 190C or SP 125C may be used for the surface. All bituminous mix designs should have been prepared or verified within 6 months of the date of placement on the project.

13.2 Rigid Pavement

If rigid concrete paving is selected, a minimum 4-in. thickness granular base compacted to 100% of Standard Proctor should be placed on the prepared subgrade. The Portland Cement Concrete (PCC) mix should have a minimum 28- day compressive strength of 4000 pounds per square inch (psi). Concrete should be placed at a low slump (1 to 3 inches) and have an entrained air content of 5 to 7%. If an increased slump is desired, use of Super Plasticizer is recommended.

13.3 Pavement Subgrade CBR

Based upon relatively high SPT-N values obtained during drilling, the natural soil deposits should exhibit stiff to hard subgrades for pavement construction. A CBR



value equal to 6.0 for the <u>natural</u> subgrade soils, or <u>natural</u> overburden soils that have been properly recompacted is recommended to be used in pavement design.

13.4 Pavement Thickness

Typical pavement design for this type of development would generally generate a Structural Number of 3.0 to 3.5 within heavy duty areas and 2.4 to 2.6 within light duty areas, depending on the subgrade conditions. The following table presents corresponding <u>typical</u> flexible and rigid pavement thickness using the general Structural Numbers.

Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)
	Heavy Duty	3.0	4.0	-	6.0
Flexible Pavement	Medium Duty	2.0	3.0	-	6.0
	Light Duty	2.0	-	6.0	
	Heavy Duty	-	-	7.0	4.0
Rigid Pavement	Medium Duty	-	-	6.0	4.0
	Light Duty	-	-	5.0	4.0

14.0 CONSTRUCTION OBSERVATION & TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Since geotechnical engineering is influenced by variable depositional and weathering processes and because we sample only a small portion of the soils affecting the performance of the proposed structures, unanticipated or changed conditions can be disclosed during grading. Proper geotechnical observation and testing during construction is imperative to allow the Geotechnical Engineer the opportunity to evaluate assumptions made during the design process. Therefore, we recommend that PPI be kept apprised of design modifications and construction schedule of the proposed project to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study. We recommend that during construction all earthwork be



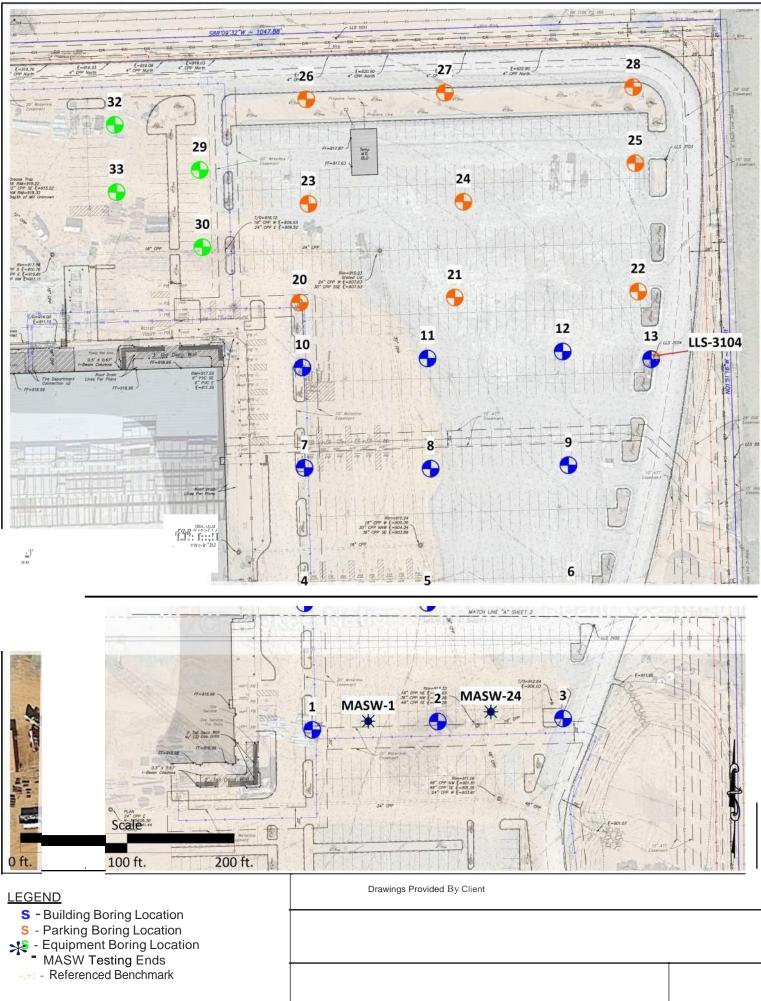
monitored by a representative of PPI, including site preparation, placement of all engineered fill and trench backfill, and all foundation excavations as outlined below.

- An experienced Geotechnical Engineer or Engineering Technician of PPI should observe the subgrade throughout the proposed project site immediately following stripping to evaluate the native clay, identify areas requiring additional undercutting, and evaluate the suitability of the exposed surface for fill placement;
- An experienced Engineering Technician of PPI should monitor and test all fill placed within the building and pavement areas to determine whether the type of material, moisture content, and degree of compaction are within recommended limits. Refer to Section 8.3 for recommendations regarding Field Density (compaction) testing frequency;
- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays; and
- The condition of the subgrade should be evaluated immediately prior to construction of the building floor slabs to determine whether the moisture content and relative density of the subgrade soils are as recommended.

15.0 **REPORT LIMITATIONS**

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. Palmerton & Parrish's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.

FIGURES



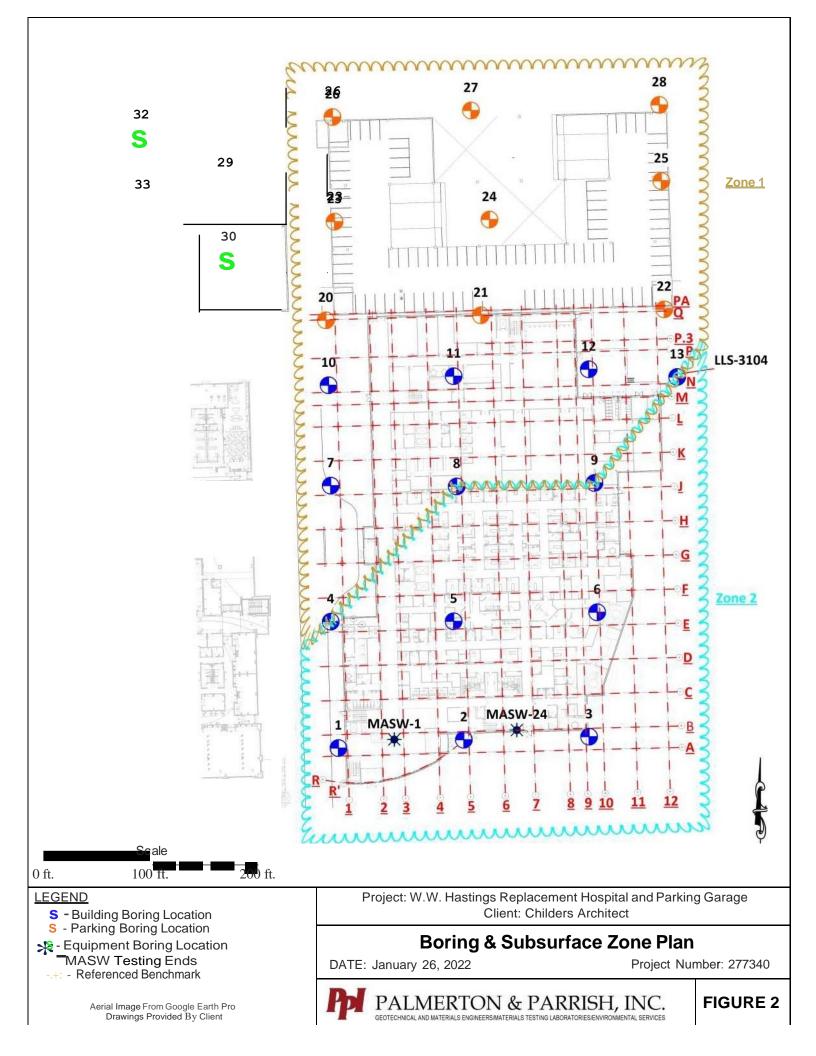
Project: W.W. Hastings Replacement Hospital and Parking Garage Client: Childers Architect В 0 r i. n g & Μ Α S W L 0 С а t i. 0 n Ρ L а n DATE: January 26,

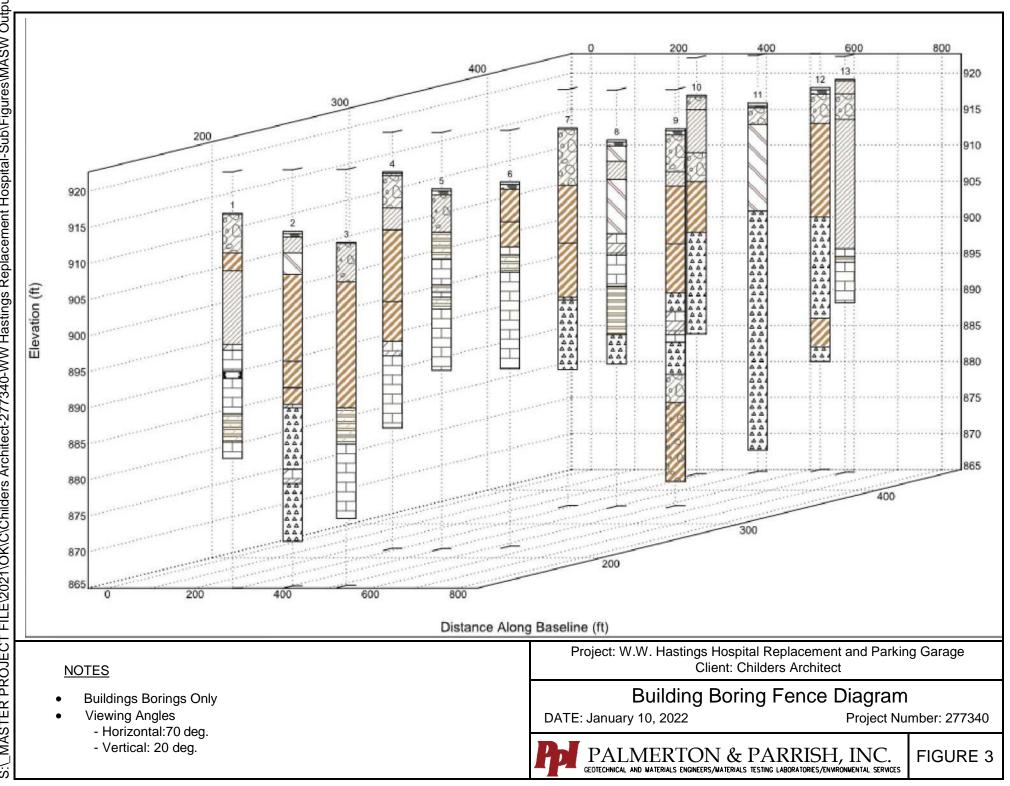
2022

Project Number: 277340

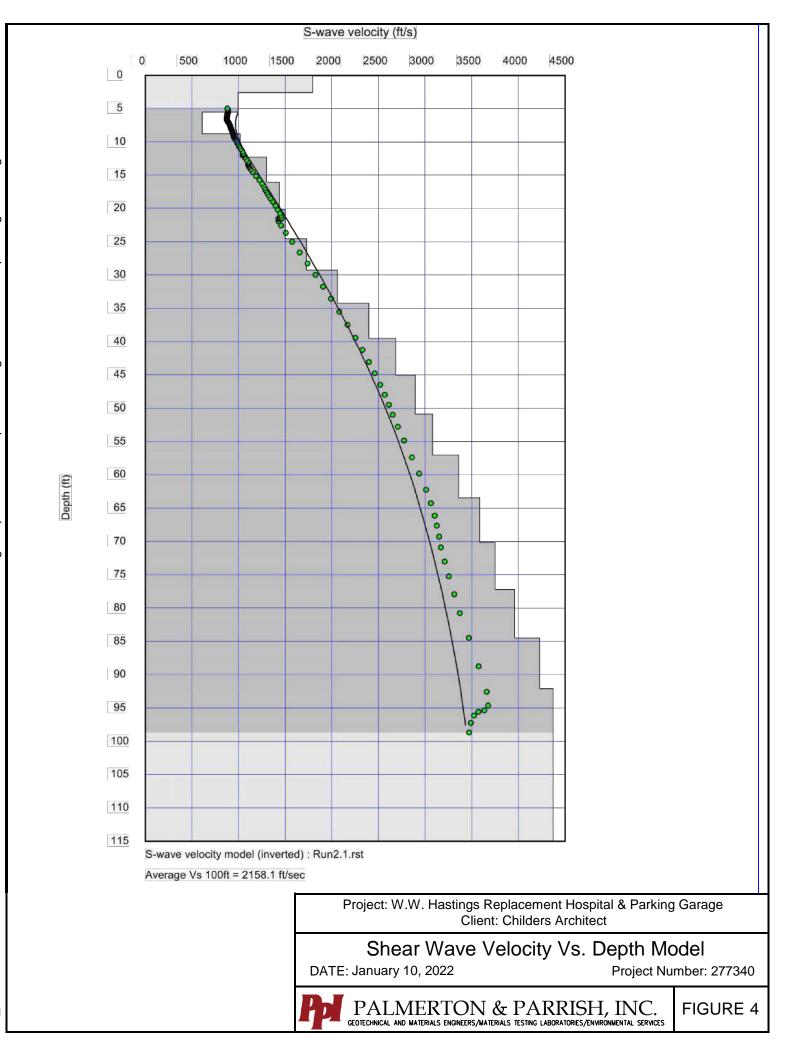
FIGURE 1







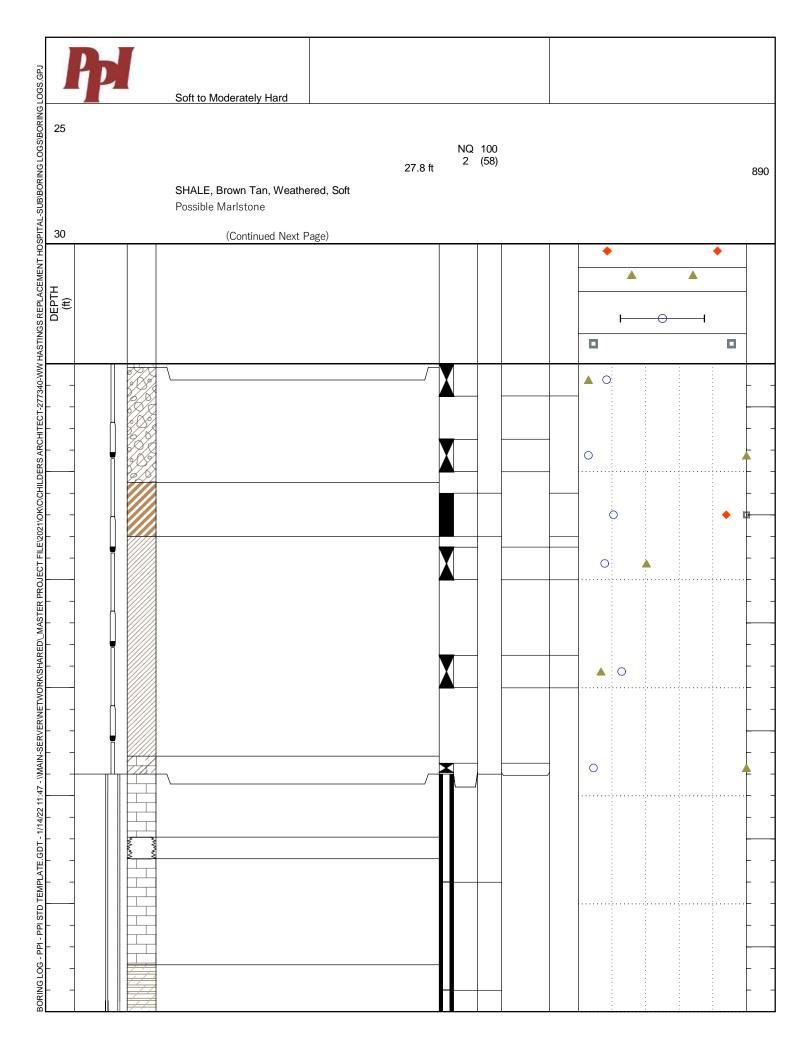
S:_MASTER PROJECT FILE\2021\OK\C\Childers Architect-277340-WW Hastings Replacement Hospital-Sub\Figures\MASW Outpu



APPENDIX I

BORING LOGS & KEY TO SYMBOLS

		6		OTECH ORING				BOF	RING NUMBER	1
			ax: 417-864-6000						PAGE 1	OF 2
CLIE	NT <u>Childe</u>	ers Arch	itect	PROJE	ECT NAI	ME <u>V</u>	V.W. Hast	ings Rep	placement Hospital	
PRO	JECT NO.	277340)	_ PROJE	ECTLO	CATIO	N Tahle	quah, Ok	lahoma	
DAT	E STARTE	D <u>12/1/</u>	21 COMPLETED <u>12/1/21</u>	SURF#	ACE ELE	EVATI	ON <u>917.</u>	D ft	BENCHMARK EL.	
	LER <u>MR</u> MER TYP		DRILL RIG 2019 CME-55					None		
			CHECKED BY _MM		AT END	of Df	RILLING _			
ΝΟΤ	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	_	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION (ft)
0			TOPSOIL, Brown, Moist, Soft	0.2 ft	SPT		3-3-3		1 2 3 4	
			CLAYEY GRAVEL, w/ Sand, Brown, Loose to Dense, Moist (GC)	o Very	1		(6)	0.75		915
5	O.D.		FAT CLAY, w/ Gravel, Red, Tan & Brown, Ve Moist (CH)	5.5 ft ry Hard, 8.0 ft	SPT 2 ST 3	71	38-53-48 (101)	4.5		10.18 910
10	ROTARY - 3.625" O.		SHALEY LEAN CLAY, Brown, Tan & Gray, H Moist (CL)	ard,	SPT 4		15-20-21 (41)	3.25		
15			-Red, Tan & Gray, Stiff Below 13.5'		SPT 5		3-6-8 (14)	3		905
20			ARGILLACEOUS LIMESTONE, Brown Tan, Hig Weathered, Very Soft ARGILLACEOUS LIMESTONE, Gray, Fine Crystalline, Soft to Medium Hard	18.2 ft gh1l9y.0 ft	SPT 6		75/5"			900
	ARREL - 2" I.D.		VOID ARGILACEOUS LIMESTONE, Gray, Fine Cry	21.9 ft 22.9 ft /stalline,	NQ 1	80 (75)				895





GEOTECHNICAL **BORING LOG**

וכ	Chinde	IS AICHILE	υ
ń١			
21			
<u> </u>	TNO	077040	

PROJECT NAME W.W. Hastings Replacement Hospital

	4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000					ORING		G					PAGE 2	OF 2
	LIENT <u>Childers Architect</u>								-	eplacement	Hospital			
PROJECT NO 277340 H I I I <tr< th=""><th></th><th>_</th><th>SAMPLE TYPE NUMBER</th><th>RECOVERY % (RQD %)</th><th>CORRECTED BLOW COUNTS (N VALUE)</th><th>POCKET PEN. (tsf)</th><th>+ DR`</th><th>Y UNIT W 0 60 N VALUI 40 6 </th><th>80 100 E 0 80 — UL</th><th>FLEVATION</th></tr<>				_	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	+ DR`	Y UNIT W 0 60 N VALUI 40 6 	80 100 E 0 80 — UL	FLEVATION		
30 _				SHALE, Brown Tan, Weather Possible Marlstone (continued CHERTY LIMESTONE, Gra Crystalline, Medium Hard, M	l)	31.8 ft	NQ 3	100 (67)			SHEAF 1	R STREN(2	GTH (ksf)	-

	P		4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000	GEOTE BORIN	-	-			BC	DRING NU	WBER	PAGE	E 1 0	2 DF 2
3	INT <u>Child</u>											<u> </u>		
	JECTINO	. <u>211</u> 34	0		JJECT				juan, C	Kianoma				
DAT	E START	ED <u>12/1</u>	/21 COMPLETED	<u>12/2/21</u> SUF	RFACE	ELEVA	ATIO	N <u>914.2</u>	<u>2 ft</u>	BENC	HMARK	EL		
	LER <u>MR</u> IMER TYF		DRILL RIG _201	<u>9 CME-55</u> GRC				/ELS ILLING	None					
LOG	GED BY	вс	CHECKED BY	MM	ATE		DRI	LLING		•				
i			switched to tricone at 24'											
DEP (ft)	-ING TOD	SYMBOL	MATERIAL DES		ЕТҮРЕ	BER ERY %	(%	CTED OUNTS LUE)	PEN.	20 PF	N VAL	<u>WT (pcf)</u> 80 10 UE 60 80	00) 🗖	TION
	글린						R	<u>уоқ</u>		PL	MC	: LL:		¥€
	DRILL	STRAIN	Unified Soil Classific	ation System		RECO	(RQD	CORRECORRECORRECORRECORRECOR	POCKE1 (tsf	° ₂₀	40	60 80 NGTH (ks		ĘLEVA (f
_ 0 _			CONCRETE AGGREGATE BASEROCK	0.3	B ft	PT.	2	9-32-33			2	3 4		
			LEAN CLAY, w/ Gravel, Brow		_) D ft	1		(65)	3.25	0				
			LEAN TO FAT CLAY, Trace s Very Stiff, Moist (CL-CH)		X ^s	PT 2	_6	6-11-14 (25)	4.5	0				910
			SHALEY FAT CLAY , Brown	6.0 Tan, Hard, Moist (CH)		SPT 3	ę	9-15-23 (38)	4.5					
	Ö.				-	PT	1	1-18-23 (41)		0				905
10	ROTARY - 3.625"							()		, , , , , , , , , , , , , , , , , , ,				
	ROT					ST 10	00		4.5	• 0				 900
15														
				18.0) ft									
			FAT CLAY, Red Brown, Stiff,	Moist (CH)				566						– –
20	<u> </u>					6		5-6-6 (12)	3.75	0				895
	BARREL - 2"		ARGILLACEOUS LIMESTON			NQ 5								
	1ш	 	Weathered, Soft to Moderatel CLAY SEAM OR POSSIBLE	, · · • • •		1 (5	0)							
	25" ©OR		ARGILLACEOUS LIMESTONE	E, Brown Tan, High²l4y.5	ft	2	2				5			

Weathered, Soft to Medium Hard CHERT, White, Very Dense	SPT 7	18-75/0"	1	890

30

(Continued Next Page)

SPT 8

75/0"



BORING LOG - PPI - PPI STD TEMPLATE. GDT - 1/14/22 11:47 - \WAIN-SERVERINETWORKISHARED_MASTER PROJECT FILE/2021/OK/CICHILDERS ARCHITECT-277340-WW HASTINGS REPLACEMENT HOSPITAL-SUB\BORING LOGS/BORING LOGS/B

4168 W Kearney Street 65803

GEOTECHNICAL **BORING LOG**

2

ELEVATION (ft)

880

875

E 2 OF 2

	1L	. / т	elephone: 417-864-6000	BURIN		G						
		F	Fax: 417-864-6000								PAG	GE 2
CLIE	ENT Chil	ders Archi	itect	PRO	JECT NA	ME <u>\</u>	W.W. Hast	ings Re	eplacemer	<u>nt Hospita</u>	al	
		277340)	PRO	JECTIO	CATIC	N Table	nuah (Oklahoma			
DEPTH (ft)	(1.0	STRATA SYMBOL	MATERIAL DES Unified Soil Classifi	SCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	O _S	POCKET PEN. (tsf)	DF 20 20 Pt	40 60 N VAL 40	<u>_UE</u> 60 8 С——Ш	100 30
30			CHERT, White, Very Dense	(continued)					20 SHEA 1	40 AR STRE 2	60 8 NGTH (k 3 4	80 (sf) 4
- 35	ROTARY - 3.625" O.D.		ARGILLACEOUS LIMESTO Weathered, Soft to Medium H CHERT, w/ Clay Layers, Whi Very Dense	Hard 35.0	SPT 9		47-27-11 (38)	1	0			
40	-				SPT 10		8-8-75/5"					
			Bottom of boreho	43.0	ft SPT 11		75/0"					

	P			4168 W Kearney Street 65803 Telephone: 417-864-6000	GEO BO		HNIC G LO			B	ORING N	IUMBER			3
		-		Fax: 417-864-6000									F	PAGE 1 (OF 2
			ers Arc _27734	hitect 40									pital		
DAT	E STA	RTE	ED <u>11/</u> 2	29/21 COMPLETED	11/30/21	SURF	ACE ELI	EVAT	ION <u>912.</u>	<u>3 ft</u>	BE	NCHMAI	RK EL		
			E Auto	DRILL RIG _CI	ME-1050				EVELS DRILLING	None					
LOG	GED I	BY _	вс	CHECKED BY	MM	,	T END	OF D	RILLING _		•			•	-
DEPT R (#)	ES DRIFT	METHO	SYMBOL				E TYPE BER	(% /	CTED OUNTS LUE)	PEN.	20 20 20	N \/	ALUE	ocf)) 100 80 □	
			TRATA SYN	MATERIAL DES		/	SAME LE TY NUMBER	RECOVERY (RQD %)	CORRECT BLOW COUI	POCKET P (tsf)	= 20	ר א	60 MC	LL	
 	-			TOPSOIL, Brown, Soft, Mois	st, Grass Covered	0.2 ft	X	-			1		60 RENGTI 3	80 ⊣ (ksf) 4	
	-			GRAVELLY LEAN CLAY, R Stiff, Moist (CL)	ed Brown, Stiff to Ve	ery	SPT	-	4-4-5 (9)						
	-							-	9-12-9 (21)	2.75	0				910
5	<u> </u>			SHALEY FAT CLAY, Tan, B Stiff, Moist (CH)	rown & Gray, Hard t	5.5 ft to	SPT	-	7-13-21						
	Y - 3.625" O						3 SPT 4		(34) 14-18-17 (35)	4.5		0			905
10 	ROTARY														
	-						SPT 5	-	5-5-10 (15)	2.75		0			900
15 	-														- ·
 							SPT 6		4-4-5 (9)	0.75	Ô				895
20 															
 - 				SHALE, Brown Tan, Very So	oft. Highly Weather	23.0 ft		2 5					Ŀ	S T O	
								-	1				<u>M</u> E	E	<u> </u>

rnating Chert Layers & Nodules, Gray & White, Moderately Hard to Hard, Medium Bedded, Fine Crystalline

	ODT
	SPT
(Continued Next Page)	7

7-14-25 (39) 4.5

30

885

890

NQ 100 1 (100)



GEOTECHNICAL **BORING LOG**

CLENT Childers Archited PROJECT NAME_W.V. Hasings Replacement Hospid PROJECT NO 27740 PROJECT COTING Tatley up, Dialog Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding Replacement Hospid Harding		Fax: 417-864-6000						PAGE 2 (
Image: state of the state o						-			
30			DESCRIPTION		%		DRY UNIT W 20 <u>40</u> 60 N VALU 20 40 6 PL MC 20 40 6 20 40 6	80 100 JE 50 80 ─────────────────────── 60 80	ELEVATION
38.3 ft	34REL - 2" I.C	LIMESTONE, w/ Alterna Gray & White, Moderate Bedded, Fine Crystalline	ating Chert Layers & Nodules, Iy Hard to Hard, Medium e (continued)						
				NQ 3	100 (40)				-
		Bottom of br							8

	P			4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000	GEO1 BOI		HNIC G LO			B	ORING NUMI	BER	PAGE 1 C	4
CLIE		hild	ers Arc	hitect		PRO.IF		MF \	WW Hast	inas R	eplacement	Hospital	FAGE I C	<u> </u>
			2773								Oklahoma			
DATE	E STAI	RTE	ED <u>12/</u>	2/21 COMPLETED	12/2/21	SURFA	ACE ELE	VAT	ION <u>917.2</u>	<u>2 ft</u>	BENCH	MARK E	L	
			E_Auto	DRILL RIG 20	019 CME-55				EVELS ORILLING	None				
	GED B				NANA .						•		•	
				CHECKED BY		,					_		_	-
DEF	DRIL	MEI	ы Г				щ	%	S	7		UNIT W) 60 N VALU	T (pcf) 80 100 ⋿	
			SYMBOL	MATERIAL DES	SCRIPTION		EE TYPE MBER	ERY %)	LECTED COUNTS ALUE)	ET PEN. (sf)	20		60 80 🗖	ATION
			TRATA	Unified Soil Classif	ication System		NUM	RECOV (RQI	CORRE (N VAL	POCKET (tsf)				ÉLEVA (f)
		Ц									20 SHEAR 1	STREN	0 80 GTH (ksf) 3 4	
- 0 -		Π		TOPSOIL, Brown, Soft, Mois	st, Grass Covered	0.2 ft 0.5 ft	SPT 1		678517		0			
				LEAN CLAY, w/ Gravel, Red (CL)	-									
		П		CLAYEY GRAVEL, Red Bro	wn, Dense, Moist (G	iC)	Å	-				-1		915
		Ĩ				5.0 ft	SPT 2		12-17-15 (32)		0	۵	•	
5	O.D.			LEAN CLAY, Trace Sand, R	ed Tan, Stiff, Moist ((02)					
	3.625"					8.0 ft	SPT 3		3-6-9 (15)	2.75				910
	ROTARY -			FAT CLAY, Red Tan, Very S	Stiff, Moist (CH)		ST 4	100		3.75				
10	RO	ļ												
														905
							SPT		6-8-9					
15		Ц					5		(17)	3				.,
						18.0 ft	-				0			-900-
		Щ.		SHALEY FAT CLAY, Tan, V	'ery Stiff, Moist (CH)		SPT		6-9-14 (23)	3.5				
20 -									(- /					
											6	۰. ۱		
						23.5 ft					S o f	t d o i <u>Mu</u> e n	a r	_25 _

HERTY LIMESTONE, w/ Numerous Chert Layers & Nodules & Occasional Shaley/Argillaceous Seams, Medium to Moderately Hard, Medium Bedded, Fine Crystalline

SPT 75/3" 2.5

(Continued Next Page)

NQ 100 1 (32)

4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

GEOTECHNICAL **BORING LOG**

	1		Т	5803 elephone: 417-864-6000	BOR	ING	LO	G				4
			F	ax: 417-864-6000							PAGE 2 C	OF 2
			ers Archi							-	eplacement Hospital	
PRO.	JECT	NO.	277340)	P		TLOC		N Tahle	quah, (Oklahoma	
HLAN ATERIAL DESCRIN ADDINA AD				 SAMPLE TYPE NUMBER 	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 FHL MC HL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION			
;0 _ _ _	CORE BARREL - 2" I.D.			CHERTY LIMESTONE, w/ N Nodules & Occasional Shale Medium to Moderately Hard Crystalline (continued)	lumerous Chert Layers sy/Argillaceous Seams , Medium Bedded, Fin	s & 3, ie	NQ 2	97 (78)			1 2 3 4	
35				Bottom of boreho		5.5 ft	NQ 3	100 (44)				_

GEOTECHNICAL 4168 W Kearney Street **BORING LOG** 65803 5 Telephone: 417-864-6000 Fax: 417-864-6000 PAGE 1 OF 1 PROJECT NAME W.W. Hastings Replacement Hospital CLIENT Childers Architect PROJECT NO. 277340 PROJECT LOCATION Tahleguah, Oklahoma DATE STARTED 12/2/21 COMPLETED <u>12/3/21</u> SURFACE ELEVATION 914.9 ft BENCHMARK EL. DRILL RIG 2019 CME-55 DRILLER MR **GROUND WATER LEVELS** AT TIME OF DRILLING None HAMMER TYPE Auto LOGGED BY BC CHECKED BY MM AT END OF DRILLING NOTES DRY UNIT WT (pcf) 20 40 60 8Ö 100 CORRECTED BLOW COUNTS (N VALUE) STRATA SYMBOL SAMPLE TYPE NUMBER RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING 80 METHOD 20 40 60 MATERIAL DESCRIPTION PL MC LL Unified Soil Classification System 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4 0 0.³8 ft CONCRETE AGGREGATE BASE SPT 8-23-36 4 (59) GRAVELLY LEAN CLAY, Brown Red, Stiff to Hard, 1 Moist (CL) ROTARY - 3.625" O.D SPT 5-8-6 1.5 2 (14)910 5 6.0 ft SHALE, Gray, Highly Weathered, Very Soft 23-63-60 SPT 4.5 3 (123)SPT 3-3-75/3" 4.25 9.8 ft 4 ARGILLACEOUS LIMESTONE, Dark Gray and Tan, 905 10 Fine Crystalline, Slightly Weathered, Medium to Moderately Hard NQ 100 1 (34) 13.3 ft -Highly Weathered & Very Soft Shale/Mudstone14.3 ft Layer Between 13.3' and 14.3' (12") 15.0 ft ARGILLACEOUS LIMESTONE, Dark Gray and Tan, 900 15 ġ Fine Crystalline, Slightly Weathered, Medium Hard **CORE BARREL - 2**" -Highly Weathered & Very Soft Shale/Mudstone^{16.7 ft} NQ 100 Layer Between 15.0' and 16.7' (20") 2 (60) LIMESTONE, Dark Gray, Slightly Weathered, Medium Hard 20

BORING NUMBER

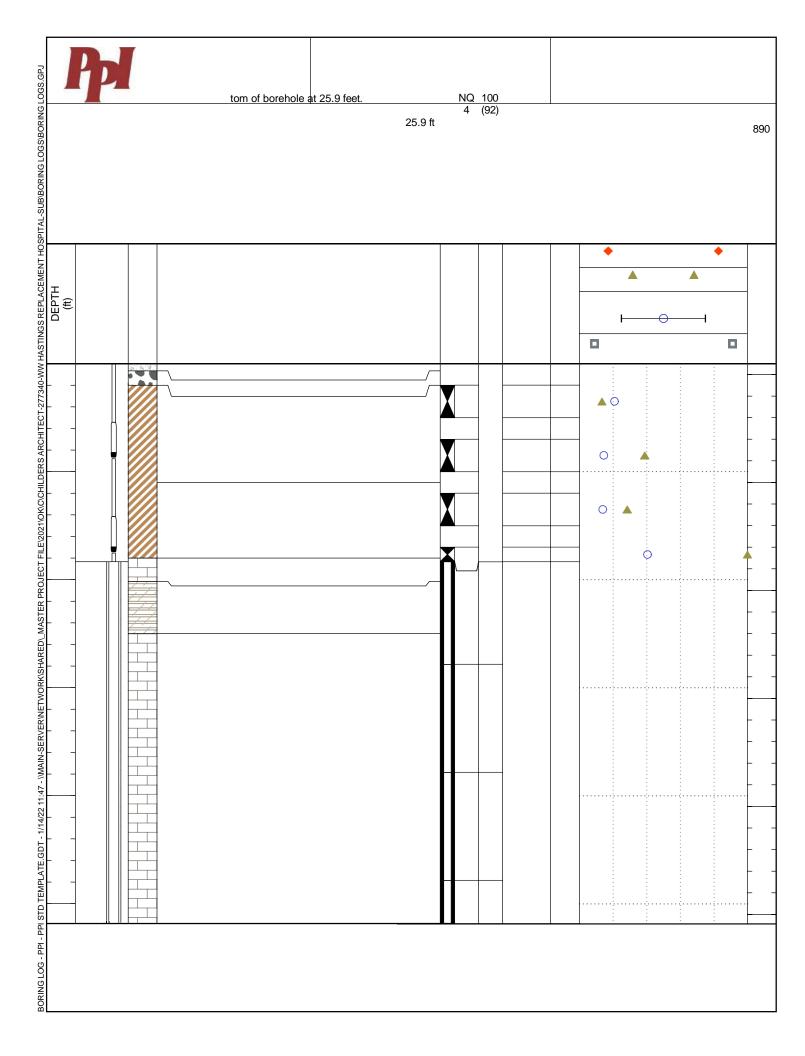
	PpI			
25 (ft) (ft)	Bottom of borehole at	25.2 ft NQ 100 4 (56) 25.2 feet.		890
			 •	•
DEPTH (ft)			 	
			0	
			0	
			0	

GEOTECHNICAL 4168 W Kearney Street **BORING LOG** 65803 6 Telephone: 417-864-6000 Fax: 417-864-6000 PAGE 1 OF 1 CLIENT Childers Architect PROJECT NAME W.W. Hastings Replacement Hospital PROJECT NO. 277340 PROJECT LOCATION Tahlequah, Oklahoma DATE STARTED <u>12/3/21</u> COMPLETED <u>12/3/21</u> SURFACE ELEVATION <u>915.5 ft</u> BENCHMARK EL. ___ DRILLER MR DRILL RIG 2019 CME-55 GROUND WATER LEVELS HAMMER TYPE Auto AT TIME OF DRILLING None CHECKED BY MM LOGGED BY BC AT END OF DRILLING NOTES DRY UNIT WT (pcf) 20 40 60 8Ö 100 CORRECTED BLOW COUNTS (N VALUE) RECOVERY % (RQD %) STRATA SYMBOL SAMPLE TYPE NUMBER POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING METHOD 80 20 40 60 MATERIAL DESCRIPTION PL MC LL Unified Soil Classification System 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4 0.3 ft 0 CONCRETE 1.0 ft 915 AGGREGATE BASE SPT 3-5-9 4.5 FAT CLAY, Trace Gravel, Red Gray, Stiff to Hard, 1 (14)Moist (CH) ROTARY - 3.625" O.D. -Tan Brown Below 3' SPT 6-17-23 4.5 2 (40) 5.5 ft 5 FAT CLAY, Shaley, Tan Brown, Very Stiff to Hard, 910 Moist (CH) SPT 15-15-14 4.5 3 (29) 9.0 ft SPT 3-75/2" 0.25 ARGILLACEOUS LIMESTONE, Gray & Tan, Me diu m ft 4 Hard, Medium Bedded, Fine Crystalline 10 SHALE, Brown Tan, Highly Weathered, Very Soft 905 -Wash Away from 10.9' to 11.7' (No Rod Drop) NQ 77 1 (44) 12.5 ft ARGILLACEOUS LIMESTONE, Gray, Medium to Moderately Hard, Medium Bedded, Fine Crystalline 15 CORE BARREL - 2" I.D. 900 NQ 100 (93) 2 20 895 -Wash Away from 20.7' to 20.9' (No Rod Drop) NQ 97 3 (95)

> 2 5

В

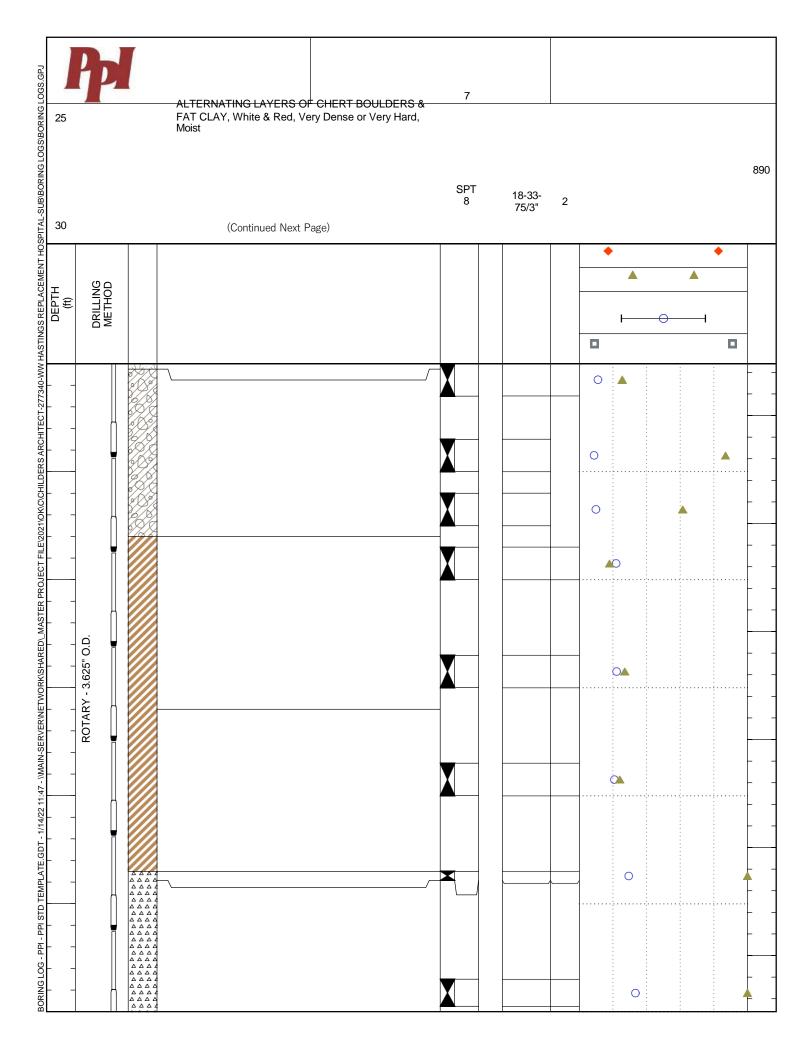
BORING NUMBER



6	168 W Kearney Street 5803 elephone: 417-864-6000	BEOTECH BORING			BOI	RING NUMBER	7
	ax: 417-864-6000					PAGE 1	OF 2
	tect						
PROJECT NO. <u>277340</u>		PROJE		ATION <u>Tahle</u>	quah, Ok	klahoma	
DATE STARTED 12/7/	21 COMPLETED <u>12/7/21</u>	SURFA		VATION <u>917.</u>	4 ft	BENCHMARK EL	
	DRILL RIG _2019 CME-55			R LEVELS	Nana		
HAMMER TYPE <u>Auto</u>							
	CHECKED BY MM		T END O	F DRILLING			
STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification Syste		SAMPLE TYPE NUMBER	RECOVERY % (RQD %) CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION (ft)
0	TOPSOIL, Brown, Soft, Moist, Grass Co	vered 0.3 ft	SPT	6-8-18		1 2 3 4	
	CLAYEY GRAVEL, With Sand, Red, Der Dense, Moist (GC)	nse to Very	1	(26)	1.75		
5			SPT 2	12-42-45 (87)			915
	FAT CLAY, Red, Very Stiff, Moist (CH)	8.0 ft	SPT 3	18-27-35 (62)			910
10			SPT 4	6-8-11 (19)	4.5		
			SPT	6-12-15			905
15	FAT CLAY, Shaley, Tan Gray, Very Stiff,	16.0 ft , Moist (CH)	5	(27)	4		
20			SPT 6	8-9-15 (24)	3.25		900
		23.5 ft					895

23.9 ft SPT 75/5" 2.25

CHERT BOULDER, Very Dense





GEOTECHNICAL BORING LOG

7

PAGE 2 OF 2

	LIENT <u>Chil</u>				_	W.W. Hast		eplacement Ho	ospital		
-277340-WW HASTINGS REPLACEMENT HOSPITAL-SUBBORING LOGS/BORIN COLUMN DEPTH	(ft) DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE	RECOVERY %	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 <u>4</u> 0 N 20 4	Me		ELEVATION (ft)
TINGS REPLACEME	0	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array}{} \\ \end{array}{} \end{array}{} \end{array}{} \\ \end{array}{} \end{array}{} \end{array}{} \\ \end{array}{} \\ \end{array}{} \end{array}{} \end{array}{} \\ \end{array}{} \end{array}{} \end{array}{} \\ \end{array}{} \\$ }	ALTERNATING LAYERS OF CHERT BOULDERS & FAT CLAY, White & Red, Very Dense or Very Hard, Moist (continued)					SHEAR S	TRENGTI 2 3	⊣ (ksf) 4	
-277340-WW HAS			33.6 Bottom of borehole at 33.6 feet.	S	PT 0	∧ 75/1"	1				885

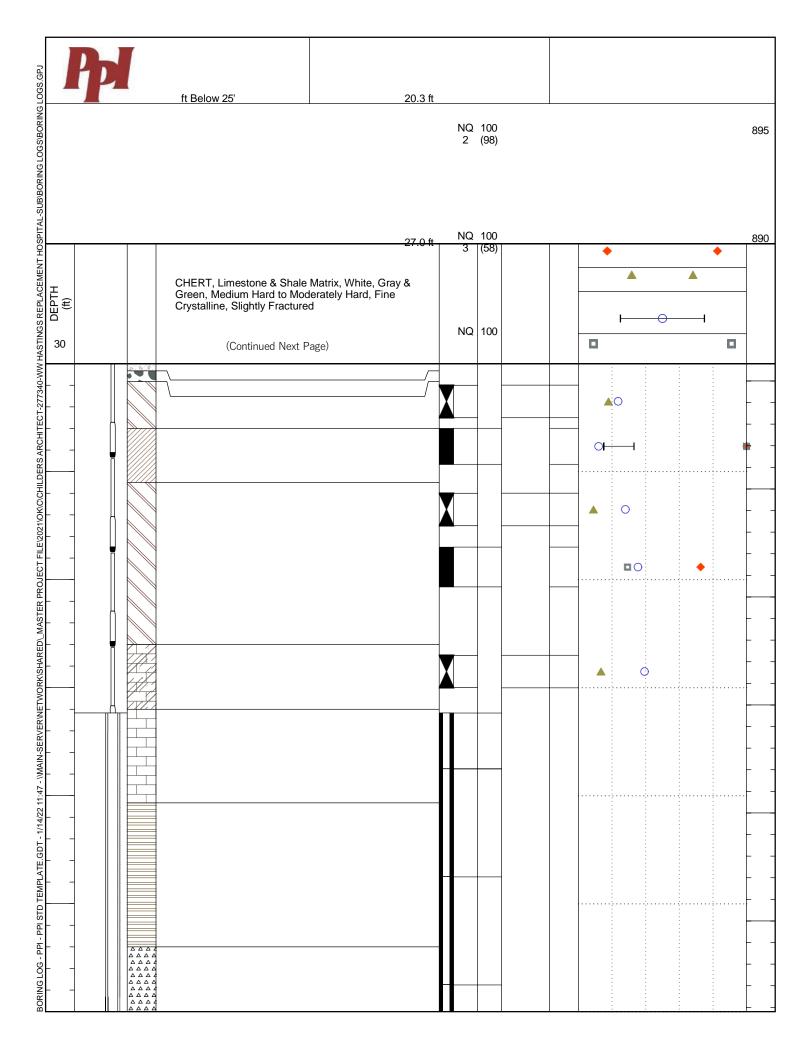
BORING NUMBER GEOTECHNICAL 4168 W Kearney Street **BORING LOG** 65803 8 Telephone: 417-864-6000 Fax: 417-864-6000 PAGE 1 OF 2 CLIENT Childers Architect PROJECT NAME W.W. Hastings Replacement Hospital PROJECT NO. 277340 PROJECT LOCATION Tahlequah, Oklahoma DATE STARTED <u>12/7/21</u> COMPLETED <u>12/7/21</u> SURFACE ELEVATION <u>915.8 ft</u> BENCHMARK EL. DRILL RIG 2019 CME-55 GROUND WATER LEVELS DRILLER MR HAMMER TYPE Auto AT TIME OF DRILLING None CHECKED BY MM LOGGED BY BC AT END OF DRILLING NOTES DRY UNIT WT (pcf) 20 40 60 8Ö 100 CORRECTED BLOW COUNTS (N VALUE) SAMPLE TYPE NUMBER STRATA SYMBOI RECOVERY % (RQD %) POCKET PEN. (tsf) N VALUE ELEVATION (ft) DRILLING 80 METHOD 20 40 60 MATERIAL DESCRIPTION PL MC LL Unified Soil Classification System 20 40 60 80 SHEAR STRENGTH (ksf) 1 2 3 4 0 0.³8 ft CONCRETE 915 AGGREGATE BASE SPT 6-8-11 4 LEAN TO FAT CLAY, Scattered Chert, Red Tan, Very (19)1 Stiff, Moist (CL-CH) 3.0 ft 10.13 LEAN CLAY, Trace Sand & Gravel, Brown Tan, Hard, ST 95 4.5 Moist (CL) 2 122.1406 1.46% Swell 2.00 TSF Swell Pressure 5.5 ft 5 ROTARY - 3.625" O.D. LEAN TO FAT CLAY, Brown, Tan & Red, Stiff, Moist 910 (CL-CH) SPT 5-5-5 1.25 3 (10)ST 100 1.5 4 10 905 13.0 ft ARGILLACEOUS LIMESTONE, Weathered, Dark Gray, Fine Crystalline, Soft to Medium Hard SPT 42-11-3 1.5 5 (14)15 16.0 ft 900 ARGILLACEOUS LIMESTONE, Dark Gray, Medium to Moderately Hard, Medium Bedded, Fine Crystalline NQ 100 1 (97) 20 Е SHALE, Dark Gray & Tan, Soft to Medium Hard, х **ARREL - 2" I.D** Medium Bedded t

Possible Marlstone

2 5

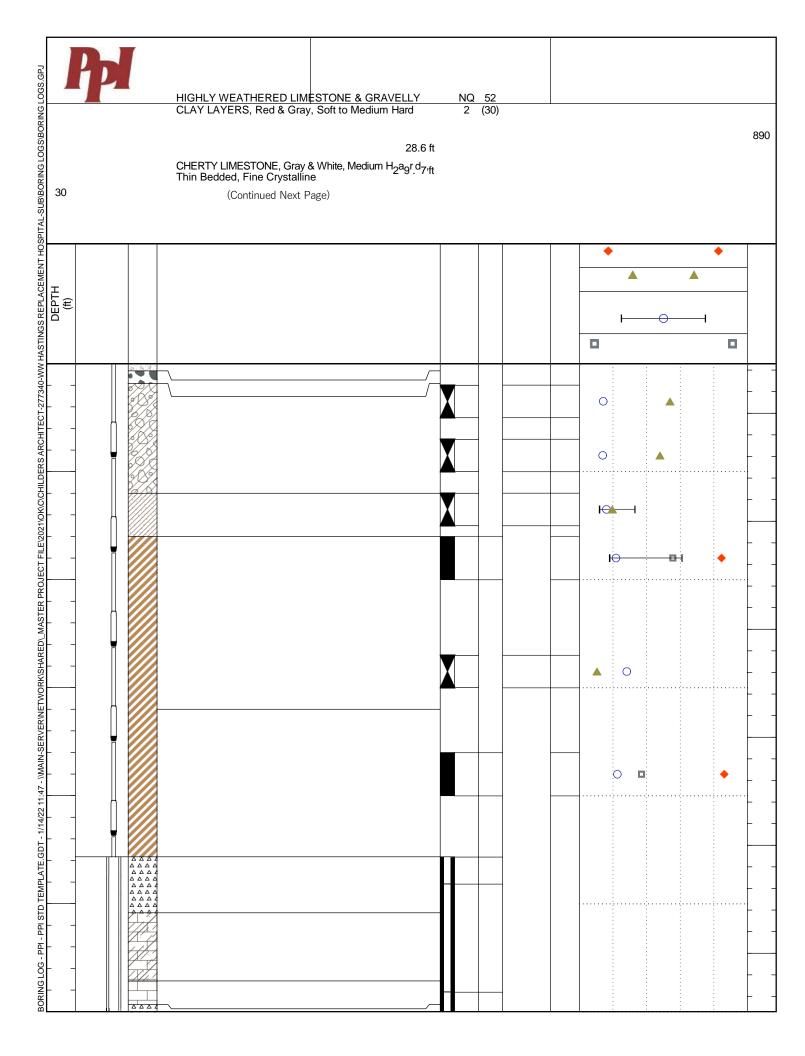
r

е



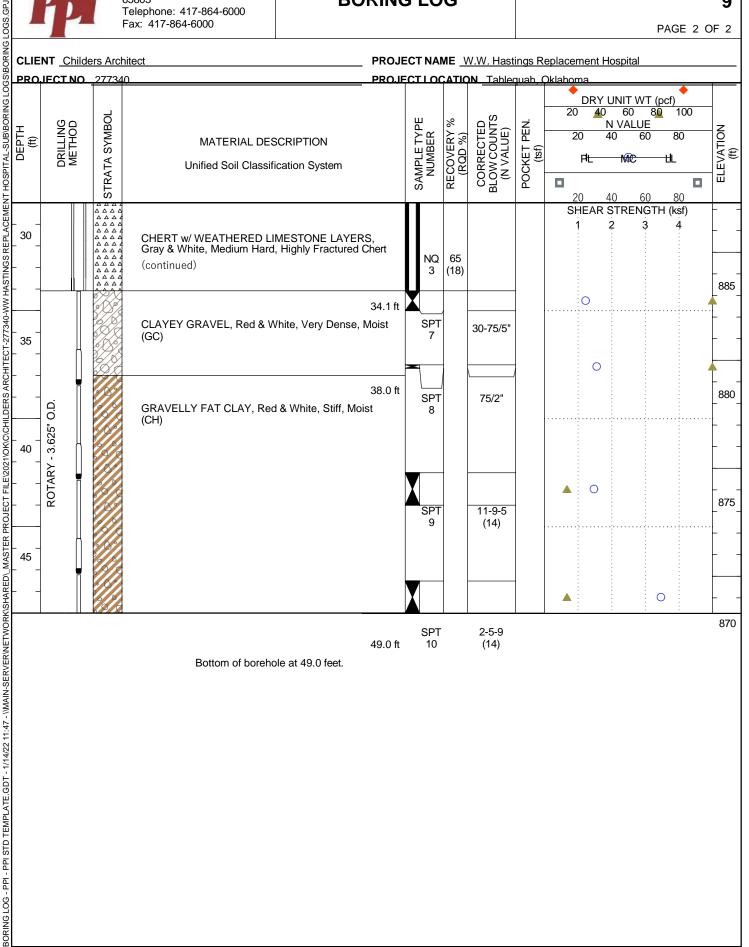
РЫ	4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000	GEOTEC BORIN				B	DRING NUMBER	8 2 OF 2
							eplacement Hospital	
PROJECT NO. 27 DELTH (t) DULT UN DULT UN DULT UN DULT	MATERIAL DESC	CRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	$\begin{array}{c ccccc} \bullet & \text{DRY UNIT WT (pcf)} \bullet \\ 20 & 40 & 60 & 80 & 100 \\ \hline 20 & 40 & 60 & 80 \\ \hline 20 & 40 & 60 & 80 \\ \hline \\ 20 & 40 & 60 & 80 \\ \hline \\ 20 & 40 & 60 & 80 \\ \hline \\ 20 & 40 & 60 & 80 \\ \hline \\ 1 & 2 & 3 & 4 \\ \hline \end{array}$	ELEVATION
	Bottom of boreho		<u>₩</u>					885

		6 T	168 W Kearney Stree 5803 elephone: 417-864-6	΄ ΒΟ					BOF	RING NUMBER		9
		F	ax: 417-864-6000								PAGE 1	OF 2
											I	
PRO	JECT NO.	277340			PROJE	ECTLO	CATIO	N <u>Tahle</u>	quah, Ok	klahoma		
DAT	E STARTE	D <u>12/6/</u> 2	21 COM	PLETED <u>12/6/21</u>	SURF	ACE ELE	EVATIO	ON <u>917.</u>	3 ft	BENCHMARK	EL	
			DRIL	L RIG 2019 CME-55					None			
LOG	GED BY E	SC	CHEC	CKED BY MM		AT END	of Dr	ILLING _				
NOT	ES DRILLING METHOD	STRATA SYMBOL	MATE	RIAL DESCRIPTION	-	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	N VALI 20 40 PL MC	80 100 UE 60 80 LL 60 80	ELEVATION (ft)
0			CONCRETE AGGREGATE BA	SE	0.3 ft 0.9 ft	SPT		9-27-27		1 2	3 4	
			CLAYEY GRAVEL Moist (GC)	., Red Brown, Very Dense to	Dense,	1		(54)	4.5			915
5					6.0 ft	SPT 2		17-21-27 (48)	4.5			
			SANDY LEAN CL/ Very Stiff, Moist (C	AY, Scattered Gravel, Red Ta L)	an, 8.0 ft	SPT 3		8-9-11 (20)	4.5			910
10	.625" O.D.		FAT CLAY, Tan, V 0.77% Swell 1.00 TSF Swell Pre	Yery Stiff to Stiff, Moist (CH)		ST 4	100		4.5			
15	ROTARY - 3.625" O.D				16.0 ft	SPT 5		3-5-6 (11)	1.25			905
20			FAT CLAY, Shaley	ν, Tan Gray, Stiff, Moist (CH)		ST 6	100		1.5			900
	Ġ		CHERT, White, Mo Slightly Fractured,	oderately Hard, Thin Bedded, Microcrystalline	22.8 ft	NQ 1	100 (0)					895
25	,RREL - 2" I.D				25.4 ft							





9



Γ	V		0.1		4168 W Kearney Street	GEO	TEC	INIC	AL		B	ORING NUM	I BER			
2					65803		RINC									10
5 0 0 0		l P	1		Telephone: 417-864-6000 Fax: 417-864-6000									DAC	GE 1 C	-
ר פ														FAC		л <u> </u>
	CLIE	NT <u>Ch</u>	ilde	ers Arcl	nitect		PROJE	ECT NAI	<u>NE V</u>	V.W. Hast	ings R	eplacemen	t Hospital			
	PRO	JECT N	0.	27734	10		PROJE	ECT LOO	CATIC	N Tahle	quah, (Oklahoma				
	DATE	E STAR	TE	D <u>12/9</u>	O/21 COMPLETED	12/9/21	SURF	ACE ELE	EVATI	ON <u>917.</u>	5 ft	BENC	HMARK E	EL		
1					DRILL RIG 20	19 CME-55					Nama					
			T	E <u>Auto</u>			,			RILLING	NONE	٠			•	
	LOG	GED B	Υ <u></u>	вс	CHECKED BY	MM	ļ		OF DI	RILLING _						-
	№ОТ 1. £		<u>)</u>													
	<u> </u>	DRII MF		L L						(0		20 L	Y UNIT W 40 60	<u>VI (pc</u>) 80	100	
				SYMBOL	MATERIAL DES			Е ТҮРЕ BER	ERY %) %)	CORRECTED BLOW COUNTS (N VALUE)	PEN.	2 0	N VALU 40 (JE 60 8	30	
									N		OCKET (tsf)	PL	MC	; LL		
-040	-			RATA	Unified Soil Classif	ication System	/	MUN	RECOV (RQI	- Rojz	POCI					יי דרב//
1-1-	-							0)	Ľ	Ξ Φ		20			30	_
	-		Π.									SHEA 1	R STREN 2	· · ·	(st) 4	L _
ARC -	0_		Π		TOPSOIL, Brown, Soft, Mois	st, Grass Covered	0.3 ft	SPT		3-3-8			4		- - - -	
					GRAVELLY LEAN CLAY, B	own Red, Stiff, Moi	st (CL) 2.0 ft			1					((41) –
			<u> </u>		LEAN CLAY, Red Gray, Stif	f to Very Stiff, Moist		X			s					
	_										Р				-	
	_		Π					▼	3	SP T 2	Т 0					8=5-5 _ (10)
	5								0		8	0			; ;	
х Ч	_								(SP						- 6-12
	_		П	A C			8.0 ft		С	Т3					. ((48) –
2	_	0.D.			CLAYEY GRAVEL, Red Bro	wn, Very Dense, Mo	oist		0							
	_	5ª O			(GC)			▼	n t	SP T 4						-21-50- (71)
	10	3.625"							i			A O				
	_	RY -	Ц				12.0 ft		n							
	_	ROTARY			FAT CLAY, Scattered Grave	l, Red Tan, Stiff to	√ery		u							
	-	С			Hard, Moist (CH)				e d	05					-	
	_							X	N	<u>SP</u> T 5		0				=6-8 _ (14)
- /+:-	15		<u> </u>						е						: : :	
4/27	_								х							
	_		Π						t P							
ם פו ביפר	_						19.0 ft	~	P	SP						
	_				CHERT, w/ Occasional Clay	Seams, White, Ver	у		g	T6					21	-75/5"_
	20		Н		Dense, Slightly Moist				e						: : :	
	-)					:		F -
	-												-			
	-							_		SPT 0					7	75/2"
	-		Ц							7			-			
Ž	25														:	

75/1"

3.25

1.5 9

2.75



10

	NT <u>Childe</u>					W.W. Hast		eplacement Hospital Oklaboma	
	DRILLING METHOD	P P P P P P P P	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CTED DUNTS UUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80	ELEVATION (ft)
			CHERT, w/ Occasional Clay Seams, White, Very Dense, Slightly Moist (continued)					1 2 3 4	
HI I EU I -27 / 340-WW MAS III			33.1 f Bottom of borehole at 33.1 feet.	sp ⁻ 9	ј го	75/1"			885

Γ	Y		2	/	4168 W Kearney Street	GEO	TEC	INIC	AL	ı	В	ORING	NUMB	ER			
25		4			65803 Telephone: 417-864-6000	BO	RINO	g lo	G								11
-090-			1		Fax: 417-864-6000										PAG	9E 1 C)F 2
			لمناط	lara Aral	aitaat	•					in an D		mont	loonitol			
9				lers Arcl . <u>27734</u>										ospital			
										<u>- ramo</u>	10011,	ondinio	114				
	DATE	STAF	RTE	ED <u>12/8</u>	3/21 COMPLETED	12/9/21	SURF	ACE ELE	EVAT	ION <u>916.</u>	1 ft	В	ENCHN	/IARK E	L		
	ווחר						CROW		ED I								
1				E Auto	DRILL RIG 20	19 CME-55				DRILLING	None						
												•	,			•	
	_OG	GED B ෆ	ץ _ ר	BC	CHECKED BY	MM	/		OF D	RILLING _							1
	ЧОТ L €		5												/T (n of)		1
	5		ШM	Ы				ш		S		20		UNIT W		100	
				SYMBOL	MATERIAL DE	SCRIPTION			ERY % 0 %)	ECTED OUNTS LUE)	PEN.		۲ 20 4	N VALU 40 6	1 E 50 8	30 🗖	TION (
L				is A	Unified Soil Classif			UPLE UMB		V O O O	POCKET (tsf)		PL	MC	LL	-	
-040	-			LRA				₹Ż	RECOVII (ROD	CORRE(BLOW OC (N VAL	00	0.	-				<u> </u>
	_		ļ	S					-					40 6 STREN		30 sf)	
	0				0011005555		0.4 ft		-						· ·	4	
	0 -		Π		CONCRETE AGGREGATE BASE		0.7 ft	Ă				▲-	0			•	015
					CLAYEY GRAVEL, Red, Ve	ry Dense, Moist (G0		SPT 1		11-30-47 (77)	3						[.] –915-
							3.0 ft						\mathbf{O}			•	
	_		$\left[\right]$		LEAN TO FAT CLAY, Scatte	ered Gravel, Red Ta	ın &					-	Ŭ				
	_		Π		Gray, Stiff to Very Stiff, Mois	st (CL-CH)		▼		∮ <u>SPT 7</u> P			0				2-6-8 (14) _
	5								-	T 2			0				·L _
Х Т Т	_								3		00						
	-		Ϊ						0	s	96						
	-	0.D.	H						(T SPT 8		С	× ×			^ 5	-8-9 -
	_	3.625" (-c-	-						(17) _
	10									P							·
	-	ROTARY	П						n t	T 4							
Ц Х Ц	-	RO ⁻							i								
	-								n		100		0			4	≜ -
- /+	15				CHERT, w/ Scattered Clay S	Seams & Lavers W/	15.0 ft		u e							•	
27			Н		Red, Medium Dense to Very	Dense, Slightly Mo	oist		d	S T)	·]·····	· · · · · · · · · · · · · · · · · · ·		
- 1/14/									N	5						•	
פר									e							7	5/1"
								X	1 X t				0			1	
	20		Н						P				:				. –
	_								ag	5			•			•	
	_		Ĩ						g	P T							
- 	-								е)	6		-					69-71_
	-		Д					X						0		: (1	140)
D D	25								1			1	<u>:</u>	<u>:</u>	<u>:</u>	<u>.</u>	



0.75



4.5

> 4.5 5

1.75

0.5



4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

GEOTECHNICAL **BORING LOG**

BORING NUMBER

	P	F	elephone: 417-864-6000 ax: 417-864-6000	BORIN								PAGE 2	11 OF 2
		Iders Archi					N.W. Hast	-			ospital		
PRO (1) (1)	DECT NG DRILLING METHOD	C 2777340 TOBINO	MATERIAL DE	SCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ 20 20 20	DRY U 40 N D 4 FIL		80 100 E 0 80 HL 0 80	ELEVATION
 	-		CHERT, w/ Scattered Clay S Red, Medium Dense to Very (continued)	Seams & Layers, White & / Dense, Slightly Moist			A	_	SH 1		5TREN(2	GTH (ksf) 3 4	88
	O.D.				SPT 9	0	75/1"		- - - - - - - - - - - - - - - - - - -				
- 35 - 	ROTARY - 3.625"				SPT	-	15-6-5	0.25	•		0		- - 88
						-	(11)	0.23		0			
	-				SPT 11		15-75/3"						-
45				48.2 f		I							87
			Bottom of boreh		SPT 12	0	75/2"						

			_		GEOTE	ECH	NIC	AL		B	ORING NUMBER	ł		
	D .			4168 W Kearney Street 65803	BORI									12
				Telephone: 417-864-6000	DOM			Ŭ						12
				Fax: 417-864-6000								PAG	GE 1 C)F 2
								·						
												spital		
PRO	JECTI	NO.	27734	0	Pr	ROJE		AIIC	N laneo	quah, (Jklahoma			
DAT	E STAF	RTE	D <u>12/8</u>	COMPLETED	<u>12/8/21</u> SL	URFAG	CE ELE	VATI	ON <u>918.(</u>) ft	BENCHMA	RK EL		
			E_Auto	DRILL RIG <u>20</u>	<u>19 CME-55</u> GF				EVELS RILLING	None				
													٠	
LOG	GED B	Y <u>I</u>	BC	CHECKED BY	MM	A 1	F END (of Di	RILLING _					1
	ES <u>≱t</u>	<u>jle l</u>	ost circ	struggling to pull out tricone and	<u>d get spoon down</u> . Offs	set due	e to firs	: hole	being cro	oked a	and collapsing. N	lo luck on s	econd h	ole.
E E E E E E E	DRILL	<u>ц</u>										NT WT (pcf))	
		2	30L					%	TS D		20 +0 NI \	60 80	100	
			SYMBOL	MATERIAL DES	CRIPTION		Е ТҮРЕ BER	ЕRY () %)	CTED OUNT(LUE)	FEN.	20 40		80 🗖	NOIL (
				Unified Soil Classifi				29	DRRE(DW OC N VAL	А Ш Ш Ш Ш Ш	PL	MC ELL	-:	₩£
+ -			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				уŽ	RECOV	BLOW	POCKEI (tst				ELEVA (f
			S Sol				X ^o	ш	<u> </u>		O 20 40	-,-	80	
- I		Н				ľ					SHEAR ST	RENGTH (I	kst) A	
0				CONCRETE	0).3 ft).9 ft							7	
		Π	1 t	AGGREGATE BASE	·		SPT		18-21-53		0		4	•
			Ĩ				_0		10 21 00					
				CLAYEY GRAVEL, Red & Ta	an, Very Dense, Moist		1		(74)				:	
		Н		(GC)			Ň.							915
						Γ	SPT		30-42-					915
		H			5	5.0 ft	2		75/5"					L _
5				FAT CLAY, Trace Gravel, Re	ed Tan, Very Stiff, Mois	st					0		•	
				(CH)			SPT		12-9-9					
		Д					3		(18)	2.5				
	О. О.	H					<u>от</u>						-	910
	2						ST 4	54		4.5				
10	3.625"										~			L _
						Γ								
Γ -	ROTARY													F -
- 1	No	Ų												905
							SPT		5-9-15	2.75				
							5		(24)	2.13	0			- 🛉
15						ſ						·····		L _
		Π												
[Γ -
F -								1					:	
				CHERT, Dark Gray, Very De	nse			8			0		SPT	8
				enzer, Banceray, vory De				. s 0	PT 6				4	F -
		Н						f				·····		.L _
20					30			t					:	L
ſ -		Π			30	'								[
+ -					(Co	onti			DT 7					F -
- 1					nue	ied -		5	PT 7				4	<u> </u>
		Н			Ne	ext							:	
25					Pa	age)							:	

30-75/4"

900

5-75/5" 895

75/1"

Р

4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

GEOTECHNICAL BORING LOG

12

PAGE 2 OF 2

CLIENT <u>Childers Architect</u>

PROJECT NAME W.W. Hastings Replacement Hospital

PRO	JECTNO	27734	0 PRO.II	ECTLO		N Tableo	uuah (Oklahoma			
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 20	AY UNIT W 40 60 N VALU 40 6 . Me 40 6	80 100 E 0 80 — UL	ELEVATION (ft)
 30 	O.D.		CHERT, Dark Gray, Very Dense (continued)						AR STREN 2		
	ROTARY - 3.625"		32.0 ft FAT CLAY, Scattered Gravel, Red, Medium Stiff, Moist (CH)	SPT	-	9-5-3	0.25			D	
	L L L L L L L L L L L L L L L L L L L		36.0 ft	9		(8)					

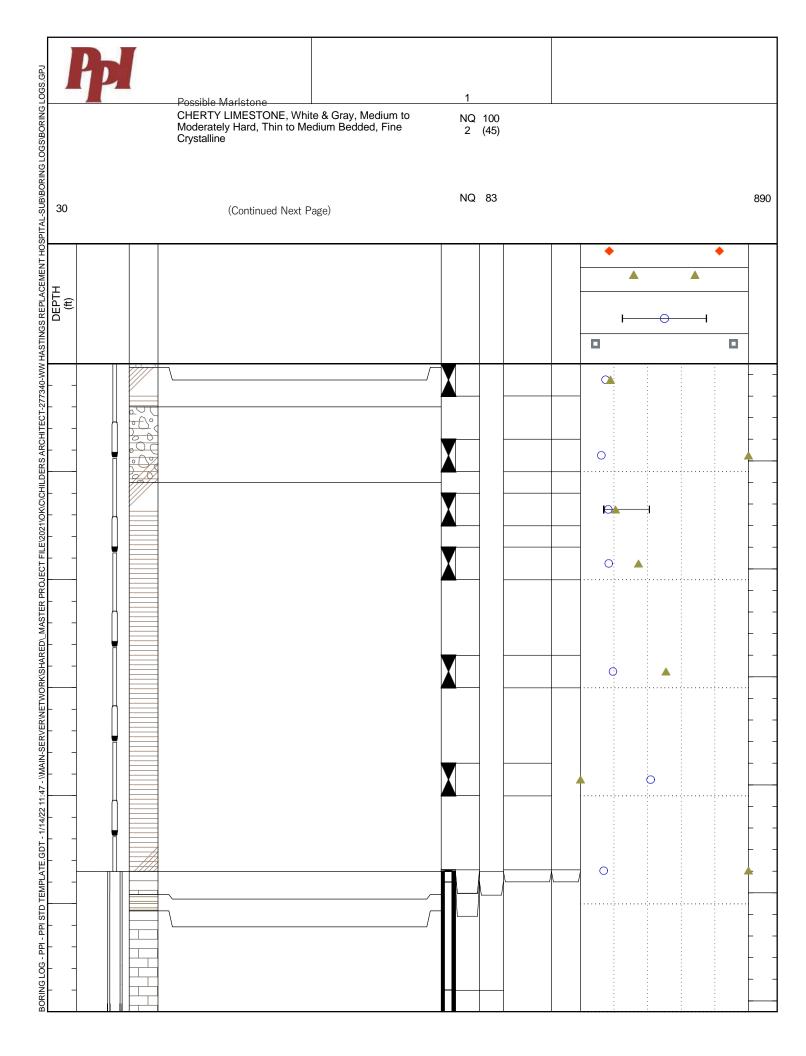
CHERT, White Gray, Very Dense

38.0 ft

Bottom of borehole at 38.0 feet.

BORING LOG - PPI STD TEMPLATE.GDT - 1/1422 11:47 - \WAIN-SERVER/NETWORK/SHARED_MASTER PROJECT FILE/2021/OK/CICHILDERS ARCHITECT-277340-WW HASTINGS REPLACEMENT HOSPITAL-SUB/BORING LOGS/BORING LOGS/B

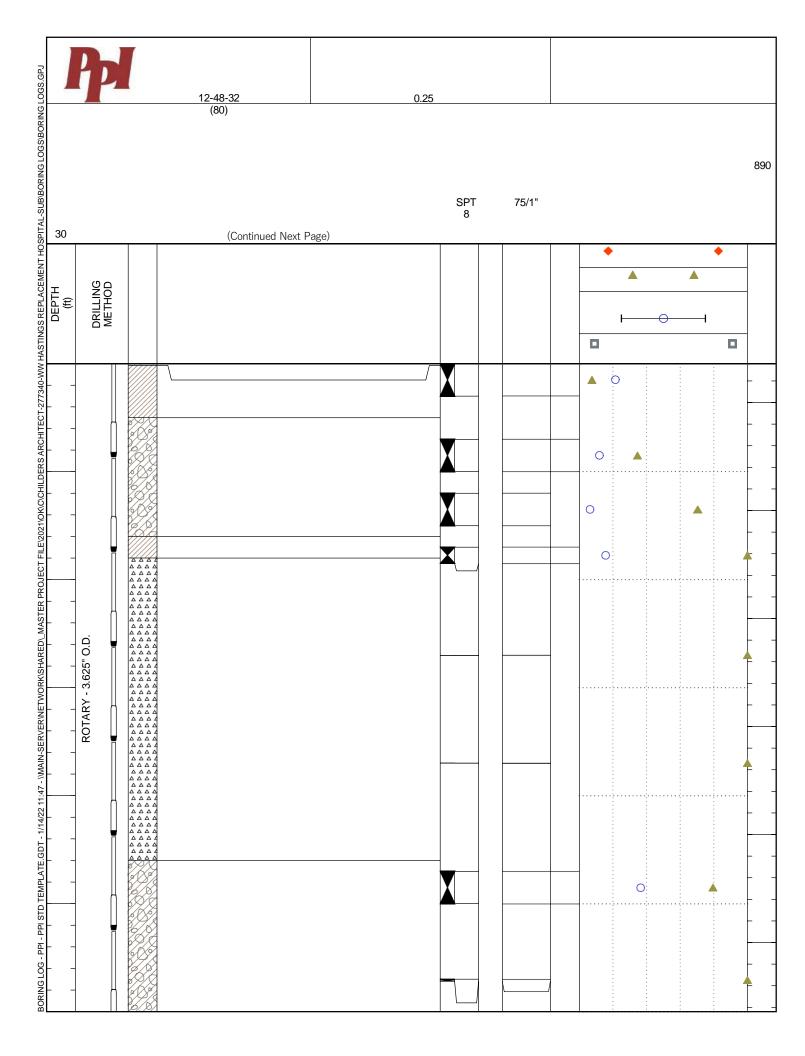
		6	168 W Kearney Street 5803 elephone: 417-864-6000	GEOTEC BORIN				BOF	RING NUMBER	13
			ax: 417-864-6000						PAGE	1 OF 2
CLIE	NT Childe	ers Archi	tect	PROJ	JECT NAI	ME <u>W</u>	.W. Hasti	ngs Rep	placement Hospital	
PRO	JECT NO.	277340		PROJ	JECT LOO	CATIO	N <u>Tahleo</u>	<u>uah, Ok</u>	klahoma	
DAT	E STARTE	D <u>12/7/</u>	21 COMPLETED <u>12/8/2</u>	<u>1</u> SURF	ACE ELE	EVATIO	DN <u>919.5</u>	5 ft	_ BENCHMARK EL	
			DRILL RIG 2019 CM		JND WAT			None		
100	GED BY <u>I</u>	30	CHECKED BY MM							
	ES Slippe				ATEND					,
	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPT		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION (ft)
0			TOPSOIL, Brown, Soft, Moist, Gras	s Covered 0.2 ft	t SPT		5-11-8		1 2 3 4	
			LEAN CLAY, Scattered Gravel, Bro	wn, Moist (CL) 2.0 f	1 t		(19)	2.25		
			CLAYEY GRAVEL, Brown Red, Ver (GC)	y Dense, Moist						
5				5.5 ft	SPT 2 t		20-56-48 (104)	3		915
			LEAN CLAY, Red, Tan & Gray, Ver Moist (CL)	/ Stiff to Hard,	SPT 3		6-9-12 (21)	4.5		
10	5" O.D.				SPT 4		11-17-18 (35)	4.5		910
15	ROTARY - 3.625" O.D		-Shaley Below 13'		SPT 5		18-30-21 (51)	4		905
20			-Very Soft Below 18.5'		SPT 6		0-0-0 (0)			900
25	ARREL - 2" I.D.		ARGILLACEOUS LIMESTONE, Gra Crystalline, Medium Hard, Thin Bed SHALE, Highly Weathered, Brown,	ded 25.3 ft	SPT	100 (100)	75/1"	0.25		895



	P		4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000		DTECH DRING	-			B	ORING NUI	MBER	F	PAGE 2 C	13 DF 2
	NT <u>Childe</u> JECT NO.				_			V.W. Hast		eplacemen Oklahoma	t Hospi	tal		
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DES Unified Soil Classif			SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		40 40	2 80 LUE ▲ 60 C	80 LL -1 ₈₀	ELEVATION (ft)
30					31.0 ft	3	(71)			-	-			
			Bottom of boreh	ole at 31.0 feet.										

6		TECH				BO	RING NUMBER		20
	ax: 417-864-6000						I	PAGE 1	OF 2
CLIENT <u>Childers Archi</u> PROJECT NO. <u>277340</u>	tect						placement Hospital		
DATE STARTED 12/9/3	21 COMPLETED <u>12/10/21</u>	SURFA	ACE ELE	EVATIO	DN <u>916.8</u>	3 ft	_ BENCHMARK EL.		
DRILLER <u>MR</u> HAMMER TYPE <u>Auto</u>	DRILL RIG 2019 CME-55					None			
	CHECKED BY _MM	A	AT END	of Dr	LLING _				
STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (20 40 60 80 N VALUE 20 40 60 PL MC 20 40 60 SHEAR STRENGT	80 LL 80	ELEVATION (ft)
0	TOPSOIL, Brown, Soft, Moist, Grass Covered	0.1 ft	SPT		2-3-5		1 2 3	4	
	LEAN CLAY, Scattered Gravel, Dark Brown, Mo Stiff, Moist (CL)	edium	1		(8)	0.75			
5	CLAYEY GRAVEL, With Sand, Red, Dense to V Dense, Moist (GC)	2.5 ft √ery	SPT 2		11-17-18 (35)	4.5			915
		8.0 ft	SPT 3		17-36-35 (71)				910
10	LEAN CLAY, Red, Tan & Gray, Hard, Moist (C CHERT, White, Very Dense	L) 9.0 ft	SPT 4		14-75/3"	3			
15			SPT 5		75/0"				905
20			SPT 6		75/0"				900
	CLAYEY GRAVEL, Occasional Boulders, Red	23.0 ft &							895

25 SPT 7

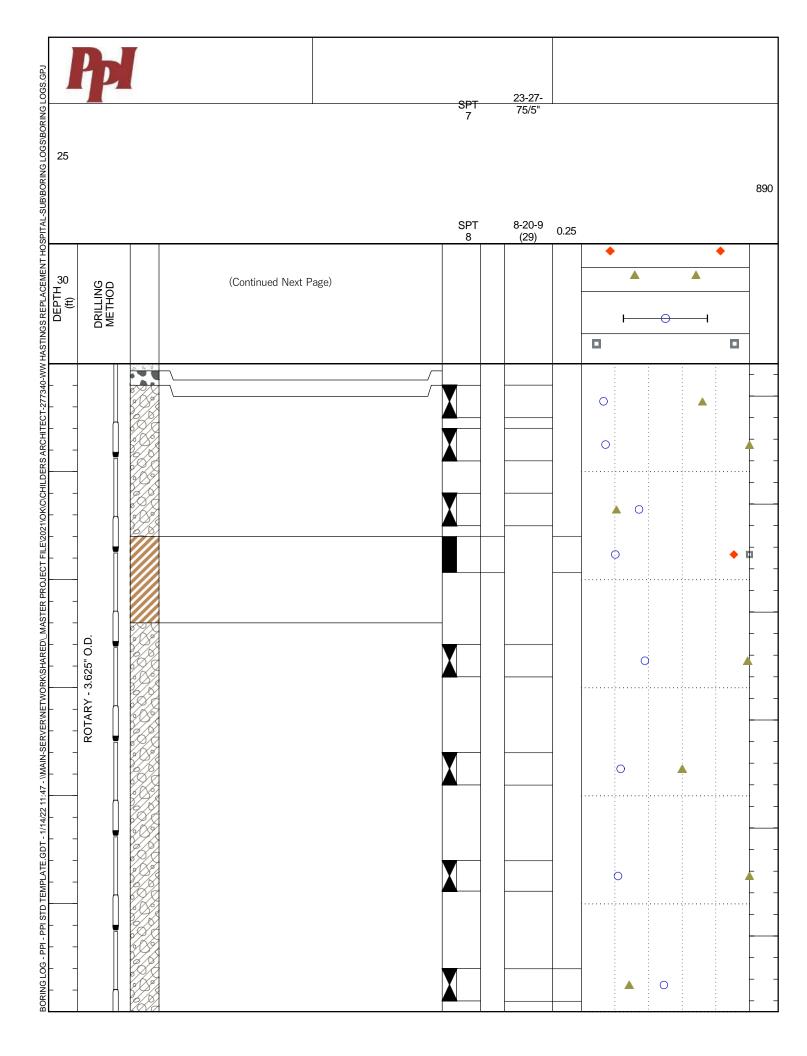




	Childers A	rchite	ect	PRO		ME V	VW Hast	inas Ri	eplacement He	nsnital		
	<u>NO 277</u>							-		oopitai		
	METHOD STRATA SYMBOL		MATERIAL DES Unified Soil Classifi	CRIPTION	щ	RECOVERY % (RQD %)	S	POCKET PEN. (tsf)	DRY L 20 40 N 20 4 Fl 20 4 20 4 20 4 20 4	MC 0 60	30 100 80 ttL 80	ELEVATION
30 35 35 37 37 37 37 37 37		9 8. * 0 * 1 * 0 * 1 * 0 * 1 * 0 * 1 * 0 * 1 * 0 * 1 * 0 * 1 * 0 * 1 * 0 * 1 * 0 * 0	CLAYEY GRAVEL, Occasior White, Dense to Very Dense (continued)	hal Boulders, Red &	SPT 9 SPT 10 SPT 11		45-57-72 (129) 5-12-23 (35) 15-23-32 (55)	0.5			4 4	
-						-			0			87
		-			SPT		23-24-26	1				_ <u></u>
50			Bottom of boreho	50.0 le at 50.0 feet.	ft 12		(50)					

6: T	5803 BC	DTECI DRING				BO	RING NUMBER	21
F	ax: 417-864-6000						PAGE	1 OF 2
CLIENT Childers Archi	tect	PROJ		ME <u>V</u>	/.W. Hasti	ngs Rep	placement Hospital	
PROJECT NO. 277340		PROJE	ECTLO	CATIO	N Tahleo	<u>luah, Ok</u>	klahoma	
DATE STARTED 12/13	/21 COMPLETED <u>12/13/21</u>	SURF	ACE ELE	EVATI	ON <u>916.5</u>	i ft	BENCHMARK EL.	
DRILLER <u>MR</u> HAMMER TYPE <u>Auto</u>	DRILL RIG _2019 CME-55		ND WAT		EVELS	None		
	CHECKED BY _MM	/	AT END	of Df	RILLING _			
STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	_	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION (ft)
0	CONCRETE AGGREGATE BASE CLAYEY GRAVEL, w/ Scattered Clay and Che Layers, Red, Brown & White, Medium Dense t Dense, Moist (GC)		SPT 1 SPT 2		24-27-45 (72) 27-45-68 (113)		1234	915
5	FAT CLAY, Trace Gravel and Sand, Red and T Hard, Moist (CH)	8.0 ft Гап,	SPT 3 ST 4	95	20-11-11 (22)	4.5		910 5.13
10	CLAYEY GRAVEL, w/ Scattered Clay and Che	12.0 ft ert						905
	Layers, Red, Brown & White, Dense to Very D Moist (GC)		SPT 5		38-60-39 (99)			
15								900
			SPT 6		18-35-26 (61)			

SPT	18-3
6	(61





LOGS.GPJ

4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

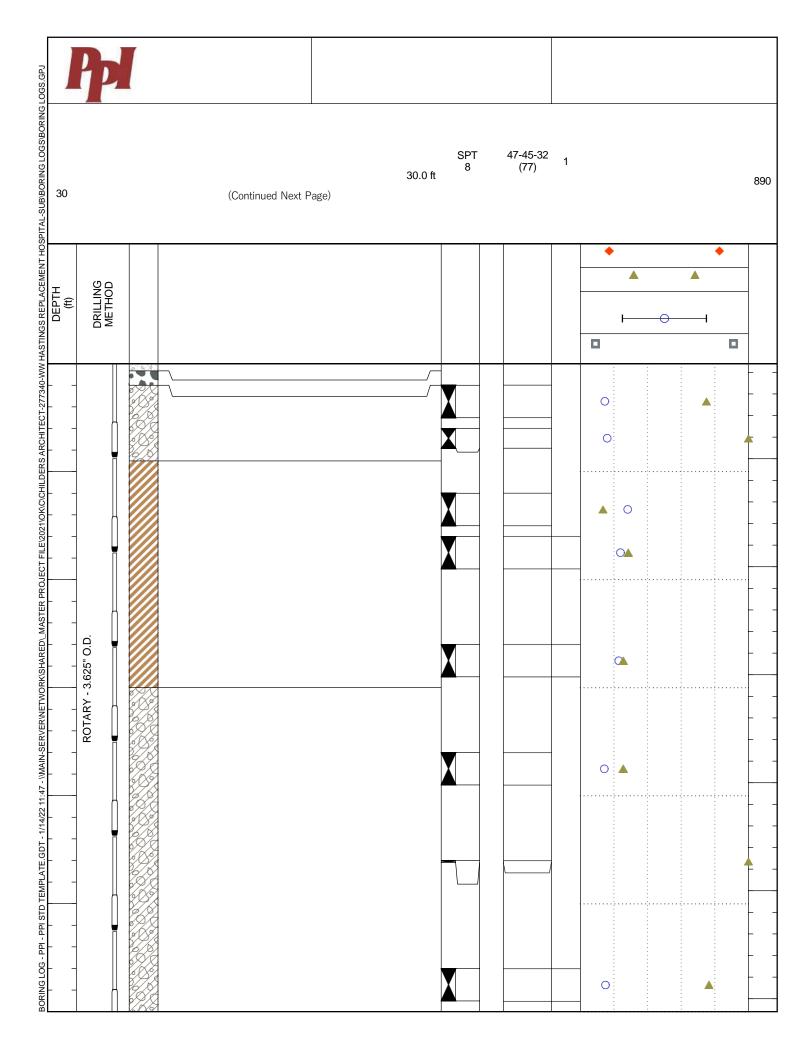
GEOTECHNICAL BORING LOG

21

	NT <u>Childe</u> JECT NO.						-	eplacement Hospital Oklahoma	
DEPTH (ff)	METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	S	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PIL MIC LIL 20 40 60 80	ELEVATION
30			CLAYEY GRAVEL, w/ Scattered Clay and Chert Layers, Red, Brown & White, Dense to Very Dense, Moist (GC) (continued)	SPT 9	0	75/1"		SHEAR STRENGTH (ksf) 1 2 3 4	- 888 - - -
40	ROTARY - 3.625" O.D.			SPT 10		11-14-18 (32)	1		- 88
- - 45 -				SPT 11	0	75/2"			-
50			50.0 ft Bottom of borehole at 50.0 feet.	SPT 12		11-15-12 (27)	0.25		87

	65803 B(Telephone: 417-864-6000	OTECH ORING				BOI	RING NUMBER	22
	Fax: 417-864-6000						PAGE 1	OF 2
CLIENT Childers Arc	hitect	_ PROJE		ME <u>V</u>	/.W. Hast	ings Rep	placement Hospital	
PROJECT NO. 27734	10	_ PROJE	ECTLO	CATIO	N Tahleo	klahoma		
DATE STARTED <u>12/</u>	14/21 COMPLETED <u>12/14/21</u>	SURF#	ACE ELE	EVATI	DN <u>919.</u> 4	4 ft	BENCHMARK EL.	
DRILLER <u>MR</u> HAMMER TYPE <u>Auto</u>	DRILL RIG _2019 CME-55					None		
		-						
	CHECKED BY MM		AT END	of Df	RILLING _			
NOTES	MATERIAL DESCRIPTION Unified Soil Classification System	_	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION (ft)
0	CONCRETE	0.3 ft 1.0 ft					1 2 3 4	
	AGGREGATE BASE	1.0 1	SPT		26-39-36			
	CLAYEY GRAVEL, w/ Sand & Chert Cobbles Brown, & Gray, Very Dense, Moist (GC)	, Red,	1		(75)			
			SPT 2		38-75/5"			
5	FAT CLAY, Scattered Gravel, Red Tan & Gra Very Stiff, Moist (CH)	4.5 ft y, Stiff to	_					915
			SPT 3		5-6-8 (14)			
10			SPT 4		18-14-15 (29)	1.5		910
15	CLAYEY GRAVEL, w/ Sand & Chert Cobbles Tan Gray, Dense to Very Dense, Moist (GC)	15.0 ft , Red,	SPT 5		6-5-21 (26)	2.25		905
20			SPT 6		15-15-11 (26)			900

SPT	75/1"
7	





		ders Archi	tect	•		/F \	//\// ∐っ <u>ი</u> +	ince P	Penlacement Hospital		
		277340						-	eplacement Hospital		
UEPIH (ft)	DRILLING	STRATA SYMBOL	MATERIAL DES Unified Soil Classific		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 40	8 <u>0</u> 100 JE 60 80 ──────────────────────────── 60 80	ELEVATION
30 _			CHERT, White, Very Dense						SHEAR STREN 1 2	3 4	_
	RY - 3.625" O.D.	$ \begin{array}{c} \triangle \land \triangle \land \land \\ \triangle \land \triangle \land \land \\ \triangle \land \triangle \land \land \land \\ A \land \triangle \land \land \\ A \land \triangle \land \land \\ A \land \triangle \land \land \\ A \land A \land \land \\ A \land A \land \land \\ A \land A \land A$			SPT 9	0	75/1"				
- - 40	ROTARY	$\begin{array}{c} \Delta \land \Delta \land \\ \Delta \land \Delta \land \land \\ \Delta \land \Delta \land \land \\ \Delta \land \Delta \land$			SPT 10		75/0"				88
			Bottom of borehol		3.2 ft SPT 11	0	75/2"				

LUGS.GPJ	4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000 JENT Childers Architect					TECI RINO				B	ORING NUMBE		PAGE 1 O	23 DF 2	
	NT Chi	lde	ers Arc	hitect		PROJECT NAME _W.W. Hastings Replacement Hospital									
ŋ	JECT N														
	E STAR	TE	D <u>12/</u>	15/21 COMPLETED	12/15/21	SURF	ACE ELI	EVAT	ION <u>916.</u>	5 ft	BENCHM/	ARK EL.			
4	LER <u>M</u>			DRILL RIG 20	019 CME-55	_ GROUND WATER LEVELS AT TIME OF DRILLING									
											•		•		
ן LOG געסד	GED BY FS 보유	<u> </u>	<u> 3C</u>	CHECKED BY	MM	1	AT END	OFD	RILLING _		_		<u> </u>		
DEPT	DRILLING METHOD		Ъ				ш	%	S	7	N	NIT WT () 60 80 VALUE			
HASII			SYMBOL	MATERIAL DES	SCRIPTION		E TYPE BER	S) (%	CTED OUNTS LUE)	T PEN. f)	20 40		80	NOIL (
MAN-01			RANK A	Unified Soil Classif	ication System		NUM	RECOVI (RQD	CORRE(BLOW OC (N VAL	POCKET (tsf)	PL	MC	LL	ELEVA	
17			R.]	X	R	BLOC	Ъ	20 40) 60	80	<u> </u>	
											SHEAR S	-	H (ksf) 4		
				CONCRETE		0.4 ft 0.6 ft					0	9			
				AGGREGATE BASE			SPT		21-41-68						
				CLAYEY SAND, w/ Gravel, Moist (SC)	Red Brown, Very De	ense,	Y	1		1	H O 🔺	d , 1			
]								S	8	V e	SPT 7		
							X			P T		r y	0117		
5						<u>6.0 ft</u>		1		2	t i	D			
				FAT CLAY, w/ Gravel, Red	Tan, Hard, Moist (C	H)					Ŭ Ĥ	n s e			
	Ö.D.									S		0	SPT 8		
	25" O]				10.0 ft			30		₿ <mark>.</mark>		4		
10	- 3.625"			CLAYEY GRAVEL, w/ Cher Red & White, Dense to Very	t Boulders & Clay La	ayers, bist			(Co ntin	s	• O				
	ROTARY			(GC)					ued		Ċ Ċ				
	S No								Nex t		a s				
							X		Pag		i o 🔺 🔿				
15								1	e)		n a				
- 1										S	Ç	-			
		1								ר נ	a				
							Y	1			y S e 🎽				
								-			e a m				
											S	-	-		
- - 										s	, W h	-	-		
								-			r i t	-	4		
25				4							e &	-	-		
<u>-</u>		-		a			1	1	1		R	·····	:		

(109) 32-54-47 (101)		195 165. 5
11-15-24 (39) 38-30-27	3	91
(57)	2.25	0
44-74- 75/0"		90 5
20-11-17 (28)	2.25	90 0
33-30-11 (41)	0.25	89 5
75/0"		80



23

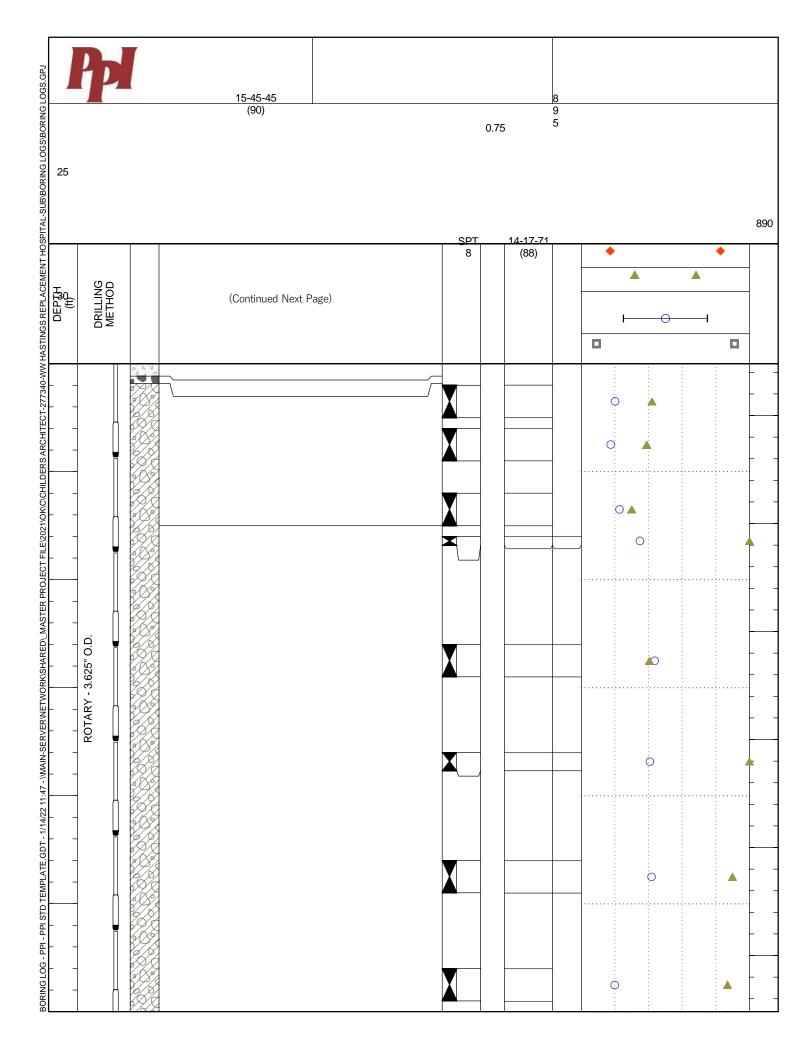
PAGE 2 OF 2

CLIENT <u>Childers Architect</u>

PROJECT NAME W.W. Hastings Replacement Hospital

PROJECT NO 277340 PROJECT LOCATION Tablequab, Oklahoma									
DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC ±L 20 40 60 80 20 40 60 80	
 	ROTARY - 3.625" O.D.	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} $	CHERT, w/ Occasional Clay Seams, White & Red, Very Dense (continued)	SPT 9		75/2"		SHEAR STRENGTH (ksf)	
	· I I		38.1 ft Bottom of borehole at 38.1 feet.	SPT 10		75/1"		880	

	4168 W Kearne 65803 Telephone: 417		GEO BOI	rech Ring				BOI	ring nui	IBER		24	
	Fax: 417-864-6	000									PAGE 1	I OF 2	
CLIENT Childers A	rchitect			PROJE		ME <u>N</u>	/.W. Hast	ings Rep	blacemen	t Hospital			
PROJECT NO. 277	340			PROJECT LOCATION Tahlequah, O						Iklahoma			
DATE STARTED <u>12</u>	2/14/21	COMPLETED 12/15/2	21	SURFA	CE ELI	EVATIO	DN <u>917.</u> 4	4 ft	_ BENC	HMARK EL			
DRILLER MR		DRILL RIG 2019 CME	<u>-55</u>	GROUN	ID WAT	ER LE	VELS						
HAMMER TYPE Au	ito			Α	TTIME	OFD	RILLING	None					
LOGGED BY BC		CHECKED BY MM											
NOTES		MATERIAL DESCRIPT	ION		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	20 4 20 PL 20 SHEA	N VALUE 40 60 MC 40 60 R STRENG	80 100 E D 80 LL B 80 GTH (ksf)	ELEVATION (ft)	
0	CONCRETE AGGREGA			0.6 ft 0.9 ft	SPT		9-18-24		1	2 3	4		
	CLAYEY G Dense, Moi	RAVEL, With Sand, Red st (GC)	, Tan & Whit	e,	1 SPT 2		(42) 12-15-24 (39)					915	
5	CLAYEY G Red & Whit (GC)	RAVEL, w/ Chert Boulde e, Dense to Very Dense,	rs & Clay La , Slightly Moi	7.5 ft yers, st	SPT 3 SPT 4		15-14-17 (31) 75/5"	0.25				910	
10					SPT 5		9-20-21 (41)	1				905	
					SPT 6		27-75/4"	1.25				900	





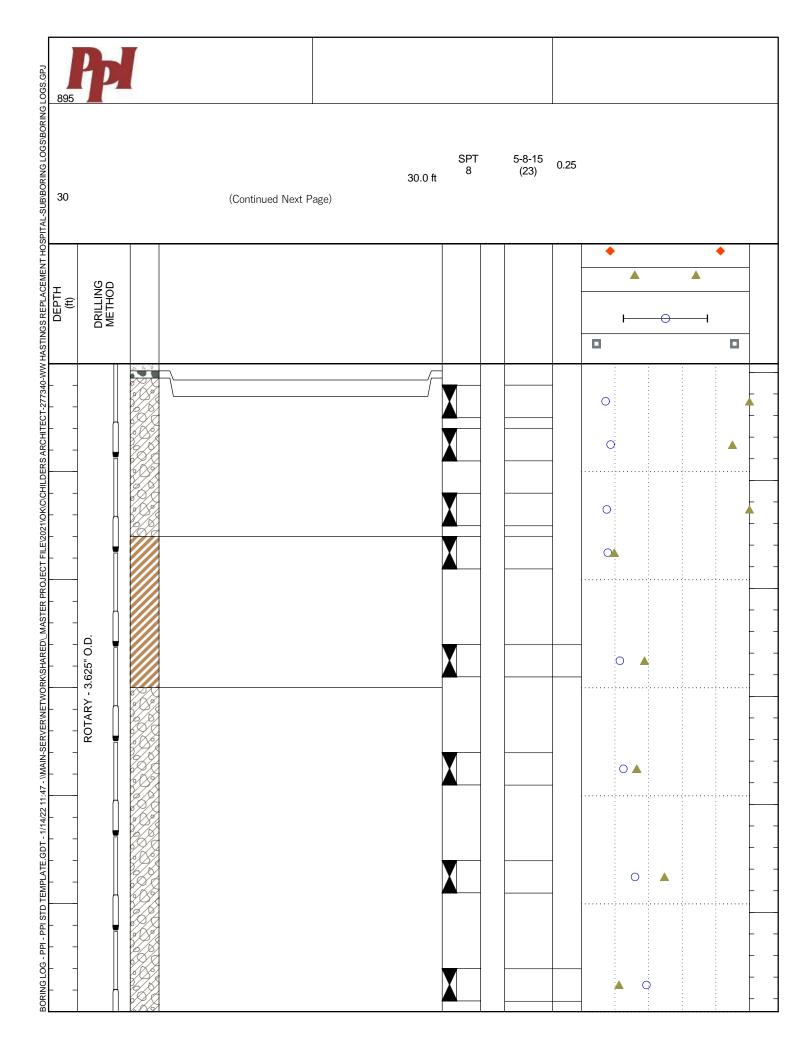
4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

GEOTECHNICAL **BORING LOG**

		F	ax: 417-864-6000						PAGE 2 C	DF 2
CLIE	NT <u>Chil</u>	ders Archi	tect	PROJ		ИЕ <u></u>	V.W. Hast	ings R	eplacement Hospital	
PRO,	JECT NO). 277340		PROJ	ECTLOC	ATIC	N Tahleo	ouah. (Oklahoma	
UETIN (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DES Unified Soil Classif		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 FIL MIC UL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION
30 _			CLAYEY GRAVEL, w/ Chern Red & White, Dense to Very (GC) (continued)	Boulders & Clay Layers, Dense, Slightly Moist					1 2 3 4	
	Y - 3.625" O.D.				SPT 9		75/1"			- 8 - -
35 - - -	ROTARY				SPT 10		75/5"		0	- 8
40								,		_
			Bottom of boreho	43.2 ft ble at 43.2 feet.	SPT 11	0	75/2"			8

(Telephone: 417-864-6000	rech Ring				BO	RING NUMBER		25
I	Fax: 417-864-6000						F	PAGE 1	OF 2
	nitect								
PROJECT NO. <u>27734</u>	0	PROJE	CTLO	CATIO	N <u>lahleo</u>	<u>quah, Ok</u>	klahoma		
DATE STARTED 12/1	4/21 COMPLETED <u>12/14/21</u>	SURFA	CE ELE	EVATI	ON <u>920.4</u>	4 ft	BENCHMARK EL.		
DRILLER <u>MR</u> HAMMER TYPE <u>Auto</u>		GROUN A				None			
	CHECKED BY MM	A		of Df	RILLING _				
NOTES	MATERIAL DESCRIPTION Unified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT () 20 40 60 80 N VALUE 20 40 60 PL MC 20 40 60 SHEAR STRENGTH 1 2 3	80 LL 80	ELEVATION (ft)
0	CONCRETE AGGREGATE BASE	0.3 ft 0.7 ft	SPT		35-60-63		1 2 3	4	920
	CLAYEY GRAVEL, Red Brown, Very Dense, Mo (GC)	ist	1 SPT		(123) 30-54-36				
5			2		(90)				
		8.0 ft	SPT 3		39-50-69 (119)				915
10	FAT CLAY, Brown Tan, Stiff to Very Stiff to Hard Moist (CH)	,	SPT 4		26-11-9 (20)				
									910
15	CLAYEY GRAVEL, w/ Chert Boulders & Clay La Red & White, Medium Dense to Dense, Slightly (GC)		SPT 5		8-15-23 (38)	1.25			905
20			SPT 6		42-12-21 (33)				900
			SPT 7		15-8-42 (50)				

15-8-42 (50)





	łp.	6 T	168 W Kearney Street 5803 elephone: 417-864-6000 ax: 417-864-6000	BC	ORING	6 LO	G			PAGE 2 0	25 DF 2		
		ders Archi			PROJECT NAME W.W. Hastings Replacement Hospital								
DEPTH (ft)	DRILLING	277340 STRATA SYMBOL	MATERIAL DES	MATERIAL DESCRIPTION Unified Soil Classification System			RECOVERY % DI (RQD %)	S		DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80			
30 _			CHERT, White, Very Dense			×				SHEAR STRENGTH (kšf) 1 2 3 4	8		
	ROTARY - 3.625" O.D.					SPT 9		75/5"			-		
-	ROT	$\begin{array}{c} \Delta & \Delta & \Delta & \Delta \\ \Delta & \Delta & \Delta & \Delta \\ \Delta & \Delta &$				SPT 10		75/0"			-		
40									1		<u>م</u>		
			Bottom of boreho	ole at 43.1 feet.	43.1 ft	SPT 11		75/1"					

BO 100 W Realley Street BO BO							TECHNICAL RING LOG					DRING N	UMBER						
												26							
ß				Fa	ax: 417-864-6000										PA	GE 1 C)F 2		
	CLIENT Childers Architect							PROJECT NAME W.W. Hastings Replacement Hospital											
9								PROJECT LOCATION Tahlequah, Oklahoma											
	DATE STARTED <u>12/15/21</u> COMPLETED <u>12/20/21</u>								SURFACE ELEVATION 918.7 ft BENCHMARK EL.										
<u> </u>	DRILLER <u>MR</u> DRILL RIG <u>2019 CME-55</u> HAMMER TYPE <u>Auto</u>							GROUND WATER LEVELS AT TIME OF DRILLING <u>None</u>											
											٠			•					
		98Y <u>BC</u>			СН	MM	/		of Di										
	DEPTER (f) DRILLING												DRY UNIT WT (pcf) 20 40 60 80 100						
	L R	ME		ğ					Щ Щ Ц	%	TS	ż	ΝΙ \/ΔΙ Ι			UE			
				SYMBOL		MATERIAL DESCRIPTION			E TYPE BER	ERY 0 %)) %) :CTED OUNTS LUE)	T PEN.	20	40	60	80	ATION		
	_			RATA	Unified	Soil Classific	ation System		MUN	RECOV (RQI	CORRE (N VAL	OCKET (tsf)	▲ O	L	C L	L	ELĖVA (ft)		
	-									R		٩ ٩	20	40	60	80			
	-	Н	8						-				SHE	AR STRI 2	ENĠTH (3	(ksf) 4			
0	-		0		TOPSOIL, Brow	n, Soft, Moist	, Grass Covered	0.2 ft	SPT		3-5-8								
	-		Z		LEAN CLAY, Sc	attered Grave	el, Brown, Stiff, Mo	st	1		(13)	1.5							
	1		21		(CL)			2.0 ft	X					0		4			
]	П			CLAYEY GRAVI	FI w/ Chert I	Boulders & Clay La	vers							-				
	_	Π			Red & White, Ve	ery Dense, Sli	ightly Moist (GC)	<i>y</i> 010,			75-8/0"		(C					
	-								2								_915_		
5	-																		
	╡.								SPT 3		42-75/3"	0.5							
	0.0	Ĭ												0					
	3.625"							25		5	SPT 4					2	27-75/2		
		Ц						20		1		s							
10	ROTARY				CHERT, White,	Very Dense				0		F T							
	-									0 f			0						
	-									t S	PT 5		U						
	-	Н						30									14-75/4		
15	1							(Conti					-						
]							nued Next											
								Page)		5	PT 6								
	-	Н															2-75/4		
	-												-	-	-	-			
20	-												-	-	-				
	-									5	PT 7		-	-	-	4			
	1	Ц												-	-		_75/1"_		

75/2"

1.25

0.5

1 0

0 5

0 0



GEOTECHNICAL BORING LOG

26

PAGE 2 OF 2

	NT <u>Childe</u>						V.W. Hast	-	<u>eplacement</u> Oklaboma	Hospital		
VT HOSPITAL-SUB\BORING LOG DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System		SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	ED NTS :)	POCKET PEN. (tsf)	DR ^V 20 4 20	N VALU 40 6	8 <mark>0</mark> 100	ELEVATION (ff)
VGS REPLACEMEN			CHERT, White, Very Dense (continued)						SHEAF 1	R STREN 2	GTH (ksf) 3 4	
LERS ARCHITECT-277340-WW HASTINGS REPLACEMENT HOSPITAL-SUB/BORING LOGS/BORING 1 1 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0			Bottom of borehole at 33.1 feet.	33.1 ft	SPT 9		75/1"					

	P			4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000	GEO BO	teci Ring				B	ORING NUMB		PAGE 1 (27
CLIE	ENT <u>C</u>	hilde	ers Arc	nitect						-	eplacement H			
PRO	JECT	NO.	27734	0		PROJE	ECT LOO	ATIC	N <u>Tahleo</u>	quah, (Oklahoma			—
DAT	E STA	RTE	D <u>12/</u>	6/21 COMPLETED	12/16/21	SURF	CE ELE	VATI	ON <u>920.′</u>	1 ft	BENCH	IARK EL.		
				DRILL RIG 2	019 CME-55									
IAM	MER	ΓΥΡΙ	E <u>Auto</u>			4	AT TIME	OF D	RILLING	None	•		•	
OG IOT	GED E	א <u>ר ו</u> ב	BC	CHECKED BY	MM	ļ	TEND	of Di	RILLING			-		-
E	DRILLING	ЛЕТНО	<u> </u>									JNIT WT (60 80	pcf)	
		2	SYMBOL	MATERIAL DE	SCRIPTION		E TYPE BER	ERY %) %)	ECTED OUNTS LUE)	PEN.	1	00 80 1 VALUE 10 60	80 •	TION (
			RATASI	Unified Soil Classi				RECOVE (RQD	CORREC BLOW CO (N VALI	OCKET (tsf)	PL	MC	LL	ELEVAT (f))
_			STR					RE		Q Q	20 4	0 60	80	ΓШ -
-		Ϊ		TOPSOIL, Brown, Soft, Moi	ist Grass Covered	0.2 ft	SPT		6-8-12			STRENGT	H (ksf) 4	920
		Ĩ								3				
_				CLAYEY GRAVEL, w/ Che Red & White, Medium Den Moist (GC)	rt Boulders & Clay L se to Very Dense, S	ayers, lightly	1		(20)					-
_		П					SPT		54-35-23		0			
-		Ĩ					2		(58)		Ŭ			-
5_	-						SPT		75/0"					. 915
_		Ц					3							
-	"O.D.	Π					SPT		75/1"		0			-
0	3.625"													910
_	ROTARY -	Ц												
-	RO	Π												
_	-						SPT 5		75/5"					
5		Ц		CHERT, White, Very Dense		15.0 ft								905
_		Π												
-							SPT 6		75/0"					
-		Ц					6							
20 -													-	900
_														
-		H		CLAYEY GRAVEL, w/ Cher	t Boulders & Clay La	23.0 ft ayers,		2 5						(Con
			6/8	Red & White, Dense to Ver (GC)	y Dense, Slightly Mo	ist			30		-	<u>.</u>		ed N Page

SPT 7

SPT 8

11 -17 -18 (3 5)

895

75 /1 "



4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

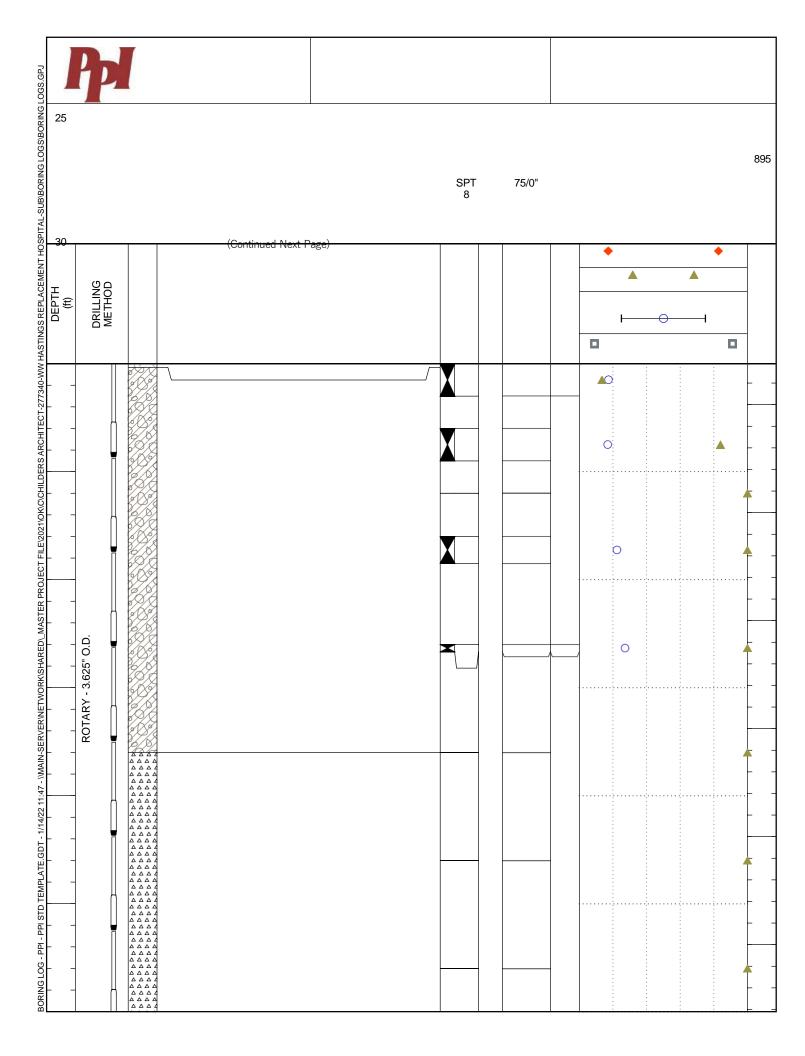
GEOTECHNICAL **BORING LOG**

BORING NUMBER

LIE		ders Archi	tect	PRO	DJECT NA	ME_V	<u>W.W. Ha</u> st	ings Re	<u>eplac</u> e	ment l	-lospital			
		277340						-	-					
(ft)	DRILLING	STRATA SYMBOL	MATERIAL DES Unified Soil Classif		SAMPLETYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)		20 20 P L	M	8 <u>0</u> JE 60 8 — HL	100 30 - 30	FI FVATION
30 _			CLAYEY GRAVEL, w/ Cherr Red & White, Dense to Very (GC) (continued)	t Boulders & Clay Layers Dense, Slightly Moist					5	HEAR 1	STREN 2		4 4	8
					SPT 9	-	27-23-18 (41)			0				-
- 35 _ -	3.625" O.D.													- 8
	ROTARY - 3				SPT 10		75/0"							-
40 _														3
-					SPT 11		75/0"			- - - - - - - - - - -				_
45										-	C)	,	<u>الم</u>
			Bottom of boreho	49.3 ble at 49.3 feet.	SPT 3 ft 12		6-14- 75/3"	1						

65						BO	RING NUMBER	28
	ax: 417-864-6000						PAGE	1 OF 2
	ect						placement Hospital	
PROJECT NO. <u>277340</u>		PROJE		CATIO	N <u>lahle</u>	quan, Or	klahoma	
DATE STARTED 12/16	21 COMPLETED 12/16/21	SURFA		EVATIO	ON <u>921.9</u>	9 ft	BENCHMARK EL.	
DRILLER <u>MR</u> HAMMER TYPE <u>Auto</u>	DRILL RIG 2019 CME-55					None		
LOGGED BY BC	CHECKED BY MM	4		of Dr	ILLING _			
NOTES	MATERIAL DESCRIPTION Unified Soil Classification System	-	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) 20 40 60 80 100 N VALUE 20 40 60 80 PL MC LL 20 40 60 80 SHEAR STRENGTH (ksf)	ELEVATION (ft)
0	TOPSOIL, Brown, Soft, Moist, Grass Covered	0.2 ft	SPT		8-8-6		1 2 3 4	
	CLAYEY GRAVEL, w/ Chert Boulders & Clay L Red & White, Medium Dense to Very Dense, S Moist (GC)		1		(14)	3		920
5			SPT 2	· .	41-42-42 (84)			
5			SPT 3		75/0"			915
			SPT 4		24-12- 75/3"			
10								
			SPT 5		75/4"	0.25		910
15								
	CHERT, White, Very Dense	18.0 ft	SPT 6		75/0"			905
20								

900





4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

GEOTECHNICAL **BORING LOG**

											PAGE 2	
		ders Archi			OJECT NAI				eplacement H	lospital		
	DRILLING	STRATA SYMBOL	, MATERIAL DES Unified Soil Classif	SCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (ROD %)	S	POCKET PEN. (tsf)	DRY 20 40 20 - FIL 20 -	ME	80 100 E 50 80 — UL 50 80	ELEVATION
30 _			CHERT, White, Very Dense	(continued)							GTH (ksf) 3 4	_
- - - 35 -	O.D.		CLAYEY GRAVEL, w/ Cher Red & White, Medium Dens Moist (GC)	32.t t Boulders & Clay Layers e to Very Dense, Slightl	s,		8-8-15 (23)	0.25		· · · · · · · · · · · · · · · · · · ·	0	- 8
	ROTARY - 3.625"				SPT 10		18-27-23 (50)					
					SPT 11	0	75/2"			o		= 8
45 [−]			Bottom of boreho	49.3 ble at 49.3 feet.	SPT 3 ft 12	1	53-47- 75/3"	0.25		-	: :	8

	P			4168 W Kearney Street 65803 Telephone: 417-864-6000	GEO BO		HNIC G LO			В	ORING	G NUMB	ER		29
				Fax: 417-864-6000										PAGE	1 OF 1
CLIE	NT <u>Cł</u>	nilde	ers Arch	nitect		PROJ	ECT NAM	ME <u>\</u>	N.W. Hast	ings R	eplace	ement H	ospital		
	JECTN														
DAT	E STAF	RTEI	D <u>12/2</u>	COMPLETED	12/21/21	SURF	ACE ELE	VAT	ION <u>916.</u> 8	<u>8 ft</u>	I	BENCHN	IARK E	L	
:	LER <u>N</u>			DRILL RIG _20	19 CME-55				EVELS	None					
LOG	GED B	Y <u> </u>	c	CHECKED BY	MM			OF D	RILLING _		•	•		-	
DEPTA (ff)	ES DRILLING										2		UNIT W	<u>T (pcf)</u> 80 10	00
		11	SYMBOL	MATERIAL DES	SCRIPTION		LE TYPE MBER	VERY % 00 %)	RECTED COUNTS ALUE)	ET PEN. (sf)		N	N VALU 10 6	E 0 80	• NOIT
;			STRATA	Unified Soil Classif	ication System		NUM	RECOVE (ROD	CORREC BLOW OC (N VAL	POCKET I (tsf)	`	<mark>2</mark> 0	06	0 80 GTH (ksf	
_ 0 _				CONCRETE AGGREGATE BASE		0. ³ 8 ft	SPT		14-17-18				:	3 4	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
				CLAYEY SAND, With Grave Clay Layers, Red & White, M Dense, Slightly Moist (SC)	I, w/ Chert Boulder /ledium Dense to V	s & ery				/	(3 5	-	-		/3
5							30.0 ft		SPT 2)		-		
							00.0 1		SPT 4		1				1 <u>5-30</u> (66)
– – – – – 10	3.625" O.D.										, (C	· · · · · · · · · · · · · · · · · · ·		-
	ROTARY -							S	SPT 5		7	-	-		
 										-	5 / 1 "	0	- - - - - - - - - - - - - - - - - - -		
								5	SPT 6		7 5 /	- - - - - - - - - - - - - - - - - - -	· · · · · ·		75/3"
20									SPT 7		0"	• •	- - - - - - - - - - - - - - - - - - -		
													-		
25				Bottom of boreho				5	SPT 8	۸	7 5	-	Ö		

0.5

0.5

Bottom of borehole at 30.0 feet.

			_		GEO	TECH	INIC	AL	_	B	ORING NUMBER	र		
	D			4168 W Kearney Street 65803		RINC								30
bio l				Telephone: 417-864-6000				U						30
Ś				Fax: 417-864-6000								PA	AGE 1 C	DF 1
		ام ا: ما د		h ito at					A/ \ A/ = = +					
				hitect								spital		
	JECI	NU.	27734	10		PROJE			JN <u>Tanie</u>	<u>quan, q</u>	JKIANOMA			
	E STA	RTE	D 12/2	21/21 COMPLETED	12/21/21	SURFA		EVAT	ION 916.0) ft	BENCHMA	RK EL.		
										-				
	LER	MR		DRILL RIG 20	019 CME-55	GROU		ER L	EVELS					
	MER	TYPI	<u>Auto</u>			A	TTIME	OF	RILLING	None				
											•		•	
	GED E	3Y <u></u>	<u>3C</u>	CHECKED BY	MM	4	T END	OF D	RILLING _			_		
E E E	DRILLING	Ê.												
	DRII	Ш										VIT WT (pc 60 80	^{])} 100	
			SYMBOL				Е ТҮРЕ BER	× ~	ECTED DOUNTS VLUE)	PEN.	20 40	VALUE 60	80	
				MATERIAL DES	SCRIPTION			VERY 8)		<u>н</u>				Ŭ ¥€
≩ 	-		E.	Unified Soil Classif	ication System		NUM	RECOV	CORRE(CORRE((N VAL	POCKET (tsf)	PL	MC	LL	ELEVA:
			H]	A	R	BLO C	R	○ 20 ▲ 40	60	20	Ш
		Ц						1		1	SHEAR ST		80 (ksf)	
				001005555		0.3 ft 0.9 ft	X				01 2	3	4	↓ ¯
	1	Π		CONCRETE AGGREGATE BASE		0.9 ft		1				-		915_
	1						SPT		24-18-11					-915-
				CLAYEY GRAVEL, w/ Cher	Boulders & Clay La	iyers,	1	1	(29)		0)	1	
5	-	Н		Red & White, Dense to Very (GC)	Dense, Slightly Mo	ist	SPT					-		
	-						\mathbf{X}^{2}		21-75/5"		0	-	4	┢ -
	-	Ī						/				-		
	-													·
- 5 -	-											-	-	
	-	$\left[\right]$					SPT		29-75/5"	2.25		-		-910-
	O.D.	ų.					3		20 10/0	2.20		-	1	-
	55" 0						SPT		75/5"	1		-		
	3.625"						4							
- 10 -		Ц										-		
	ROTARY					11.5 ft						-		-905-
) Å	Ĭ		CHERT, White, Very Dense								-		905
							×			1	0	-	4	↑
]						SPT 5	1	75/1"			-		Γ -
]	Ц												· F -
15 -	1											-		
	-	Ī	- Al									-		-900-
	-							1		1		-		
	-					18.5 ft	Å	2			0	-	SPT	¢ -
<u></u>	-	Π		CLAYEY GRAVEL, w/ Cher Red & White, Very Dense, S	Boulders & Clay La	iyers,		5						· - -
20 -	-	ļ			(. ,							-	-	
	-											-		
	-									ļ		-		L _
	-	Ц							<u> </u>			-	SPT	Ł _
												-		
30				Bottom of boreho	ole at 30.0 feet.									

SPT 8

75 /4 "

895

890

38 -45 -44 (8 9)

75 /1 "

	P			4168 W Kearney Street 65803 Telephone: 417-864-6000	GEO BO		HNIC G LO		I	B	ORING NUMBER		32
		1		Fax: 417-864-6000								PAGE 1 C	DF 1
CLIE	NT C	hilde	ers Arc	nitect		PRO.I	ΕCT ΝΔΙ	ME	NW Hast	inas R	enlacement Hosn	nital	
			27734										
DAT	E STAI	RTE	D <u>12/2</u>	COMPLETED	12/22/21	SURF	ACE ELE	EVAT	ION <u>917.</u>	5 ft	BENCHMAR	₹K EL	
			E_Auto	DRILL RIG 20	19 CME-55				EVELS DRILLING	None			
LOG	GED B	SY E		CHECKED BY	MM				RILLING		•	▲	
DEPT	DRILLING										DRY UNI 20 40 6	T <u>WT (pcf)</u> 80 80 100	-
		<	SYMBOL	MATERIAL DES	SCRIPTION		E TYPE BER	ERY %) %)	:CTED OUNTS LUE)	T PEN. f)	■ 20 40	ALUE 60 80	
	-		AT A	Unified Soil Classifi	ication System		NUM	RECOVI (ROD	CORRE (N VAL	POCKE (tat	PL N	MC LL	
 	-							-			20 40 SHEAR STR 1 2	60 80 RENGTH (ksf) 3 4	
- 0 -	-			CONCRETE AGGREGATE BASE		0.4 ft 1.0 ft			15-38-				
				CLAYEY GRAVEL, w/ Chert Red & White, Very Dense, S	Boulders & Clay La	ayers,	1		75/5"	0.5		4	
	-			, - , , -	3 . ,		SPT	-	75/3"		0		915
5	-												
	-						SPT 3		75/2"				910
	5" O.D.						SPT 4		18-36- 75/0"	0.75			
10	ry - 3.625"												
	ROTARY						SPT		75/1"				 905
							5			1			
 	-						-						.
						25							30.0
	-	ļ											
20				CHERT, White, Very Dense				2 0					
								5 f t					
		Ц		Bottom of boreho	No of 20 0 fact								

SPT 6	75/0"	9 0 0
-------	-------	-------------

SPT 7

75/0"

			_	4168 W Kearney Street	GEO	TEC	HNIC	AL		B	ORING NUME	BER		
				65803			G LO							33
		1		Telephone: 417-864-6000 Fax: 417-864-6000									PAGE 1	
													FAGE I	
CLIE	NT <u>C</u>	hilde	ers Arc	hitect		PROJ	ECT NA	ME <u>\</u>	W.W. Hast	ings R	eplacement H	lospital		
PRO	JECT	NO.	2773	40		PROJI	ECTLO	CATIC	DN <u>Tahle</u>	quah, (Oklahoma			
	ESTA	RTE	D <u>12/</u>	22/21 COMPLETED	12/22/21	SURF	ACE ELE	EVAT	ION <u>917.</u>	1 ft	BENCH	MARKE		
	LER	MR		DRILL RIG 20	19 CME-55	GROU	ND WAT	ER L	EVELS					
			E Auto						RILLING	None				
											•		•	
LOG	GED E	<u>אי ו</u> ב	BC	CHECKED BY	MM	1	AT END	OF D	RILLING _					
NOT La €	DRILLING										55%		.	-
B		ME	5						ω.			UNIT W		
			SYMBOL				E TYPE BER	ERY % 0 %)	:CTED OUNTS LUE)	PEN.		N VALUI 40 6		NOF
			A S∕	MATERIAL DES				No.		POCKET (tsf)	PL	MC	ELL:	
				Unified Soil Classifi	cation System			RECOV (RQI	CORRE BLOW OC (N VAL	0C			-	ELEV)
			5				#				20	40 6		- T
		П						-					GTH (ksf) 3 4	
- 0 -				CONCRETE		0.5 ft 1.3 ft								
				AGGREGATE BASE		1.3 II	SPT		14-15-					····
				GRAVELLY LEAN CLAY, W	th Sand, w/ Chert			-	20/0"	-				
		Ц		Boulders & Clay Layers, Rec	& White, Very Der	nse,	 				0			915
				Slightly Moist (CL)			SPT		9-26- 33/0"	-			-	
<u> </u>		ī							33/0		0			1.
5														
							SPT		39-47-		-		-	
2		Н					3		66/0"		-		-	910
	0.D.						SPT		44-53-					
	0 10						\mathbf{X}^{4}		75/0"			0		
10	3.625" (-	-			- - -			
		Ц												[.
	ROTARY													[.
	۲¥	Π		4									-	905
							SPT		11-63-42	2			-	T
				4			5	1	(105)					
15		Ц		4		16.0 ft								
				4 CHERT, White, Very Dense							-		-	
				4										900
				4			SPT		75/2"		-	: :		<u> </u>
		Ц					6_						-	
20											·····			···
:F -											-		-	
:			J.										-	
3				4						/		Y	-	+ -
		Н	<u> </u>	x 1 7		24.0 ft		l			Á	E Y		
30			VXX	Bottom of boreho	le at 30.0 feet.	24.U I[

VEL, w/ Chert Boulders & Clay Layers,
Red & White, Very Dense, Slightly Moist (GC)

SPT 75/1" 7

30.0 ft

SPT 75/2"

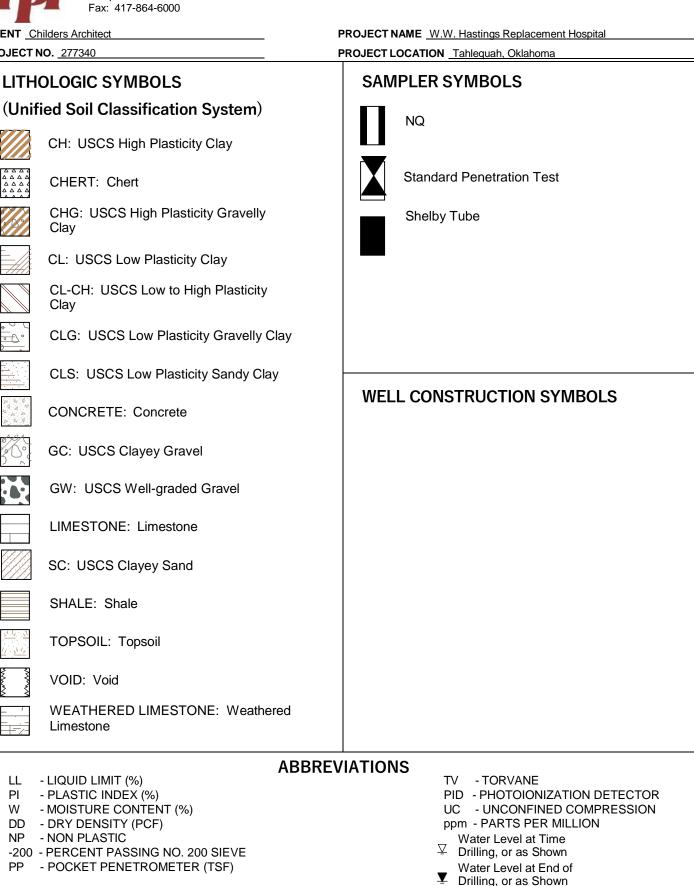
890

895



4168 W Kearney Street 65803 Telephone: 417-864-6000 Fax: 417-864-6000

KEY TO SYMBOLS



Water Level After 24

Hours, or as Shown

ν

CLIENT Childers Architect

PROJECT NO. 277340

Clay

Clay

KEY TO SYMBOLS - PPI STD TEMPLATE.GDT - 1/14/22 11:48 - NMAIN-SERVER/NETWORK/SHARED/, MASTER PROJECT FILE/2021/0K/C/HILDERS ARCHITECT-277340-WW HASTINGS REPLACEMENT HOSPITAL-SUBBORING LOGS/BORING LOGS/GR

LL

ΡI

W

DD

NP

APPENDIX II

GENERAL NOTES

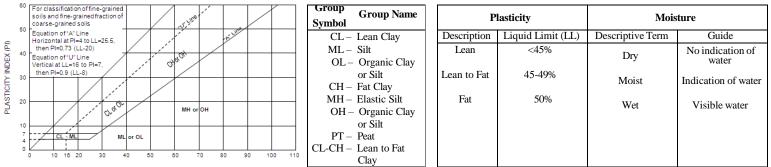


GENERAL NOTES

SOIL PROPERTIES & DESCRIPTIONS

COHESIV	VE SOIL S
COILDIN	

COMESTVE SOLLS				
Consistency	Unconfined Compressive Strength (Qu)	Pocket Penetrometer Strength	N-Value	
-	(psf)	(tsf)	(blows/ft)	
Very Soft	<500	<0.25	0-1	
Soft	500-1000	0.25-0.50	2-4	
Medium Stiff	1001-2000	0.50-1.00	5-8	
Stiff	2001-4000	1.00-2.00	9-15	
Very Stiff	4001-8000	2.00-4.00	16-30	
Hard	>8000	>4.00	31-60	
Very Hard			>60	



LIQUID LIMIT	(LL)

Fine Grained Soil Subclassification	Percent (by weight) of Total Sample	
Terms: SILT, LEAN CLAY, FAT CLAY, ELASTIC SILT	PRIMARY CONSTITUENT	
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]	
with sand, with gravel, with cobbles, with boulders	>15-30] - secondary coarse grained constituents	
scattered sand, scattered gravel, scattered cobbles, scattered boulders a trace sand, a trace gravel, a few cobbles, a few boulders	5-15]	
	<5]	
The relationship of clay and silt constituents is based on plasticity and normally determined by performing index tests. Refined classifications are		
based on Atterberg Limits tests and the Plasticity Chart.		

NON-COHESIVE (GRANULAR) SOILS

Г

		***GRAIN SIZE IDENTIFICATION		HON		
				Name	Size Limits	Familiar Example
RELATIVE DENSITY	N-VALUE	MOISTU	JRE CONDITION	Boulder Cobbles Coarse Gravel	12 in. or more 3 in. to 12 in. 34-in. to 3 in.	Larger than basketball Grapefruit Orange or lemon
		Descriptive Term	Guide	Fine Gravel	No. 4 sieve to $\frac{3}{4}$ -in.	Grape or pea
Very Loose Loose Medium Dense Dense Very Dense	0-4 5-10 11-24 25-50 51	Dry Moist Wet	No indication of water Damp but no visible water Visible free water, usually soil is below water table.	Coarse Sand Medium Sand Fine Sand* Fines	No. 10 sieve to No. 4 sieve No. 40 sieve to No. 10 sieve No. 200 sieve to No. 40 sieve Less than No. 200 sieve	Rock salt Sugar, table salt Powdered sugar
				*Particles finer t	han fine sand cannot be discerned	with the naked eye at

*Particles finer than fine sand cannot be discerned with the naked eye a distance of 8 in.

**CDAIN SIZE IDENTIFICATION

Coarse Grained Soil Subclassification	Percent (by weight) of Total Sample	
Terms: GRAVEL, SAND, COBBLES, BOULDERS	PRIMARY CONSTITUENT	
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]	
with gravel, with sand, with cobbles, with boulders	>15-30] - secondary coarse grained constituents	
scattered gravel, scattered sand, scattered cobbles, scattered boulders	5-15]	
a trace gravel, a trace sand, a few cobbles, a few boulders	<5]	
Silty (MH & ML)*, clayey (CL & CH)*	<15]	
(with silt, with clay)*	5-15] - secondary fine grained constituents	
(trace silt, trace clay)*	<5]	
*Index tests and/or plasticity tests are performed to determine whether the term "silt" or "clay" is used.		

GENERAL NOTES

BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD)		
Description of Rock Quality	*RQD (%)	
Very Poor	< 25	
Poor	25-50	
Fair	50-75	
Good	75-90	
Excellent	90-100	
*RQD is defined as the total length of sound core pieces 4 in. or greater in length, expressed as a		

pieces 4 in. or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

		Approx. Unconfine
Term	Field Identification	Compressive
		Strength (tsf)
Extremely Soft	Can be indented by thumbnail	2.6-10
Very Soft	Can be peeled by pocket knife	10-50
Soft	Can be peeled with difficulty by pocket knife	50-260
Medium Hard	Can be grooved 2 mm deep by firm pressure of knife	260-520
Moderately Hard	Requires one hammer blow to fracture	520-1040
Hard	Can be scratched with knife or pick only with difficulty	1040-2610
Very Hard	Cannot be scratched by knife or sharp pick	>2610

	DEGREE OF WEATHERING		
Slightly Weathered	Rock generally fresh, joints stained and discoloration extends into rock up to 25mm (1 in), open joints may contain clay, core rings under hammer impact.		
Weathered	Rock mass is decomposed 50% or less, significant portions of rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.		
Highly Weathered	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.		

VOIDS		
Pit	Voids barely seen with naked eye to 6mm (1/4-in)	
Vug	Voids 6 to 50mm (¹ / ₄ to 2 in) in diameter	
Cavity	50 to 6000mm (2 to 24 in) in diameter	
Cave	>600mm	

GRAIN SIZE (TYPICALLY FOR SEDIMENTARY ROCKS)			
Description	Diameter (mm)	Field Identification	
Very Coarse Grained	>4.76		
Coarse Grained	2.0-4.76	Individual grains can easily be distinguished by eye.	
Medium Grained	0.42-2.0	Individual grains can be distinguished by eye.	
Fine Grained	0.074-0.42	Individual grains can be distinguished by eye with difficulty.	
Very Fine Grained	<0.074	Individual grains cannot be distinguished by unaided eye.	

BEDDING THICKNESS

Very Thick Bedded	> 3' thick
Thick Bedded	1' to 3' thick
Medium Bedded	4" to 1' thick
Thin Bedded	11/4" to 4" thick
Very Thin Bedded	1/2" to 11/4" thick
Thickly Laminated	¹ / ₂ " to ¹ / ₂ " thick
Thinly Laminated	¹ / ₂ " or less (paper thin)

DRILLING NOTES

Drilling and Sampling Symbols

NQ - Rock Core (2-in. diameter)

- HQ Rock Core (3 in. diameter)
- HSA Hollow Stem Auger

CFA – Continuous Flight (Solid Stem) Auger SS – Split Spoon Sampler

ST - Shelby Tube

WB – Wash Bore or Mud Rotary TP – Test-Pit HA – Hand Auger

Soil Sample Types

Shelby Tube Samples: Relatively undisturbed soil samples were obtained from the borings using thin wall (Shelby) tube samplers pushed hydraulically into the soil in advance of drilling. This sampling, which is considered to be undisturbed, was performed in accordance with the requirements of ASTM D 1587. This type of sample is considered best for the testing of "in-situ" soil properties such as natural density and strength characteristics. The use of this sampling method is basically restricted to soil containing little to no chert fragments and to softer shale deposits.

Split Spoon Samples: The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot of an 18-in. long, 2-in. O.D. split-barrel sampler with a 140 lb. hammer falling a distance of 30 in. The Standard Penetration Test is carried out according to ASTM D-1586.

Water Level Measurements

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, shallow groundwater may indicate a perched condition. Caution is merited when interpreting short-term water level readings from open bore holes. Accurate water levels are best determined from piezometers.

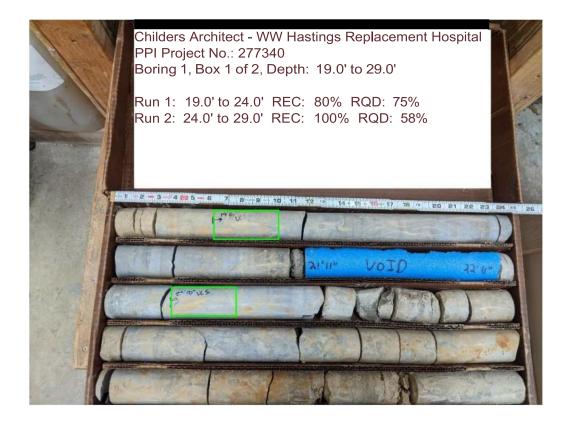
Automatic Hammer

Palmerton and Parrish's CME's are equipped with automatic hammers. The conventional method used to obtain disturbed soil samples used a safety hammer operated by company personnel with a cat head and rope. However, use of an automatic hammer allows a greater mechanical efficiency to be achieved in the field while performing a Standard Penetration resistance test based upon automatic hammer efficiencies calibrated using dynamic testing techniques.

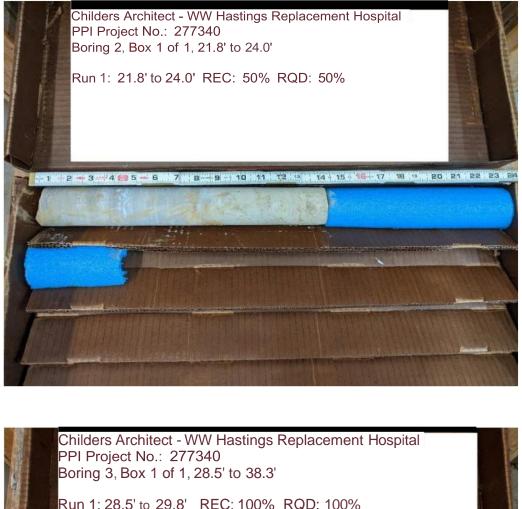


APPENDIX III

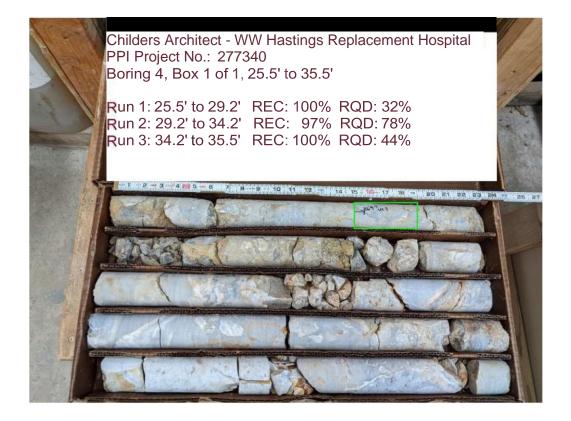
ROCK CORE PHOTOGRAPHS

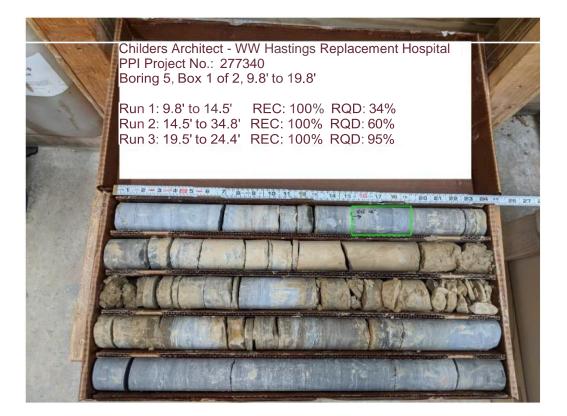




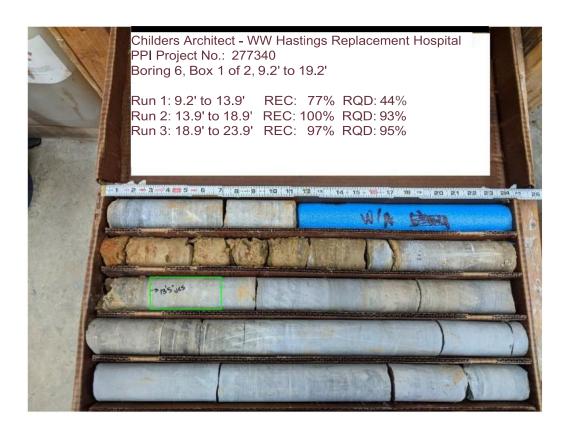


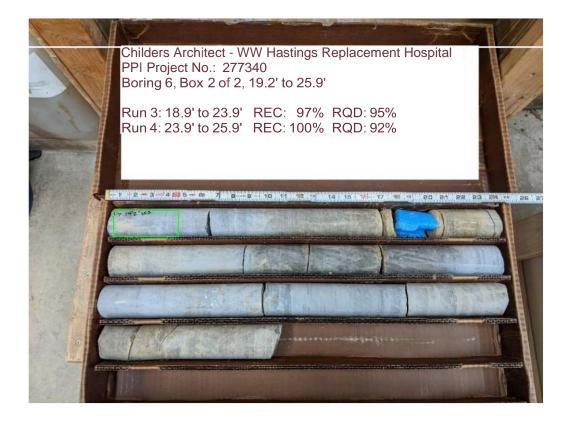


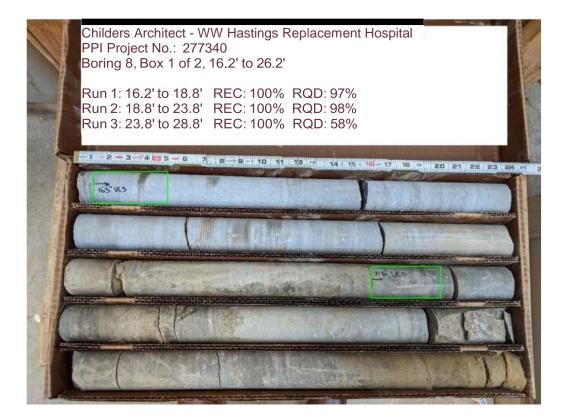






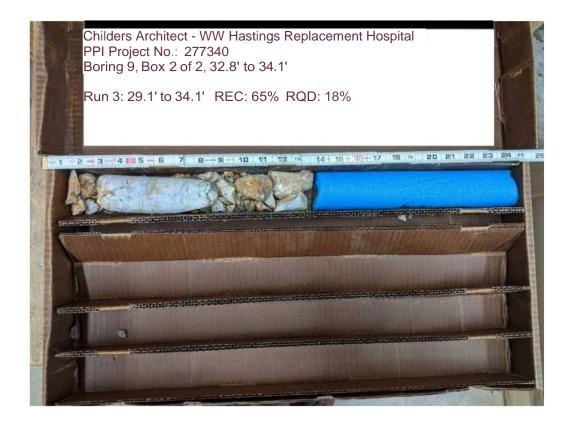


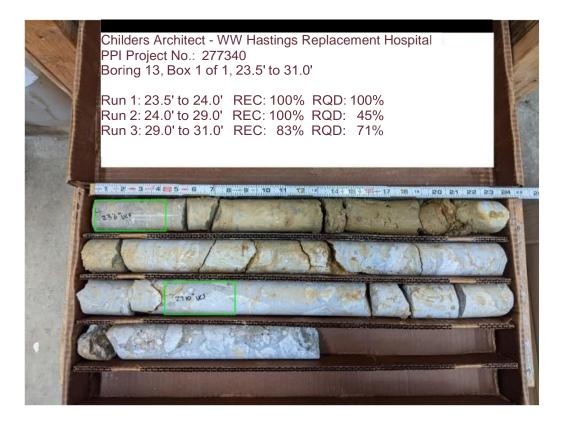












APPENDIX IV

IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you - assumedly a client representative - interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated*.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnicalengineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full*.

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered*.

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnicalengineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.* Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists.*



Telephone: 301/565-2733 e-mail: info@geoprofessional.org www.geoprofessional.org

Copyright 2016 by Geoprofessional Business Association (GBA). Duplication, reproduction, or copying of this document, in whole or in part, by any means whatsoever, is strictly prohibited, except with GBA's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of GBA, and only for purposes of scholarly research or book review. Only members of GBA may use this document or its wording as a complement to or as an element of a report of any kind. Any other firm, individual, or other entity that so uses this document without being a GBA member could be committing negligent



ADDENDUM NO. 1 - GEOTECHNICAL ENGINEERING REPORT DATED: 08/18/2022



August 18, 2022

Childers Architect 142 Howell Street, Suite 170 Dallas, Texas 75207

- Attn: Mr. Matthew Thomas, Associate AIA Email: <u>mthomas@childersarchitect.com</u>
- RE: Geotechnical Engineering Report Addendum 1 W.W. Hastings Replacement Hospital & Parking Garage Tahlequah, Oklahoma PPI Project Number: 277340

Dear Mr. Thomas:

This report addendum No. 1 was prepared to provide additional information for the design of drilled piers at the project site. As stated within Section 9.2.3 and 9.2.4 of the original Geotechnical Engineering Report, dated February 9, 2022, pier pre-drilling was recommended at each drilled pier location to determine specific subsurface conditions at the exact column location. The Design Team has elected to perform pre-drilling. As a result it is recommended that the following items of the original Geotechnical Engineering Report be amended, including:

- Table 9.2.2 Minimum Pier Penetration The minimum pier penetration for Zone 1 & 2 piers will be dictated by specific column loads and soil conditions determined by PPI, however, the following absolute minimum pier penetration for each are provided below:
 - Zone 1 Min. 10 ft. below <u>existing</u> ground surface or deeper, although much deeper pier depths are anticipated to be required.
 - Zone 2 Min. 1 ft. rock socket into competent bedrock consisting of limestone, shale or solid chert. Again, column loads may dictate deeper embedment depths.
- **Table 9.2.2 Minimum Shaft Diameter** Minimum pier diameter may be reduced to 24-inches, in lieu of 30-inches as originally published.

Ph: (918) 872-9898

3500 East 13th Street Joplin, MO 64801 Ph: (417) 624-2005 W.W. Hastings Replacement Hospital Geotechnical Report Addendum No. 1 Tahlequah, OK



Closure

We appreciate this opportunity to be of service and if you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC. By:

PALMERTON & PARRISH, INC By: ANDO ROSS PARRIS Brandon R. Parrish, P.E. 08/18/22 Vice President

Shane M. Rader, P.E. Geotechnical Engineer

Submitted: One (1) Electronic .pdf Copy

BRP/SMR/brp



ADDENDUM NO. 2 - GEOTECHNICAL ENGINEERING REPORT DATED: 11/09/2022



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

November 9, 2022

Childers Architect 142 Howell Street, Suite 170 Dallas, Texas 75207

- Attn: Mr. Matthew Thomas, Associate AIA Email: <u>mthomas@childersarchitect.com</u>
- RE: Geotechnical Engineering Report Addendum 2 W.W. Hastings Replacement Hospital & Parking Garage Tahlequah, Oklahoma PPI Project Number: 277340

Dear Mr. Thomas:

This report addendum No. 2 was prepared to provide additional information for the design of structure foundations at the project site. As stated within Section 9.0 of the original Geotechnical Engineering Report, dated February 9, 2022, only one foundation type per structure was recommended to reduce the potential for differential settlement or structures designed to accommodate some differential settlement between foundation types. Since report submittal, preliminary design of the foundations is understood to have been performed. Preliminary design is understood to utilize drilled piers for the heavy, loads from the multi-story structure and shallow foundations within the single story, lightly loaded area within the northeast of the structure footprint. It is our opinion that due to the very light loads anticipated in the single story area, as well as the relatively stiff soil conditions present at the site, only minimal to negligible differential settlement is anticipated between these two foundation types and using a shallow foundation system to support the single story, very light loads is considered acceptable. This recommendation is only valid at the current bay spacing. Any reduction in bay spacing between deep and shallow foundations should be reviewed by PPI and this Addendum revised, if necessary.

Closure

We appreciate this opportunity to be of service and if you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC. By:

Shane M. Rader, P.E. Geotechnical Engineer

PALMERTON & PARRISH,	NCSPESSION
By:	BRANDON OF
-	ROSS PARRISH
Broch Paril	24765 24765
Brandon R. Parrish, P.E.	11/09/22
Vice President	

(417) 561-8395

3500 East 13th Street Joplin, MO 64801 Ph: (417) 624-2005



DRILLED PIER PRE-DRILLING SUMMARY LETTER DATED: 11/04/2022



November 4, 2022

Foreman – Manhattan Construction Team 5601 South 122nd East Ave. Tulsa, OK 74146

- Attn: Mr. Patrick Fogarty, Sr. Project Manager Email: pfogarty@manhattanconstruction.com
- RE: Pier Pre-Drill Results Summary Letter W.W. Hastings Replacement Hospital 17665 S. Muskogee Ave. Tahlequah, Oklahoma PPI Project Number: 280212

Dear Mr. Fogarty:

Palmerton and Parrish, Inc. (PPI) appreciates the opportunity to submit this Pier Pre-Drill Summary Letter for the W.W. Hastings Replacement Hospital project located in Tahlequah, Oklahoma. PPI has previously provided a Geotechnical Engineering Report for the proposed Replacement Hospital numbered 277340 and dated February 9, 2022. The purpose of this letter is to provide a summary of the Pier Pre-Drilling Results as well as considerations for the proposed W.W. Hastings Replacement Hospital Foundations. **This is not a stand-alone letter and should be used along with the original geotechnical report noted above.**

Pier Pre-Drilling Summary

Subsurface conditions at the subject site in the locations of the proposed drilled piers were explored through the completion of subsurface borings. Pier locations and elevations were provided by the client and marked in the field by a surveyor. A total of 108 pier pre-drill borings were completed at the subject site.

Borings were drilled between August 30th to October 27, 2022. Borings in soils were generally advanced using a combination of 4.5-inch O.D. continuous flight augers and mud rotary techniques using a 3-inch O.D. tri-cone bit powered by ATV-mounted drill-rigs. Soil samples and SPT blow counts were collected at 5-foot centers during drilling for estimates of soil shear strengths/friction angles. Soil sample types included split spoon samples collected while performing the Standard Penetration Test (SPT) in general accordance with ASTM D1586. These values along with the soil classifications were utilized to estimate allowable loads, skin friction, and lateral loading criteria for the drilled pier at the specific boring location.



When bedrock was encountered, rock coring procedures were implemented. Continuous rock cores were obtained using a NQ2 double tube wireline core barrel with a diamond-impregnated bit. The rock core obtained was placed in core boxes in the order of recovery. Rock core recovery and conditions were observed by PPI's engineers to determine appropriate bearing stratums, allowable loads, skin friction values, and lateral loading conditions of the bedrock for the drilled pier at the specified boring location.

Results of Pier Pre-Drilling

As previously noted, a total of 108 pre-drill borings were performed at the subject site. Results of the pier pre-drilling were evaluated on a weekly basis and provided to the client and design teams. As noted in the Geotechnical Report numbered 277340 and dated February 9, 2022, the site contains zones of deep, cherty clays and zones of solid chert and shallower bedrock materials. Where deep cherty clays were encountered, PPI provided drilled pier parameters for soil bearing conditions. Where bedrock was noted, PPI provided parameters for bedrock bearing conditions. Additionally, if voids were noted in the bedrock or clays, PPI adjusted allowable end bearing and side friction values to account for these voids. Individual drilled pier parameters based on the results of the pier pre-drilling have been attached to this summary letter.

Drilled Pier Considerations

As previously noted above, this letter is not a stand-alone letter and should be used along with the Original Geotechnical Report numbered 277340 and dated February 9, 2022 and with the Addendum Letter dated August 18, 2022. PPI is providing the following additional considerations based on the results of the pier pre-drilling performed at the subject site:

- Soil and Bedrock Bearing Conditions Pier pre-drilling identified zones of deep soils, intermittent solid chert layers, and zones of relatively shallow bedrock materials. Due to the strain incompatibility of soil versus bedrock, borings with intact bedrock were not provided soil skin frictional values. Accordingly, drilled pier design should not assign skin frictional values to soils where bedrock was the primary bearing material. The attached Pier Drilling Summary tables account for this recommendation.
- **Possible Pier Pre-Drilling and Pier Drilling Variation** PPI's pre-drilling utilized a 2-inch to 4.5-inch diameter exploration boring to evaluate the conditions at the proposed pier location. It is understood that pier diameters may vary from 2.5 feet to 6 feet in diameter. Accordingly, some variability of the drilled pier termination conditions compared to the pre-drill conditions may be encountered across the bottom of the drilled pier area. It is recommended that the drilled pier be observed for any unsuitable conditions including voids or soft soils prior to drilled pier



construction. Drilled piers may have to be deepened if these conditions are encountered. Additionally, a condition of partial bedrock and partial soils may be encountered within some drilled pier end bearings due to the highly variable bedrock pinnacles/elevations encountered. If highly varying pier end bearing conditions are encountered, PPI should be contacted to provide additional recommendations.

- Significant Construction Difficulty As noted in the Original Geotechnical Report, the subsurface materials at the site are oftentimes hard and highly abrasive and considered very resistant to typical auger methods. In any event, the drilled pier contractor should anticipate the use of rock augers, rock core barrels and potentially down the hole hammers with a heavy-duty drill rig in order to excavate the drilled piers to the minimum depths specified. Slow drilling production and heavy bit wear should also be anticipated. It is highly recommended that the drilled pier contractor selected have the proper equipment and experience with drilling in the nearby area and in these material types.
- <u>Concrete Loss Due to Voids</u> PPI encountered numerous small voids and loss of circulation areas at the subject site during pier pre-drilling operations. Additionally, a consistent void depth was noted in the southwest corner of the proposed new hospital building that may indicate the presence of a larger void. Significant concrete loss may be possible within this area when drilling through this void. Additionally, concrete over-run related to sloughing or caving of the shaft sidewalls is possible and unit prices should be established for these items in the contract documents.
- Drilled Pier Load Testing An on-site load test of a production drilled pier is not considered a requirement. However, due to the potential for piers to encounter differing end bearing conditions across the width of the drilled pier bearing depth, it is recommended that the contractor bid form include a cost to perform such a load test if conditions encountered within a certain pier necessitate confirmation. Pier load tests, if required, should be performed in accordance with ASTM D1143 and ASTM D3689 for compressive and tensile capacity.

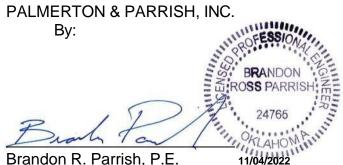
Should you have any questions or need additional information, please feel free to call our office (417-864-6000).



PALMERTON & PARRISH, INC. By:

Humber

R. Todd Hercules, P.E. Geotechnical Engineer



Brandon R. Parrish, P.E. Vice-President

Attachments: Pre-Drill Boring Summary Sheets (108 total)



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	<u>280212</u>
	Pre Drill Boring #:
	<u>1</u>
Grid Line Location:	<u>1-Q</u>
Top Elevation (ft.):	916.1
Total Depth (ft.):	<u>50</u>
Bottom of Boring	
Elevation (ft.):	<u>866.1</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 913.6	0.5	N.R.	Clay with Intermittent Cherty Clay
is shallower 2.5 to 17	913.6 to 899.1	0.75	N.R.	Clay with internittent cherty clay
17 to 25	899.1 to 891.1	1.5	20	Clay/Chert Matrix
25 to 29	891.1 to 887.1	1.0	15	Clay with Trace Chert
29 to 33	887.1 to 883.1	1.5	15	Clay/Chert Matrix
33 to 50	883.1 to 866.1	1.5	10	Cherty Clay

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 899.1	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	899.1 to 881.1	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	881.1 to Bottom of Pier	125	2,000	1,000	400	0.005



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital				
Client:	Foreman Manhattan				
Project #:	280212				
	Pre Drill Boring #:				
	<u>2</u>				
Grid Line Location:	<u>Q-2</u>				
Top Elevation (ft.):	915.8				
Total Depth (ft.):	<u>40</u>				
Bottom of Boring					
Elevation (ft.):	<u>875.8</u>				

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier				
Diameter or 2.5' whichever	Up to 913.3	0.75	N.R.	Cherty Clay/Clayey Gravel
is shallower				
2.5 to 20.0	913.3 to 895.8	0.75	N.R.	
20.0 to 23.5	895.8 to 892.3	1.5	30	Chert/Clay Matrix
23.5 to 28.8	892.3 to 887.0	1.5	35	Gravely Clay/Clayey Gravel
28.8 to 40	887.0 to 875.8	1.5	40	Chert/Clay Matrix
Chin friation Chauld hai	an aread to a denth of 1 mian	diamaatar halaw t	he ground surface	

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.3	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	897.3' to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital				
Client:	Foreman Manhattan				
Project #:	<u>280212</u>				
	Pre Drill Boring #:				
	<u>3</u>				
Grid Line Location:	<u>Q-3</u>				
Top Elevation (ft.):	<u>915.6</u>				
Total Depth (ft.):	<u>50</u>				
Bottom of Boring					
Elevation (ft.):	<u>865.6</u>				

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier				
Diameter or 2.5' whichever	Up to 913.1	0.75	N.R.	
is shallower				Clay/Cherty Clay
2.5 to 23	913.1 to 892.6	0.75	N.R.	
23 to 38	892.6 to 877.6	1.5	7.0	
38 to 45	877.6 to 870.6	1.5	12.0	Cherty Clay
45 to 50	870.6 to 865.6	1.5	20	Chert/Clay Matrix

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Deep Foundation - Lateral Loading

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 877.6	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	877.6 to Bottom of Pier	125	4,000	2,000	800	0.003

PPI Project No. 280212

PPI Project No. 280212



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital				
Client:	Foreman Manhattan				
Project #:	<u>280212</u>				
	Pre Drill Boring #:				
	<u>4</u>				
Grid Line Location:	<u>Q</u> -4				
Top Elevation (ft.):	915.6				
Total Depth (ft.):	<u>50</u>				
Bottom of Boring					
Elevation (ft.):	<u>865.6</u>				

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever	Up to 913.1	0.75	N.R.	Clay/Cherty Clay		
is shallower				Clay/Cherty Clay		
2.5 to 20	913.1 to 895.6	0.75	N.R.			
20 to 28	895.6 to 887.6	1.5	10	Cherty Clay		
28 to 50	887.6 to 865.6	1.5	40	Chert/Clay Matrix		
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						
- Pier depth should meet	or exceed a D/B ratio of 5 b	pelow the ground	surface			

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Deep Foundation - Lateral Loading

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 895.6	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	895.6 to Bottom of Pier	125	4,000	2,000	800	0.003

PPI Project No. 280212

PPI Project No. 280212



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital				
Client:	Foreman Manhattan				
Project #:	280212				
	Pre Drill Boring #:				
	<u>5</u>				
Grid Line Location:	Q-5				
Top Elevation (ft.):	916				
Total Depth (ft.):	<u>50</u>				
Bottom of Boring					
Elevation (ft.):	866.0				

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.5	0.75	N.R.	
2.5 to 23	913.5 to 893.0	0.75	N.R.	Clay/Cherty Clay
23 to 28	893.0 to 888.0	1.5	N.R.	
28 to 33	888.0 to 883.0	1.5	10	
33 to 40.5	883.0 to 875.5	0.75	N.R.	Clay
40.5 to 50 875.5 to 866		1.5	30	Chert/Clay Matrix
- Skin friction Should be ig	nored to a depth of 1 pier	diameter below th	e ground surface	
- Pier depth should meet	or exceed a D/B ratio of 5 b	elow the ground s	surface	
- End bearing not applicat	ble below a depth of 1.5 tim	nes the pier diame	ter above the bot	om of the pre-drill Boring.
- N.R. = Not Recommende	d			

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 893.0	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	893.0 to 883.0	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	883.0 to 875.5	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	875.5 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital				
Client:	Foreman Manhattan				
Project #:	<u>280212</u>				
	Pre Drill Boring #:				
	<u>6</u>				
Grid Line Location:	Q-6				
Top Elevation (ft.):	916.6				
Total Depth (ft.):	<u>50</u>				
Bottom of Boring					
Elevation (ft.):	<u>866.6</u>				

Pre-Drill Information

Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Up to 914.1	0.75	N.R.	Cherty Clay/Clayey Gravel
914.1 to 893.6	0.75	N.R.	,,,,
893.6 to 885.6	1.5	10	
885.6 to 872.6	1.5	4.0	Clay with Chert
872.6 to 866.6	1.5	30	Chert/Clay Matrix
	Up to 914.1 914.1 to 893.6 893.6 to 885.6 885.6 to 872.6	Applicable Elevation (ft.) Friction (ksf) Up to 914.1 0.75 914.1 to 893.6 0.75 893.6 to 885.6 1.5 885.6 to 872.6 1.5	Applicable Elevation (ft.) Friction (ksf) Bearing (ksf) Up to 914.1 0.75 N.R. 914.1 to 893.6 0.75 N.R. 893.6 to 885.6 1.5 10 885.6 to 872.6 1.5 4.0

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 893.6	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	893.6 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	<u>280212</u>
	Pre Drill Boring #:
	<u>7</u>
Grid Line Location:	<u>Q</u> -6.6
Top Elevation (ft.):	916.8
Total Depth (ft.):	<u>50</u>
Bottom of Boring Elevation (ft.):	<u>866.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.3	0.75	N.R.				
2.5 to 18.5	914.3 to 898.3	0.75	N.R.				
18.5 to 22	898.3 to 894.8	1.5	25	Intermittent Clay/Cherty Clay			
22 to 33	894.8 to 883.8	1.5	6.0				
33 to 44	883.8 to 872.8	1.5	3.0				
44 to 50	872.8 to 866.8	1.5	10				
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below th	e ground surface				
- Pier depth should meet	or exceed a D/B ratio of 5 b	elow the ground s	surface				
- End bearing not applicat	ole below a depth of 1.5 tim	nes the pier diame	ter above the bot	tom of the pre-drill Boring.			
- N.R. = Not Recommende	- N.R. = Not Recommended						
- Skin friction factor of saf	fety of 2						
End bearing factor of col	fatura f 2						

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 898.3	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	898.3 to 889.8	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	889.8 to 878.8	125	1,000	500	200	0.010
Stiff Clay Without Free Water	878.8 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital					
Client:	Foreman Manhattan					
Project #:	<u>280212</u>					
	Pre Drill Boring #:					
	<u>8</u>					
Grid Line Location:	Q-7					
Top Elevation (ft.):	917.1					
Total Depth (ft.):	<u>50</u>					
Bottom of Boring						
Elevation (ft.):	<u>867.1</u>					

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.6	0.75	N.R.	Clay/Cherty Clay			
2.5 to 18	914.6 to 899.1	0.75	N.R.				
18 to 33	899.1 to 884.1	1.5	5.0				
33 to 38	884.1 to 879.1	1.5	10	Chert/Clay Matrix			
38 to 50	879.1 to 867.1	1.5	10				
	 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface 						

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 899.1	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	899.1 to Bottom of Pier	125	4,000	2,000	800	0.003



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

Project:	Pier Pre-Drill - WW Hastin	gs Replacement Hospital
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:	11	
Grid Line Location:	P.7-7	
Top Elevation (ft.):	917	
Total Depth (ft.):	50	
Bottom of Boring		
Elevation (ft.):	867.0	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.5	0.75	N.R.	Clay/Cherty Clay
2.5 to 20	914.5 to 897.0	0.75	N.R.	
20 to 33	897.0 to 884.0	1.5	2.0	Charter Class
33 to 40	884.0 to 877.0	1.5	15	Cherty Clay
40 to 50	877.0 to 867.0	1.5	40	Clay/Chert Matrix
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below th	e ground surface	
- Pier depth should meet	or exceed a D/B ratio of 5 b	elow the ground s	surface	
- End bearing not applical	ble below a depth of 1.5 tin	nes the pier diame	ter above the bot	tom of the pre-drill Boring.
- N.R. = Not Recommende	ed			

N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.0	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	897.0 to 889.0	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	889.0 to 884.0	125	1,000	500	200	0.010
Stiff Clay Without Free Water	884.0 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	12			
Grid Line Location:	P.3-6			
Top Elevation (ft.):	916.7			
Total Depth (ft.):	50.3			
Bottom of Boring				
Elevation (ft.):	866.4			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.2	0.75	N.R.	Clay/Cherty Clay with Intermittent
2.5 to 19	914.2 to 897.7	0.75	N.R.	Chert Layers
19 to 34	897.7 to 882.7	1.5	7.0	,
34 to 50.3	882.7 to 866.4	1.5	20	
, i i i i i i i i i i i i i i i i i i i	gnored to a depth of 1 pier or exceed a D/B ratio of 5 b		0	
	ble below a depth of 1.5 tim	-		tom of the pre-drill Boring.
- Skin friction factor of saf	fety of 2			

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 902.7	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	902.7 to 890.7	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	890.7 to 897.7	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	897.7 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>13</u>
Grid Line Location:	<u>7-P.3</u>
Top Elevation (ft.):	917.1
Total Depth (ft.):	<u>50.3</u>
Bottom of Boring	
Elevation (ft.):	<u>866.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.6	0.75	N.R.	Clay/Cherty Clay/Weathered Shale			
2.5 to 18	914.6 to 899.1	0.75	N.R.				
18 to 25	899.1 to 892.1	1.0	N.R.				
25 to 28	892.1 to 889.1	0	N.R.	Clay and Possible Void (26.5' to 27.5')			
28 to 33	889.1 to 884.1	1.5	30	Clay/Chert Matrix			
33 to 50	884.1 to 866.8	1.5	10				
- Skin friction Should be ig	- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface							
- End bearing not applicab	ble below a depth of 1.5 tim	nes the pier diame	er above the bott	om of the pre-drill Boring.			

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 892.1	125	2,000	1,000	400	0.005
Moderately Stiff Clay Without Free Water	892.1 to 889.1	115	500	100	N/A	0.01
Stiff Clay Without Free Water	889.1 to 884.1	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	884.1 to 869.1	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	869.1 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Ho	ospital
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:	<u>14</u>	
Grid Line Location:	<u>1-P - Offset 2' East Due to Utility</u>	
Top Elevation (ft.):	<u>916.6</u>	
Total Depth (ft.):	<u>50</u>	
Bottom of Boring		
Elevation (ft.):	<u>866.6</u>	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 914.1	0.75	N.R.	Clean Clay/Cherty Clay Layers			
is shallower 2.5 to 18	914.1 to 898.6	0.75	N.R.				
18 to 26	898.6 to 890.6	1.5	10	Cherty Clay/Chert Layers			
26 to 38	890.6 to 878.6	1.0	15	Intermittent Clean Clay and Chert Layers			
38 to 50	878.6 to 866.6	1.5	20	Chert and Clayey Gravel Layers			
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface							
- Pier depth should meet	- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
End bearing not applied	hia halawa danthaf 1 Ftin	a a a tha mian dia ma		tons of the area drill Devine			

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 901.6	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	901.6 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>15</u>
Grid Line Location:	<u>P-2</u>
Top Elevation (ft.):	916.3
Total Depth (ft.):	<u>47</u>
Bottom of Boring	
Elevation (ft.):	<u>869.3</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever	Up to 913.8	0.75	N.R.	Gravelly Clay/Clayey Gravel		
is shallower				Graveny Clay/Clayey Graver		
2.5 to 14	913.8 to 902.3	0.75	N.R.			
14 to 16	902.3 to 900.3	0.75	N.R.	Chert, Trace Clay		
16 to 27	900.3 to 889.3	0.75	N.R.			
27 to 32	889.3 to 884.3	0.75	20	Chert/Clay Matrix		
32 to 38.3	884.3 to 878.0	1.5	40			
38.3 to 47	878.0 to 869.3	1.5	40			
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applical	ole below a depth of 1.5 tin	nes the pier diame	ter above the bot	tom of the pre-drill Boring.		
N R = Not Pocommondo						

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 884.3'	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	884.3' to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>16</u>		
Grid Line Location:	P-3		
Top Elevation (ft.):	916.1		
Total Depth (ft.):	<u>50</u>		
Bottom of Boring			
Elevation (ft.):	<u>866.1</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 913.6	0.75	N.R.			
is shallower 2.5 to 19	913.6 to 897.1	0.75	N.R.	Cherty Clay		
19 to 29.0	897.1 to 887.1	1.5	10	Cherty Clay		
29.0 to 35.0	887.1 to 881.1	1.5	30			
35.0 to 50	881.1 to 866.1	1.5	25			
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below t	he ground surface	2		
- Pier depth should meet	or exceed a D/B ratio of 5	below the ground	surface			
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						
- N.R. = Not Recommended						
- Skin friction factor of safety of 2						
- End bearing factor of sa	fety of 3					

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.1	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	897.1 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>17</u>
Grid Line Location:	P-4 - Extended Depth
Top Elevation (ft.):	915.8
Total Depth (ft.):	<u>71</u>
Bottom of Boring	
Elevation (ft.):	<u>844.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever	Up to 913.3	0.75	N.R.	Clay/Crayally, Clay		
is shallower				Clay/Gravelly Clay		
2.5 to 19.2	913.3 to 896.6	0.75	N.R.			
19.2 to 25.5	896.6 to 890.3	1.5	40	Chert/Clay Matrix		
25.5 to 35.5	890.3 to 880.3	1.5	30	Gravelly Clay/Clayey Gravel		
35.5 to 59	880.3 to 856.8	1.5	5.0	Clay/Gravelly Clay		
59 to 71	856.8 to 844.8	1.5	40	Chert/Clay Matrix		
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applica	ble below a depth of 1.5 tir	nes the pier diame	eter above the bot	tom of the pre-drill Boring.		

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Deep Foundation - Lateral Loading

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 896.6	125	2,000	1,000	400	0.005

PPI Project No. 280212

Stiff Clay Without Free Water	896.6 to Bottom of Pier	125	4,000	2,000	800	0.003
----------------------------------	-------------------------	-----	-------	-------	-----	-------



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	<u>18</u>			
Grid Line Location:	<u>P-5</u>			
Top Elevation (ft.):	916.1			
Total Depth (ft.):	<u>36</u>			
Bottom of Boring				
Elevation (ft.):	<u>880.1</u>			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.6	0.75	N.R.	Clay/Cherty Clay		
2.5 to 17	913.6 to 899.1	0.75	N.R.			
17 to 25	899.1 to 891.1	1.5	35	Chert/Clay Matrix		
25 to 36	891.1 to 880.1	1.5	40			
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface			
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						
- N.R. = Not Recommended						
- Skin friction factor of sa	fety of 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 899.1	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	899.1 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>19</u>		
Grid Line Location:	<u>P-6</u>		
Top Elevation (ft.):	<u>916.7</u>		
Total Depth (ft.):	<u>50</u>		
Bottom of Boring			
Elevation (ft.):	<u>866.7</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier		0.75	N.R.		
Diameter or 2.5' whichever is shallower	Up to 914.2	0.75	N.R.	Clay/Cherty Clay with Intermittent	
2.5 to 28	914.2 to 888.7	1.0	N.R.	Chert Layers	
28 to 39	888.7 to 877.7	1.5	10	,	
39 to 50	877.7 to 866.7	1.5	25		
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	2	
- Pier depth should meet	or exceed a D/B ratio of 5 I	pelow the ground	surface		
- End bearing not applical	ble below a depth of 1.5 tir	nes the pier diame	eter above the bo	ttom of the pre-drill Boring.	
- N.R. = Not Recommended					
- Skin friction factor of safety of 2					
- End bearing factor of sa	fety of 3				

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 888.7	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	888.7 to Bottom of Pier	125	4,000	2,000	800	0.003



Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever is shallower	Up to 914.6	0.5	N.R.	Clay/Cherty Clay		
2.5 to 20	914.6 to 897.1	0.75	N.R.			
20 to 34	897.1 to 883.1	1.5	10			
34 to 39	883.1 to 878.1	1.5	30	Clay/Chert Matrix		
39 to 50	878.1 to 867.1	1.5	40			
- Skin friction Should be ig	nored to a depth of 1 pier	diameter below th	e ground surface			
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						
- N.R. = Not Recommended						
- Skin friction factor of sat	- Skin friction factor of safety of 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 902.6	125	1,000	500	200	0.010
Moderately Stiff Clay Without Free Water	902.6 to 897.1	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	897.1 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>24</u>		
Grid Line Location:	<u>2-N</u>		
Top Elevation (ft.):	916.7		
Total Depth (ft.):	<u>50.5</u>		
Bottom of Boring			
Elevation (ft.):	<u>866.2</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.2	0.5	N.R.	Cherty Clay With Intermittent Clean Clay Layers		
2.5 to 20	914.2 to 896.7	0.75	N.R.			
20 to 40	896.7 to 876.7	1.5	15	Clay/Chart Matrix		
40 to 50.5	876.7 to 866.2	1.5	30	Clay/Chert Matrix		
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	2		
- Pier depth should meet	- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						
- N.R. = Not Recommended						
- Skin friction factor of sa	fety of 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Moderately Stiff Clay Without Free Water	1 Pier Diameter to 900.2	115	1,000	500	200	0.010
Stiff Clay Without Free Water	900.2 to to Bottom of Pier	115	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>25</u>		
Grid Line Location:	<u>3-N</u>		
Top Elevation (ft.):	<u>916.5</u>		
Total Depth (ft.):	<u>50.9</u>		
Bottom of Boring			
Elevation (ft.):	<u>865.6</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 914.0	0.75	N.R.			
is shallower	0010 914.0	0.75	N.K.			
2.5 to 19	914.0 to 897.5	0.75	N.R.	Clean Clay with chert Lenses		
19 to 26	897.5 to 890.5	1.5	2.5			
26 to 32	890.5 to 884.5	1.0	2.5			
32 to 35	884.5 to 881.5	1.5	40	Clay/Chert Matrix		
35 to 50	881.5 to 865.6	1.5	20	Cherty Clay		
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applica	- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommende	ed					

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 884.5	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	884.5 to Bottom of Pier	125	4,000	2,000	800	0.003



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:		<u>26</u>	
Grid Line Location:	4-N - Offset 4' East Due to Utilitiy - Extended Depth		
Top Elevation (ft.):	916.1		
Total Depth (ft.):		<u>70</u>	
Bottom of Boring			
Elevation (ft.):		846.1	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 913.6	0.75	N.R.		
is shallower	00 10 515.0	0.75		Clay With Some Cherty Clay	
2.5 to 19	913.6 to 897.1	0.75	N.R.		
19 to 23	897.1 to 893.1	1.5	20	Cherty Clay	
23 to 36	893.1 to 880.1	1.5	10	Cherty Clay	
36 to 62	880.1 to 854.1	1.5	4	Clay with Intermittent Chert Layers	
62 to 70	854.1 to 846.1	1.5	30	Chert	
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below th	e ground surface		
- Pier depth should meet	or exceed a D/B ratio of 5 b	elow the ground s	surface		
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommended					
- Skin friction factor of safety of 2					
- End bearing factor of sat	fety of 3				

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 905.1	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	905.1 to 880.1	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	880.1 to 854.1	125	1,000	500	200	0.010
Stiff Clay Without Free Water	854.1 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>27</u>		
Grid Line Location:	<u>5-N</u>		
Top Elevation (ft.):	<u>916.3</u>		
Total Depth (ft.):	<u>50</u>		
Bottom of Boring			
Elevation (ft.):	<u>866.3</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier					
Diameter or 2.5' whichever is shallower	Up to 913.8	0.75	N.R.	Clay With Chert	
2.5 to 14	913.8 to 902.3	0.75	N.R.		
14 to 20	902.3 to 896.3	1.5	20	Class/Chart Matrix	
20 to 25	896.3 to 891.3	1.5	40	Clay/Chert Matrix	
25 to 41	891.3 to 875.3	1.5	20	Cherty Clay	
41 to 50	41 to 50 875.3 to 866.3 1.5 40 Clay/Chert Matrix				
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface					
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					
- End bearing not applical	ble below a depth of 1.5 tir	nes the pier diame	eter above the bo	ttom of the pre-drill Boring.	

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 902.3	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	902.3 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>28</u>
Grid Line Location:	N-6 - Extended Depth
Top Elevation (ft.):	<u>916.8</u>
Total Depth (ft.):	<u>70</u>
Bottom of Boring	
Elevation (ft.):	<u>846.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier					
Diameter or 2.5' whichever is shallower	Up to 914.3	0.75	N.R.	Clay/Cherty Clay	
2.5 to 20	914.3 to 896.8	0.75	N.R.		
20 to 25	896.8 to 891.8	1.5	40	Intermittent Cherty Clay and Chert/Clay Matrix	
25 to 46	891.8 to 870.8	1.25	7.0	Intermittent Clay & Charty Clay	
46 to 63	870.8 to 853.8	1.25	4.0	Intermittent Clay & Cherty Clay	
63 to 70	853.8 to 846.8	1.5	20	Chert	
- Skin friction Should be ig	nored to a depth of 1 pier o	liameter below the	e ground surface		
- Pier depth should meet o	or exceed a D/B ratio of 5 be	elow the ground s	urface		
- End bearing not applicab	le below a depth of 1.5 tim	es the pier diamet	er above the botto	om of the pre-drill Boring.	
- N.R. = Not Recommended					
- Skin friction factor of safety of 2					
- End bearing factor of saf	ety of 3				

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static Kh (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 896.8	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	896.8 to 883.8	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	883.8 to 876.8	125	1,000	500	200	0.010
Stiff Clay Without Free Water	876.8 to 865.8	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	865.8 to 853.8	125	1,000	500	200	0.010
Stiff Clay Without Free Water	853.8 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	36
Grid Line Location:	1-L - 2' Offset East Due to Utility
Top Elevation (ft.):	917
Total Depth (ft.):	50
Bottom of Boring	
Elevation (ft.):	867.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.5	0.5	N.R.	Clay/Cherty Clay	
2.5 to 20	914.5 to 897.0	0.5	N.R.		
20 to 40	897.0 to 877.0	1.5	30	Chert/Cherty Clay	
40 to 50	877.0 to 867.0	1.5	40	Clay/Chert Matrix	
	- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface				
 Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended Skin friction factor of safety of 2 					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.0	125	1,000	500	200	0.010
Stiff Clay Without Free Water	897.0 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>37</u>
Grid Line Location:	<u>2-L</u>
Top Elevation (ft.):	916.7
Total Depth (ft.):	<u>61</u>
Bottom of Boring	
Elevation (ft.):	<u>855.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.2	0.5	N.R.	Clay		
2.5 to 23	914.2 to 893.7	0.5	N.R.			
23 to 27	893.7 to 889.7	1.5	30	Chert with Clay Layers		
27 to 39	889.7 to 877.7	1.5	20	Cheft with Clay Layers		
39 to 54	877.7 to 862.7	1.5	12	Cherty Clay		
54 to 61	862.7 to 855.7	1.5	30	Chert with Clay Layers		
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface - Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	lgnore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 893.7	125	1,000	500	200	0.010
Stiff Clay Without Free Water	893.7 to 877.7	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	893.7 to 862.7	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	862.7 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>38</u>
Grid Line Location:	<u> 3-L - Extended Depth</u>
Top Elevation (ft.):	916.5
Total Depth (ft.):	<u>51.5</u>
Bottom of Boring	
Elevation (ft.):	865.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.0	0.5	N.R.	Clay/Cherty Clay
2.5 to 17	914.0 to 899.5	0.5	N.R.	
17 to 30	899.5 to 886.5	1.0	N.R.	Cherty Clay With Soft Clay Layers
30 to 36	886.5 to 875.5	1.5	15	Cherty Clay
36 to 44	875.5 to 872.5	0.5	N.R.	Chert/Clay to 41' Clean Clay Below 41'
44 to 59	872.5 to 857.5	1.5	5.0	Clay/Chert Alternating Layers
59 to 75	857.5 to 841.5	1.5	40	Chert/Clay Matrix

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 886.5	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	886.5 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	39
Grid Line Location:	4-L
Top Elevation (ft.):	916
Total Depth (ft.):	51
Bottom of Boring	
Elevation (ft.):	865.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.5	0.5	N.R.	Clay
2.5 to 17	913.5 to 899.0	0.5	N.R.	
17 to 22	899.0 to 894.0	1.5	40	Clay/Chert Matrix
22 to 38	894.0 to 878.0	1.5	10	Clay/Chart Matrix With Intermittent
38 to 43	878.0 to 873.0	1.5	20	Clay/Chert Matrix With Intermittent
43 to 51	873.0 to 865.0	1.5	15	Clean Clay
- Pier depth should meet	nored to a depth of 1 pier or exceed a D/B ratio of 5 b ole below a depth of 1.5 tim d	elow the ground s	surface	tom of the pre-drill Boring.

Skin friction factor of safety of 2End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	Ignore	lgnore	Ignore	Ignore
Moderately Stiff Clay Without Free Water	1 Pier Diameter to 899.0	115	500	100	N/A	0.010
Stiff Clay Without Free Water	899.0 to 868.0	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	868.0 to Bottom of Pier	125	2,000	1,000	400	0.005



Project:	Pier Pre-Drill - WW Hasting	s Replacement Hospital
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:	40	
Grid Line Location:	5-L	
Top Elevation (ft.):	916	
Total Depth (ft.):	50	
Bottom of Boring		
Elevation (ft.):	866.0	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.5	0.5	N.R.	Gravelly Clay to 8'			
2.5 to 15	913.5 to 901.0	0.5	N.R.	Clean Clay Below 8'			
15 to 23	901.0 to 893.0	0	N.R.				
23 to 33	893.0 to 883.0	1.5	20	Clay/Chert Matrix			
33 to 44	883.0 to 872.0	1.5	5.0	Chert/Clay to 39' Clean Clay below 39'			
44 to 50	872.0 to 866.0	1.5	15	Chert/Cherty Clay			
- Pier depth should meet	44 to 50 872.0 to 866.0 1.5 15 Chert/Cherty Clay - Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface - Pier depth should meet or exceed a D/B ratio of 5 below the ground surface - End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	lgnore	Ignore	Ignore
Moderately Stiff Clay Without Free Water	1 Pier Diameter to 901.0	125	1,000	500	200	0.010
Soft Clay	901.0 to 893.0	100	50	N/A	N/A	0.020
Stiff Clay Without Free Water	893.0 to 881.0	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	881.0 to Bottom of Pier	125	2,000	1,000	400	0.005



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>41</u>
Grid Line Location:	<u>6-L</u>
Top Elevation (ft.):	916.6
Total Depth (ft.):	<u>50</u>
Bottom of Boring	
Elevation (ft.):	<u>866.6</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.1	0.75	N.R.	Cherty Clay with Intermittent Layers			
2.5 to 20	914.1 to 896.6	0.75	N.R.	of Clean Clay			
20 to 23	896.6 to 893.6	1.5	20	,			
23 to 38	893.6 to 878.6	1.0	2.5				
38 to 44	878.6 to 872.6	1.5	10	Cherty Clay			
44 to 50	872.6 to 866.6	1.5	20	Cherty Clay			
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended 							

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	lgnore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 898.6	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	898.6 to 887.6	125	4,000	2,000	800	0.003
Moderately Stif Clay Without Free Water	887.6 to 873.6	115	500	100	N/A	0.010
Stiff Clay Without Free Water	873.6 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital	
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:		<u>47</u>
Grid Line Location:	<u>1-K - Offset 2' East Due to Utility - Extended Depth</u>	
Top Elevation (ft.):	916.9	
Total Depth (ft.):		<u>60</u>
Bottom of Boring		
Elevation (ft.):		<u>856.9</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material				
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.4	0.5	N.R.	Clay/Cherty Clay				
2.5 to 31	914.4 to 885.9	0.5	N.R.					
31 to 46.5	885.9 to 870.4	1.5	10	Cherty Clay				
46.5 to 60	870.4 to 866.9	1.5	40	Clay/Chert Matrix				
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface					
- Pier depth should meet	or exceed a D/B ratio of 5 I	below the ground	surface					
- End bearing not applical	- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.							
- N.R. = Not Recommende	- N.R. = Not Recommended							
- Skin friction factor of sa	fety of 2							

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.9	125	1,000	500	200	0.010
Stiff Clay Without Free Water	897.9 to 869.9	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	869.9 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>48</u>
Grid Line Location:	<u>2-К</u>
Top Elevation (ft.):	916.6
Total Depth (ft.):	<u>80</u>
Bottom of Boring	
Elevation (ft.):	<u>836.6</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.1	0.5	N.R.	Clay/Cherty Clay with Possible Small Voids			
2.5 to 23	914.1 to 893.6	0.5	N.R.				
23 to 31	893.6 to 885.6	0.75	2.0	Charty Claywith Chart Layors			
31 to 64	885.6 to 852.6	1.5	7.0	Cherty Clay with Chert Layers			
64 to 80	852.6 to 836.6	1.5	40	Chert			
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	2			
- Pier depth should meet	or exceed a D/B ratio of 5 I	below the ground	surface				
- End bearing not applica	ble below a depth of 1.5 tir	nes the pier diame	eter above the bo	ttom of the pre-drill Boring.			
- N.R. = Not Recommende	- N.R. = Not Recommended						
- Skin friction factor of sa	fety of 2						
- End bearing factor of sa	fety of 3						

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 852.6	125	1,000	500	200	0.010
Stiff Clay Without Free Water	852.6 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	<u>49</u>			
Grid Line Location:	<u>З-К</u>			
Top Elevation (ft.):	916.4			
Total Depth (ft.):	<u>60</u>			
Bottom of Boring				
Elevation (ft.):	<u>856.4</u>			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.9	0.5	N.R.	Clay/Cherty Clay/Thin Shale		
2.5 to 17.5	913.9 to 898.9	0.75	N.R.			
17.5 to 21.5	898.9 to 894.9	2.0	N.R.	Cherty Limestone		
21.5 to 22.3	894.9 to 894.1	0	N.R.	Possible Void		
22.3 to 42	894.1 to 874.4	1.5	5.0	Cherty Clay		
42 to 60	874.4 to 856.4	1.5	40	Chert with Intermittent Clay Seams		
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applical	- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
N.D Net Decommended						

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Soft Clay	1 Pier Diameter to 906.9	100	500	30	N/A	0.010
Stiff Clay Without Free Water	906.9 to 874.4	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	874.4 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pi
Client:	Fo
Project #:	28
Pre Drill Boring #:	<u>50</u>
Grid Line Location:	4-
Top Elevation (ft.):	<u>9</u> :
Total Depth (ft.):	<u>6</u> 2
Bottom of Boring	
Elevation (ft.):	8

Pier Pre-Drill - WW Hastings Replacement Hospital
Foreman Manhattan
280212
50
4-К
916
62
854.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.5	0.5	N.R.	Clay/Cherty Clay		
2.5 to 16	913.5 to 900.0	0.5	N.R.			
16 to 17	900.0 to 899.0	1.5**	N.R.	Shale		
17 to 23	899.0 to 893.0	2.0**	50**	Charty Limestano		
23 to 33	893.0 to 883.0	1.5	N.R.	Cherty Limestone		
33 to 37.5	883.0 to 878.5	1.0	N.R.	Chert & Clay Matrix		
37.5 to 42.5	878.5 to 873.5	0	N.R.	6" Void at 38' - Cherty Clay		
42.5 to 62	873.5 to 854.0	1.5	10	Clay/Chert Matrix		
Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground sur

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

** - If the pier bears within this material, the pier should be considered bearing on bedrock and soil skin friction should not be utilized from layers other than shale and cherty limestone.

		Unit Weight			Cyclic Kh		
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀	
Stiff Clay Without Free	Ground Surface to 1 Pier	lgnore	lgnore	Ignore	Ignore	Ignore	
Water	Diameter	ignore	Ignore	Ignore	Ignore	ignore	
Stiff Clay Without Free Water	1 Pier Diameter to 900.0	125	1,000	500	200	0.010	
Weathered	000 0 to 002 0	150	Unconfined Compressive Strength (psi)				
Limestone/Strong Rock	900.0 to 883.0	900.0 to 883.0 150		2,000			
					Cyclic K _h		
Void	883.0 to 878.0	0	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀	
				N/A			
Soft Clay	878.0 to 873.5	90	100	30	N/A	0.02	
Stiff Clay Without Free Water	873.5 to 854.0	125	2000	1000	400	0.005	



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	<u>51</u>			
Grid Line Location:	<u>5-K - Extended Depth</u>			
Top Elevation (ft.):	915.9			
Total Depth (ft.):	<u>60.3</u>			
Bottom of Boring				
Elevation (ft.):	<u>855.6</u>			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.4	0.5	N.R.	Clay	
2.5 to 18.5	913.4 to 897.4	1.0	N.R.		
18.5 to 22.0	897.4 to 893.9	3.0	50	Shale/Cherty Limestone	
22.0 to 28.5	893.9 to 887.4	3.0	N.R.	Cherty Limestone	
28.5 to 46	887.4 to 869.9	1.0	N.R.	Intermittent Clay and Chert	
46 to 60.3	869.9 to 864.9	2.0	50	Fractured Chert	
 - Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface - Pier depth should meet or exceed a D/B ratio of 5 below the ground surface - End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. 					

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 898.4	125	1,000	500	200	0.010
Stiff Clay Without Free Water	898.4 to 887.4	150	4,000	2,000	800	0.003
Stiff Clay Without Free Water	887.4 to 869.9	125	1,000	500	200	0.010
Stiff Clay Without Free Water	Below 869.9	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	<u>52</u>			
Grid Line Location:	<u>6-K</u>			
Top Elevation (ft.):	916.3			
Total Depth (ft.):	<u>50</u>			
Bottom of Boring				
Elevation (ft.):	<u>866.3</u>			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier					
Diameter or 2.5' whichever is shallower	Up to 913.8	0.5	N.R.	Fat Clay	
2.5 to 21	913.8 to 895.3	0.5	N.R.		
21 to 26	895.3 to 890.3	0.75	N.R.		
26 to 38	890.3 to 878.3	1.5	7.0	Cherty Clay	
38 to 50	878.3 to 866.3	1.5	40	Chert	
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	2	
- Pier depth should meet	or exceed a D/B ratio of 5 l	below the ground	surface		
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommended					
- Skin friction factor of safety of 2					
Find have size for stars of a first set 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 878.3	125	1,000	500	200	0.010
Stiff Clay Without Free Water	878.3 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>61</u>		
Grid Line Location:	<u>1-J Offset 2' East Due to U</u> tility		
Top Elevation (ft.):	916.8		
Total Depth (ft.):	<u>70</u>		
Bottom of Boring			
Elevation (ft.):	<u>846.8</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.3	0.3	N.R.	Clay/Cherty Clay		
2.5 to 21.5	914.3 to 895.3	0.5	N.R.			
21.5 to 41	895.3 to 875.8	1.5	5	Cherty Clay		
41 to 48	875.8 to 861.8	1.5	25			
48 to 61	861.8 to 855.8	1.5	1.0	Cherty Clay/Chert		
61 to 70	855.8 to 846.8	1.5	40			
	gnored to a depth of 1 pier or exceed a D/B ratio of 5 I		•	2		
 End bearing not applica N.R. = Not Recommended 	•	nes the pier diame	eter above the bo	ttom of the pre-drill Boring.		
- Skin friction factor of sa	- Skin friction factor of safety of 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 889.3	125	1,000	500	200	0.010
Stiff Clay Without Free Water	889.3 to Bottom of Pier	125	4,000	2,000	800	0.003



Pier Pre-Drill - WW Hastings Replacement Hospital			
<u>כ</u>			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.0	0.5	N.R.	Clay/Cherty Clay	
2.5 to 22	914.0 to 894.5	0.5	N.R.		
22 to 48	894.5 to 868.5	1.5	6.0	Chert With Soft Clay Layers	
48 to 53.5	868.5 to 863.0	1.5	12	Chert/Cherty Clay	
53.5 to 69	863.0 to 847.5	1.5	7.0	Chert With Soft Clay Layers	
69 to 75	847.5 to 841.5	1.5	20	Chert/Cherty Clay	
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface					
- Pier depth should meet	- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface				
- End bearing not applical	ble below a depth of 1.5 tir	nes the pier diame	eter above the bot	tom of the pre-drill Boring.	

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 894.5	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	894.5 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>63</u>		
Grid Line Location:	<u>3-J</u>		
Top Elevation (ft.):	916.2		
Total Depth (ft.):	<u>54</u>		
Bottom of Boring			
Elevation (ft.):	<u>862.2</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.7	N.R.	N.R.	Clay
2.5 to 14.0	913.7 to 902.2	N.R.	N.R.	
14.0 to 24.0	902.2 to 892.2	1.5	N.R.	Shale
24.0 to 38.0	892.2 to 878.2	3.5	60	Weathered Cherty Limestone
38.0 to 45.5	878.2 to 870.7	3.5	N.R.	weathered cherty Linestone
45.5 to 48.5	870.7 to 867.7	1.5	N.R.	Highly Weathered Cherty Limestone
48.5 to 54.0	867.7 to 862.2	1.5	N.R.	Intermittent Voids and Cherty Limestone

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 902.2	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	902.2 to 892.2	135	4,000	2,000	800	0.003
Cherty Limestone/ Strong	892.2 to 867.7	140 Unconfined		ned Compressive Strength (psi)		
Rock	052.2 (0 007.7	140	2,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>64</u>		
Grid Line Location:	<u>4-J</u>		
Top Elevation (ft.):	915.7		
Total Depth (ft.):	<u>34.3</u>		
Bottom of Boring			
Elevation (ft.):	<u>881.4</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier				
Diameter or 2.5' whichever is shallower	Up to 913.2	N.R.	N.R.	Clay
2.5 to 15.5	913.2 to 900.2	N.R.	N.R.	
15.5 to 25.0	900.2 to 890.7	4.0	20	Shale and Shaley Limestone
25.0 to 28.0	890.7 to 887.7	3.5	20	Weathered Shaley Limestone
28.0 to 34.3	887.7 to 881.4	5.0	100	Cherty Limestone With
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below th	e ground surface	
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface				
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.				
- N.R. = Not Recommende	d			
Clin friction factor of actors of a				

Skin friction factor of safety of 2End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 900.2	125	2,000	1,000	400	0.005
Shaley Limestone and Shale/ Strong Rock	900.2 to 887.7	135	Unconfined Compressive Strength (psi) 2,000			
Cherty Limestone/ Strong Rock	887.7 to Bottom of Pier	150	4,000			



Project:
Client:
Project #:
Pre Drill Boring #:
Grid Line Location:
Top Elevation (ft.):
Total Depth (ft.):
Bottom of Boring
Elevation (ft.):
Project #: Pre Drill Boring #: Grid Line Location: Top Elevation (ft.): Total Depth (ft.): Bottom of Boring

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.3	N.R.	N.R.	Clay/Cherty Clay	
2.5 to 16.3	914.3 to 900.5	N.R.	N.R.		
16.3 to 18	900.5 to 898.8	2.5	60	Shaley Limestone	
18 to 29	898.8 to 887.8	1.5	N.R.	Shaley Limestone to Weathered Shale at 25'	
29 to 38.5	887.8 to 878.3	5.0	100	Cherty Limestone	
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended Skin friction factor of safety of 2 End bearing factor of safety of 3 					

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 900.5	125	1,000	500	200	0.010
Shaley Limestone/ Strong			Unconfined Compressive Strength (psi)			
Rock	900.5 to 891.8	140	2,000			
Marthanad Chala / Chiff					Cyclic K _h	
Weathered Shale/ Stiff Clay	891.8 to 888.8	125	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Cidy			4,000	2,000	800	0.003
Cherty Limestone/ Strong	Below 888.8	150	Unconfined Compressive Strength (ps			
Rock	DEIUW 000.0	130				



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>66</u>		
Grid Line Location:	<u>6-J</u>		
Top Elevation (ft.):	916.1		
Total Depth (ft.):	<u>60</u>		
Bottom of Boring			
Elevation (ft.):	<u>856.1</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.6	0.5	N.R.	Clay/Cherty Clay	
2.5 to 19	913.6 to 897.1	0.75	N.R.		
19 to 28	897.1 to 888.1	1.5	N.R.	Shaley Limestone With Clay Seams 3" Void at 26.1'	
28 to 42	888.1 to 874.1	1.5	5	Clay/Chert	
42 to 60	874.1 to 856.1	1.5	20	Chert with Clay Seams	
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended 					

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.1	125	1,000	500	200	0.010
Stiff Clay Without Free Water	897.1 to 884.1	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	884.1 to 874.1	125	1,000	500	200	0.010
Stiff Clay Without Free Water	874.1 to Bottom of Pier	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>73</u>		
Grid Line Location:	<u>1-H</u>		
Top Elevation (ft.):	<u>916.9</u>		
Total Depth (ft.):	<u>75</u>		
Bottom of Boring			
Elevation (ft.):	<u>841.9</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.4	0.5	N.R.	Cherty Clay	
2.5 to 18.5	914.4 to 898.4	0.75	N.R.		
18.5 to 48	898.4 to 868.9	1.5	20	Clay/Chert	
48 to 68	868.9 to 848.9	1.5	15	Charty Clay	
68 to 75	848.9 to 841.9	1.5	20	Cherty Clay	
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface					
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommended					
- Skin friction factor of safety of 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 898.4	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	898.4 to 859.9	125	4,000	2,000	800	0.003
Stiff Clay Without Free Water	859.9 to 849.9	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	Below 849.9	125	4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>74</u>		
Grid Line Location:	<u>2-H</u>		
Top Elevation (ft.):	916.4		
Total Depth (ft.):	<u>41.75</u>		
Bottom of Boring			
Elevation (ft.):	<u>874.7</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.9	N.R.	N.R.	Clay/Cherty Clay/Shaley Clay
2.5 to 25.5	913.9 to 890.9	N.R.	N.R.	
25.5 to 41.75	890.9 to 874.7	2.5	50	Highly Fractured Cherty Limestone
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface				

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 890.9	125	2,000	1,000	400	0.005
Weathered	890.9 to 135		Unconfined Compressive Strength (psi)			
Limestone/Strong Rock	650.9 10	132	2,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>75</u>		
Grid Line Location:	<u>3-H</u>		
Top Elevation (ft.):	916.1		
Total Depth (ft.):	<u>42.5</u>		
Bottom of Boring			
Elevation (ft.):	<u>873.6</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.6	N.R.	N.R.	Overburden	
2.5 to 16	913.6 to 900.1	N.R.	N.R.		
16 to 25.3	900.1 to 890.8	2.0	N.R.	Weathered Cherty Limestone	
25.3 to 27.5	890.8 to 888.6	5.0	100	Cherty Limestone	
27.5 to 36	888.6 to 880.1	2.0	N.R.	Weathered Cherty Limestone	
36 to 42.5	880.1 to 873.6	5.0	100	Cherty Limestone	
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended 					

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 900.1	125	1,000	500	200	0.010
Weathered	900.1 to 890.8	140	Unconfined Compressive Strength (psi)			
Limestone/Strong Rock	900.1 (0 890.8	140	2,000			
Limestone/Strong Rock	890.8 to 888.6		4,000			
Weathered	888.6 to 880.1	150	2,000			
Limestone/Strong Rock	880.1 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>76</u>		
Grid Line Location:	<u>4-H</u>		
Top Elevation (ft.):	915.6		
Total Depth (ft.):	<u>44.8</u>		
Bottom of Boring			
Elevation (ft.):	<u>870.8</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.1	N.R.	N.R.	Overburden	
2.5 to 14	913.1 to 901.6	N.R.	N.R.		
14 to 29.5	901.6 to 886.1	1.5	N.A.	Weathered Cherty Limestone	
Below 29.5	Below 886.1	5.0	100	Cherty Limestone	
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	!	
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommended					
- Skin friction factor of sa	fety of 2				

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 901.6	115	500	100	N/A	0.020
Weathered			Unconfin	Unconfined Compressive Strength (psi)		
Limestone/Strong Rock	901.6 to 886.1	140	2,000			
Limestone/Strong Rock	886.1 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>77</u>		
Grid Line Location:	<u>5-H</u>		
Top Elevation (ft.):	915.6		
Total Depth (ft.):	<u>43.3</u>		
Bottom of Boring			
Elevation (ft.):	<u>872.3</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier					
Diameter or 2.5' whichever is shallower	Up to 913.1	N.R. N	N.R. N	N.R.	Overburden
2.5 to 14.6	913.1 to 901.0	N.R.	N.R.		
14.6 to 31	901.0 to 884.6	1.5	N.A.	Weathered Cherty Limestone	
Below 31	Below 884.6	5.0	100	Cherty Limestone/Conglomerate	
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	!	
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommende	ed				
Clein friction factor of option of D					

Skin friction factor of safety of 2End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 901.0	115	500	100	N/A	0.020
Weathered			Unconfined Compressive Strength (psi)			
Limestone/Strong Rock	901.0 to 884.6	140	2,000			
Limestone/Strong Rock	884.6 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	<u>78</u>			
Grid Line Location:	<u>6-H</u>			
Top Elevation (ft.):	915.9			
Total Depth (ft.):	<u>35.3</u>			
Bottom of Boring				
Elevation (ft.):	<u>880.6</u>			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever is shallower	Up to 913.1	N.R. N.R.	N.R.	Overburden		
2.5 to 9.6	913.4 to 906.3	N.R.	N.R.			
9.6 to 22	906.3 to 893.9	1.5	N.R.	Weathered Cherty Limestone		
Below 22	Below 893.9	5.0	100	Cherty Limestone/Conglomerate		
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	2		
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						
- N.R. = Not Recommende	ed					

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 906.3	125	4,000	2,000	800	0.003
\M/aatharad			Unconfined Compressive Strength (psi)			
Weathered Limestone/Strong Rock	906.3 to 895.0	140	2,000			
Limestone/Strong Rock	895.0 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>83</u>		
Grid Line Location:	<u>1-G</u>		
Top Elevation (ft.):	916.7		
Total Depth (ft.):	<u>68.1</u>		
Bottom of Boring			
Elevation (ft.):	<u>848.6</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever is shallower	Up to 914.2	0.3	N.R.	Cherty Clay/Clay		
2.5 to 22.0	914.2 to 894.7	0.5	N.R.			
22.0 to 32.0	894.7 to 884.7	1.5	N.R.	Shale/Chert		
32.0 to 35.0	884.7 to 881.7	0	N.R.	VOID		
35.0 to 44.0	881.7 to 872.7	0.5	N.R.			
44.0 to 51.0	872.7 to 865.7	1.5	2.0	Cherty Clay/Chert		
51.0 to 60.0	865.7 to 856.7	1.5	12.0			
60.0 to 68.1	856.7 to 848.6	1.5	40.0	Chert		
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below th	ne ground surface			
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						
- N.R. = Not Recommende	- N.R. = Not Recommended					
- Skin friction factor of sat	fety of 2					

- End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 904.7	125	2,000	1,000	400	0.010
Soft Clay	904.7 to 894.7	115	500	100	N/A	0.020
Stiff Clay Without Free Water	894.7 to 884.7	125	4,000	2,000	800	0.005
Soft Clay	884.7 to 872.7	115	250	30	N/A	0.020
Stiff Clay Without Free Water	872.7 to Bottom of Pier	125	4,000	2,000	800	0.005



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>84</u>		
Grid Line Location:	<u>2-G</u>		
Top Elevation (ft.):	<u>916.3</u>		
Total Depth (ft.):	<u>39.2</u>		
Bottom of Boring			
Elevation (ft.):	<u>877.1</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever is shallower	Up to 913.8	N.R.	N.R.	Cherty Clay/Clay		
2.5 to 14.0	913.8 to 902.3	N.R.	N.R.			
14.0 to 24.0	902.3 to 892.3	2.5	N.R.	Shaley Limestone With Wash Away Material		
24.0 to 39.2	892.3 to 877.1	3.5	60	Cherty Limestone		
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						
- Pier depth should meet	- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					
- End bearing not applica	ble below a depth of 1.5 tir	nes the pier diame	eter above the bo	ttom of the pre-drill Boring.		

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

6.11 7		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 902.3	125	2,000	1,000	400	0.005
Shaley Limestone and	902.3 to Bottom of Pier	125	Unconfined Compressive Strength (Strength (psi)	
Shale/ Strong Rock	902.3 to bottom of Pier	135		2,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>85</u>		
Grid Line Location:	<u>3-G</u>		
Top Elevation (ft.):	<u>915.9</u>		
Total Depth (ft.):	<u>34.1</u>		
Bottom of Boring			
Elevation (ft.):	<u>881.8</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.4	N.R.	N.R.	Clay/Weathered Shale	
2.5 to 14.5	913.4 to 901.4	N.R.	N.R.		
14.5 to 27.0	901.4 to 888.9	4.0	100	Shaley Limestone	
27.0 to 34.1	888.9 to 881.8	5.0	100	Cherty Limestone	
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	!	
- Pier depth should meet	or exceed a D/B ratio of 5 I	below the ground	surface		
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommended					
- Skin friction factor of sa	fety of 2				

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 900.2	125	1,000	500	200	0.010
			Unconfin	ed Compressive	Strength (psi)	
Shaley & Cherty Limestone/ Strong Rock	900.2 to 887.7	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>86</u>
Grid Line Location:	<u>4-G</u>
Top Elevation (ft.):	<u>915.3</u>
Total Depth (ft.):	<u>46.8</u>
Bottom of Boring	
Elevation (ft.):	<u>868.5</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier					
Diameter or 2.5' whichever is shallower	Up to 912.8	N.R.	N.R.	Clay	
2.5 to 26.0	912.8 to 889.3	N.R.	N.R.		
26.0 to 35.0	889.3 to 880.3	3.5	40	Shaley Limestone	
35.0 to 47.8	880.3 to 868.5	5	100	Limestone With Chert	
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface		
- Pier depth should meet	or exceed a D/B ratio of 5 I	below the ground	surface		
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommende	ed				
Chin fristian fastar of ca	faturaf 2				

Skin friction factor of safety of 2End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	lgnore
Soft Clay	1 Pier Diameter to 889.3	125	500	150	N/A	0.010
Shaley Limestone and	889.3 to 880.3	135	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	889.5 10 880.5	2,000				
Cherty Limestone/ Strong Rock	880.3 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>87</u>		
Grid Line Location:	<u>5-G</u>		
Top Elevation (ft.):	915.3		
Total Depth (ft.):	<u>36.8</u>		
Bottom of Boring			
Elevation (ft.):	<u>878.5</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier						
Diameter or 2.5' whichever	Up to 912.8	N.R.	N.R.	Clay		
is shallower				Cidy		
2.5 to 11.7	912.8 to 903.6	N.R.	N.R.			
11.7 to 13	903.6 to 902.3	1.5	N.R.	Weathered Shale		
13.0 to 18.0	902.3 to 897.3	3.5	50	Shaley Limestone and Weathered		
18.0 to 21.5	897.3 to 893.8	3.5	N.R.	Shale		
21.5 to 22.5	893.8 to 892.8	0	N.R.	Void		
22.5 to 26.0	892.8 to 889.3	3.0	50	Shaley Limestone & Shale		
26.0 to 36.8	889.3 to 878.5	3.0	50	Cherty Limestone With Clay Seams		
- Skin friction Should be ig	- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface					
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface						
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.						
- N.R. = Not Recommende	d			-		

Skin friction factor of safety of 2End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 903.6	125	2,000	1,000	400	0.005
Shaley Limestone and	903.6 to 883.8	140	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	903.0 10 883.8	140	2,000			
Cherty Limestone/ Strong Rock	883.8 to Bottom of Pier	140	2,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>88</u>		
Grid Line Location:	<u>6-G</u>		
Top Elevation (ft.):	915.4		
Total Depth (ft.):	<u>33</u>		
Bottom of Boring			
Elevation (ft.):	<u>882.4</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.9	N.R.	N.R.	Clay	
2.5 to 16.0	912.9 to 899.4	N.R.	N.R.		
16.0 to 18.0	899.4 to 897.4	2.0	N.R.	Shale	
18.0 to 25.0	897.4 to 890.4	5.0	100	Shaley Limestone	
25.0 to 33	890.4 to 882.4	5.0	20	Limestone to Weathered Shale at 32'	
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface					

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 899.4	125	1,000	500	200	0.010
Shaley Limestone/ Strong			Unconfined Compressive Strength (psi)			
Rock	899.4 to 883.4	150	4,000			
					Cyclic K _h	
Stiff Clay Without Free Water	Below 883.4	130	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Water			4,000	2,000	800	0.003



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>94</u>		
Grid Line Location:	<u>1-F</u>		
Top Elevation (ft.):	916.7		
Total Depth (ft.):	<u>50</u>		
Bottom of Boring			
Elevation (ft.):	<u>866.7</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.2	N.R.	N.R.	Cherty Clay/Clay	
2.5 to 23.0	914.2 to 893.7	N.R.	N.R.		
23.0 to 32.0	893.7 to 884.7	2.5	40	Shale/Chert	
32.0 to 50.0 884.7 to 866.7 2.5 50 Cherty Limestone With Thin Weathered Zones				1	
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface					
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 897.9	125	2,000	1,000	400	0.005
Shaley Limestone and	897.9 to Bottom of Pier	125	Unconfin	ed Compressive	Strength (psi)	
Shale/ Strong Rock	897.9 to Bottom of Pier	135		2,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>95</u>		
Grid Line Location:	<u>2-F</u>		
Top Elevation (ft.):	916.1		
Total Depth (ft.):	<u>61.3</u>		
Bottom of Boring			
Elevation (ft.):	<u>854.8</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 913.6	N.R.	N.R.	
is shallower	00 10 913.0	N.N.	IN.R.	Clay
2.5 to 27.5	913.6 to 888.6	N.R.	N.R.	
27.5 to 35.5	888.6 to 880.6	3.5	60	Charty Limestone
35.5 to 42.5	880.6 to 873.6	3.5	N.R.	Cherty Limestone
42.5 to 47	873.6 to 869.1	1.5	N.R.	Possible Voids and Cherty Limestone
47 to 50.9	869.1 to 865.2	3.5	60	ChartyLimastana
50.9 to 56.5	865.2 to 859.6	3.5	N.R.	Cherty Limestone
56.5 to 58.5	859.6 to 857.6	N.R.	N.R.	Wash Away Material/No Recovery
58.5 to 60.9	857.6 to 854.8	3.5	60	Cherty Limestone

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 888.6	125	500	150	N/A	0.020
Cherty Limestone/ Strong	888.6 to Bottom of Pier	140	Unconfin	ed Compressive	Strength (psi)	
Rock	888.0 to Bottom of Pier	140		2,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	<u>96</u>			
Grid Line Location:	<u>3-F</u>			
Top Elevation (ft.):	<u>915.9</u>			
Total Depth (ft.):	<u>42.4</u>			
Bottom of Boring				
Elevation (ft.):	<u>873.5</u>			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.4	N.R.	N.R.	Clay
2.5 to 13.5	913.4 to 902.4	N.R.	N.R.	
13.5 to 16.5	902.4 to 899.4	3.5	40	Shaley Limestone
16.5 to 23.0	899.4 to 892.9	3.5	N.R.	Shaley Limestone With Small Clay Seams
23.0 to 27.0	892.9 to 888.9	1.5	N.R.	Shale and Chert With Large Clay Seams
27.0 to 33.5	888.9 to 882.4	4.0	60	Fractured Cherty Limestone
33.5 to 42.4	882.4 to 873.5	5.0	100	Cherty Limestone

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 903.6	125	2,000	1,000	400	0.005
Shaley Limestone and Shale/ Strong Rock	903.6 to 888.9	135	Unconfir	ed Compressive 2,000	Strength (psi)	
Cherty Limestone/ Strong Rock	888.9 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>97</u>		
Grid Line Location:	<u>4-F</u>		
Top Elevation (ft.):	<u>915.3</u>		
Total Depth (ft.):	<u>37.1</u>		
Bottom of Boring			
Elevation (ft.):	<u>878.2</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.8	N.R.	N.R.	Clay	
2.5 to 14.0	912.8 to 901.3	N.R.	N.R.		
14.0 to 16.0	901.3 to 899.3	1.5	N.R.	Shale and Shaley Limestone	
16.0 to 21.5	899.3 to 893.8	5.0	100	Shaley Limestone	
21.5 to 37.1	893.8 to 878.2	5.0	50	Shaley/Cherty Limestone With Small Clay Seams	
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended Skin friction factor of safety of 2 End bearing factor of safety of 3 					

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 905.5	125	2,000	1,000	400	0.005
Shaley Limestone and Shale/ Strong Rock	905.5 to 899.3	135	Unconfin	ed Compressive 2,000	Strength (psi)	
Cherty & Shaley Limestone/ Strong Rock	899.3 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>98</u>		
Grid Line Location:	<u>5-F</u>		
Top Elevation (ft.):	914.9		
Total Depth (ft.):	<u>37.3</u>		
Bottom of Boring			
Elevation (ft.):	<u>877.6</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.4	N.R.	N.R.	Cherty Clay
2.5 to 14.0	912.4 to 900.9	N.R.	N.R.	
14.0 to 22.0	900.9 to 892.9	1.0	N.R.	Shale and Shaley Limestone With Large Clay Seams
22.0 to 25.0	892.9 to 889.9	5.0	100	Shaley Limestone/Limestone
25.0 to 31.5	889.9 to 883.4	5.0	N.R.	Shaley Limestone/Limestone
31.5 to 33.5	883.4 to 881.4	4.0	4	Cherty Limestone With Small Clay Seams
33.5 to 37.3	881.4 to 877.6	5.0	4	Cherty Limestone

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	
son type		(per)	concolori (por)	Static Rh (per)	(pci)	e ₅₀
Stiff Clay Without Free	Ground Surface to 1 Pier	1	1	1	1	1
Water	Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free						
Water	1 Pier Diameter to 900.9	125	2,000	1,000	400	0.005
Shaley Limestone and	900.9 to 892.9	130	Unconfir	ed Compressive	Strength (psi)	
Shale/ Strong Rock	900.910 892.9	130		1,500		
Cherty Limestone/	892.9 to Bottom of Pier	150	150 4.000			
Strong Rock	892.9 to Bottom of Pier	120	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>99</u>		
Grid Line Location:	<u>6-F</u>		
Top Elevation (ft.):	914.9		
Total Depth (ft.):	<u>51.8</u>		
Bottom of Boring			
Elevation (ft.):	<u>863.1</u>		

Pre-Drill Information

Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Up to 912.4	N.R.	N.R.	Cherty Clay/Clay
912.4 to 897.9	N.R.	N.R.	
897.9 to 884.4	2.0	N.R.	Shaley Limestone With Wash Away Material
884.4 to 880.9	5.0	60	Cherty Limestone
880.9 to 874.9	5.0	N.R.	Cherty Limestone Above Wash Away Zone
874.9 to 868.9	2.0	N.R.	Cherty Limestone With Wash Away and Highly Weathered Zones
868.9 to 863.1	5.0	60	Cherty Limestone
	Up to 912.4 912.4 to 897.9 897.9 to 884.4 884.4 to 880.9 880.9 to 874.9 874.9 to 868.9	Applicable Elevation (ft.) Friction (ksf) Up to 912.4 N.R. 912.4 to 897.9 N.R. 897.9 to 884.4 2.0 884.4 to 880.9 5.0 880.9 to 874.9 5.0 874.9 to 868.9 2.0	Applicable Elevation (ft.) Friction (ksf) Bearing (ksf) Up to 912.4 N.R. N.R. 912.4 to 897.9 N.R. N.R. 897.9 to 884.4 2.0 N.R. 884.4 to 880.9 5.0 60 880.9 to 874.9 5.0 N.R. 874.9 to 868.9 2.0 N.R.

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 897.9	125	2,000	1,000	400	0.005
Shaley Limestone and	897.9 to Bottom of Pier	135	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	897.9 to bottom of Fiel	155		2,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>100</u>		
Grid Line Location:	<u>7-F</u>		
Top Elevation (ft.):	<u>915.2</u>		
Total Depth (ft.):	<u>31.8</u>		
Bottom of Boring			
Elevation (ft.):	<u>883.4</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.7	N.R.	N.R.	Clay	
2.5 to 14.5	912.7 to 900.7	N.R.	N.R.		
14.5 to 17.0	900.7 to 898.2	3.5	N.R.	Shale and Shaley Limestone	
17.0 to 31.8	898.2 to 883.4	5.0	100	Shaley/Cherty Limestone	
 Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. 					

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 900.7	125	2,000	1,000	400	0.005
Shaley Limestone and	900.7 to 898.2	135	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	900.7 10 898.2	155	2,000			
Cherty Limestone/ Strong Rock	898.2 to Bottom of Pier	150		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>101</u>		
Grid Line Location:	<u>8-F</u>		
Top Elevation (ft.):	<u>915.6</u>		
Total Depth (ft.):	<u>33.8</u>		
Bottom of Boring			
Elevation (ft.):	<u>881.8</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 913.1	N.R.	N.R.			
is shallower	00 10 913.1	N.R.	N.R.	Clay, Trace Limestone		
2.5 to 9.0	913.1 to 906.6	N.R.	N.R.			
9.0 to 24.0	906.6 to 891.6	2.0	N.R.	Limestone and Large Clay Seam		
24.0 to 33.8	891.6 to 881.8	5.0	100	Limestone and Cherty Limestone		
- Skin friction Should be ig	- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface					

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 906.6	125	2,000	1,000	400	0.005
Shaley Limestone and	906.6 to 897.1	135	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	900.0 10 897.1	122		2,000		
					Cyclic K _h	
Soft Clay	897.1 to 891.6	115	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
			500	150	N/A	0.010
Charty Limestone / Strong			Unconfined Compressive Strength (psi)			
Cherty Limestone/ Strong Rock	891.6 to Bottom of Pier	150	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan		
Project #:	280212		
Pre Drill Boring #:	<u>102</u>		
Grid Line Location:	<u>10-F</u>		
Top Elevation (ft.):	<u>915.4</u>		
Total Depth (ft.):	<u>37</u>		
Bottom of Boring			
Elevation (ft.):	<u>878.4</u>		

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.9	N.R.	N.R.	Clay	
2.5 to 20.5	912.9 to 894.9	N.R.	N.R.		
20.5 to 26.5	894.9 to 888.9	4.0	N.R.	Shale and Shaley Limestone	
26.5 to 37	888.9 to 878.4	5.0	100	Cherty Limestone With	
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below t	he ground surface		
- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface					
- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.					
- N.R. = Not Recommended					
- Skin friction factor of safety of 2					

- End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Soft Clay	1 Pier Diameter to 894.9	125	500	150	N/A	0.010
Shaley Limestone and	894.9 to 888.9	135	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	894.910888.9	155	2,000			
Cherty Limestone/ Strong Rock	888.9 to Bottom of Pier	150		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>104</u>
Grid Line Location:	<u>1-E</u>
Top Elevation (ft.):	916.8
Total Depth (ft.):	<u>63.8</u>
Bottom of Boring	
Elevation (ft.):	853.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.3	0.5	N.R.	Clay/Cherty Clay
2.5 to 24.0	914.3 to 892.8	0.75	N.R.	
24.0 to 28.0	892.8 to 888.8	1.5	N.R.	
28.0 to 35.5	888.8 to 881.3	1.5	N.R.	
35.5 to 37.0	881.3 to 879.8	2.0	8.0	Intermittent Chart and Clay Seems
37.0 to 43.5	879.8 to 873.3	2.0	N.R.	Intermittent Chert and Clay Seams
43.5 to 56.0	873.3 to 860.8	1.5	N.R.	
56.0 to 63.8	860.8 to 853.0	1.5	20.0	Chert
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface 				

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	Ignore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 892.8	125	1,000	500	200	0.007
Stiff Clay Without Free	892.8 to 860.8	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	Below 860.8	135	4,000	2,000	800	0.004



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>105</u>
Grid Line Location:	<u>2-E</u>
Top Elevation (ft.):	916.2
Total Depth (ft.):	<u>47.1</u>
Bottom of Boring	
Elevation (ft.):	<u>869.1</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.7	N.R.	N.R.	Gravelly Clay / Clay
2.5 to 26.0	913.7 to 890.2	N.R.	N.R.	crovery erdy / erdy
26.0 to 38.5	890.2 to 877.7	3.0	N.R.	Weathered and Highly Fractured Cherty Limestone with Wash Away Zones
38.5 to 47.1	877.7 to 869.1	5.0	70	Fractured Cherty Limestone
- Skin friction Should be ig	nored to a depth of 1 pier d	liameter below the	e ground surface	
- Pier depth should meet o	or exceed a D/B ratio of 5 be	elow the ground su	irface	
- End bearing not applicab	le below a depth of 1.5 time	es the pier diamete	er above the botto	m of the pre-drill Boring.
- N.R. = Not Recommende	d			
- Skin friction factor of saf	ety of 2			
- End bearing factor of saf	ety of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K (nci)	Cyclic K _h (pci)	
Son Type	Applicable Lievation (it.)	(pci)	conesion (psi)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 890.2	125	1,000	500	200	0.005
			Unconfin	ed Compressive	Strength (psi)	
Weathered Cherty Limestone/ Strong Rock	890.2 to 877.7	135		2,000		
Cherty Limestone/ Strong Rock	877.7 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	106
Grid Line Location:	3-E
Top Elevation (ft.):	915.8
Total Depth (ft.):	41.8
Bottom of Boring	
Elevation (ft.):	874.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.3	N.R.	N.R.	Clay/Cherty Clay			
2.5 to 21.5	913.3 to 894.3	N.R.	N.R.				
21.5 to 24.0	894.3 to 891.8	1.5	N.R.	Shale/ Shaley Limestone			
24.0 to 31.5	891.8 to 884.3	3.5	50	Weathered Shaley Limestone			
31.5 to 41.2	884.3 to 874.0	5.0	80	Cherty Limestone			
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N B = Not Becommended 							

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 894.3	125	1,000	500	200	0.007
Shaley Limestone and Shale/ Strong Rock	894.3 to 891.8	135	Unconfir	ed Compressive 2,000	Strength (psi)	
Cherty Limestone/ Strong Rock	891.8 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>107</u>
Grid Line Location:	<u>4-E</u>
Top Elevation (ft.):	915.2
Total Depth (ft.):	<u>36.8</u>
Bottom of Boring	
Elevation (ft.):	<u>878.4</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.7	N.R.	N.R.	Clay		
2.5 to 14.0	912.7 to 901.2	N.R.	N.R.			
14.0 to 18.5	901.2 to 896.7	2.5	N.R.	Shale to Shaley Limestone		
18.5 to 22.0	896.7 to 893.2	N.R.	N.R.	Wash Away Zone		
22.0 to 25.0	893.2 to 890.2	5.0	100	Shaley Limestone		
25.0 to 32.0	890.2 to 883.2	5.0	60	Shaley Limestone to Weathered Shaley Limestone		
32.0 to 36.8	883.2 to 878.4	5.0	80	Fractured Cherty Limestone		
32.0 to 36.8 883.2 to 8/8.4 5.0 80 Fractured Cherty Limestone - Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface - - Pier depth should meet or exceed a D/B ratio of 5 below the ground surface - End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. - N.R. = Not Recommended						

- Skin friction factor of safety of 2 - End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 901.2	125	2,000	1,000	400	0.005
Shaley Limestone and	901.2 to 893.2	135	Unconfin	ed Compressive	Strength (psi)	
Shale/ Strong Rock	901.2 (0 893.2	135		1,500		
Shaley & Cherty Limestone/ Strong Rock	893.2 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>108</u>
Grid Line Location:	<u>5-E</u>
Top Elevation (ft.):	915.8
Total Depth (ft.):	<u>34.3</u>
Bottom of Boring	
Elevation (ft.):	<u>881.5</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.3	N.R.	N.R.	Clay
2.5 to 11.1	913.3 to 904.7	N.R.	N.R.	
11.1 to 18.0	904.7 to 897.8	3.5	40	Weathered Shaley Limestone
18.0 to 19.5	897.8 to 896.3	5.0	100	Limestone
19.5 to 29.5	896.3 to 886.3	3.5	N.R.	Weathered Shaley Limestone
29.5 to 34.3	886.3 to 881.5	5.0	100	Cherty Limestone
- Skin friction Should be igno	ored to a depth of 1 pier diam	eter below the grou	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	y of 2			

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 904.7	125	1,000	500	200	0.007
Shaley Limestone/ Strong	904.7 to 897.8	135	Unconfi	ined Compressive	Strength (psi)	
Rock	904.7 10 897.8	155		2,000		
Shaley & Cherty Limestone	897.8 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>109</u>
Grid Line Location:	<u>6-E</u>
Top Elevation (ft.):	<u>914.3</u>
Total Depth (ft.):	<u>29.3</u>
Bottom of Boring	
Elevation (ft.):	885.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.8	N.R.	N.R.	Clean Clay
2.5 to 9.3	911.8 to 905.0	N.R.	N.R.	
9.3 to 15.5	905.0 to 898.8	3.0	40	Weathered Shaley Limestone
15.5 to 16.5	898.8 to 897.8	5.0	100	Shaley Limestone
16.5 to 23.5	897.9 to 890.8	5.0	60	Fractured Shaley Limestone
23.5 to 29.3	890.8 to 885.0	5.0	100	Shaley Limestone
5	pred to a depth of 1 pier diam	0	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	y of 2			

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 905.0	125	2,000	1,000	400	0.005
Weathered Shaley	905.0 to 899.3	135	Unconf	ined Compressive	Strength (psi)	
Limestone/Strong Rock	905.010899.5	135		2,000		
Shaley Limestone/ Strong Rock	899.3 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital	
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:	<u>110</u>	
Grid Line Location:	<u>7-E</u>	
Top Elevation (ft.):	914.4	
Total Depth (ft.):	<u>34.2</u>	
Bottom of Boring		
Elevation (ft.):	<u>880.2</u>	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.9	N.R.	N.R.	Clay
2.5 to 8.5	911.9 to 905.9	N.R.	N.R.	
8.5 to 16.5	905.9 to 897.9	1.5	N.R.	Shaley Limestone
16.5 to 23.0	897.9 to 891.4	N.R.	N.R.	VOID
23.0 to 34.2	891.4 to 880.2	4.0	100	Shaley Limestone To Limestone

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀	
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore	
Stiff Clay Without Free Water	1 Pier Diameter to 905.9	125	1,000	500	200	0.007	
Shaley Limestone/ Strong	905.9 to 897.9	135	Unconfined Compressive Strength (psi)				
Rock	905.9 (0 897.9	155	2,000				
VOID	897.9 to 891.4	0		0			
Shaley & Cherty Limestone/ Strong Rock	891.4 to Bottom of Pier	145	4,000				



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital	
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:	<u>111</u>	
Grid Line Location:	<u>8-E</u>	
Top Elevation (ft.):	914.8	
Total Depth (ft.):	<u>29.2</u>	
Bottom of Boring		
Elevation (ft.):	<u>885.6</u>	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.3	N.R.	N.R.	Clay
2.5 to 9.2	912.3 to 905.6	N.R.	N.R.	Ciay
9.2 to 14.0	905.6 to 900.8	3.5	N.R.	Weathered Shaley Limestone
14.0 to 29.2	900.8 to 885.6	5.0	100	Shaley Limestone
- Skin friction Should be ig	gnored to a depth of 1 pier	diameter below th	e ground surface	
- Pier depth should meet	or exceed a D/B ratio of 5 b	elow the ground s	surface	
- End bearing not applicat	ple below a depth of 1.5 tim	nes the pier diame	ter above the bott	com of the pre-drill Boring.
- N.R. = Not Recommende	ed			

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 905.6	125	4,000	2,000	800	0.005
Maatharad Chalau			Unconfined Compressive Strength (psi)			
Weathered Shaley Limestone/ Strong Rock	905.6 to 900.8	135		2,000		
Shaley Limestone/ Strong Rock	900.8 to Bottom of Pier	145	4,000			



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	112
Grid Line Location:	10-E
Top Elevation (ft.):	915.2
Total Depth (ft.):	34.2
Bottom of Boring	
Elevation (ft.):	881.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.7	N.R.	N.R.	Clay
2.5 to 8.5	912.7 to 906.7	N.R.	N.R.	
8.5 to 15.5	906.7 to 899.7	2.5	N.R.	Shaley Limestone
15.5 to 18.0	899.7 to 897.2	0	N.R.	Probable Void
18.0 to 21.0	897.2 to 894.2	2.5	N.R.	Shaley Limestone With Wash Away Material
21.0 to 34.2	894.2 to 881.0	4.0	80	Shaley/Cherty Limestone
- Skin friction Should be ig	nored to a depth of 1 pier	diameter below th	e ground surface	
- Pier depth should meet	or exceed a D/B ratio of 5 b	elow the ground s	urface	
- End bearing not applicat	le below a depth of 1.5 tim	nes the pier diame	ter above the bott	om of the pre-drill Boring.
- N.R. = Not Recommende	d			
- Skin friction factor of saf	ety of 2			

Skin friction factor of safety of 2End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 906.7	125	4,000	2,000	800	0.005
Shaley Limestone/ Strong Rock	906.7 to 894.2	135	Unconfin	ed Compressive 2,000	Strength (psi)	
Shaley and Cherty Limestone/ Strong Rock	894.2 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>114</u>
Grid Line Location:	<u>1-D</u>
Top Elevation (ft.):	916.6
Total Depth (ft.):	<u>51.9</u>
Bottom of Boring	
Elevation (ft.):	<u>864.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier				
Diameter or 2.5' whichever	Up to 914.1	N.R.	N.R.	Cherty Clay/Clay
is shallower				
2.5 to 13.5	914.1 to 903.1	N.R.	N.R.	
13.5 to 18.0	903.1 to 898.6	4.0	60	Shaley Limestone
18.0 to 24.3	898.6 to 892.3	4.0	N.R.	
24.3 to 26.0	892.3 to 890.6	1.0	N.R.	Weathered Shaley Limestone and
26.0 to 34.0	890.6 to 882.6	5.0	100	
34.0 to 40.0	882.6 to 876.6	5.0	N.R.	Limestone With Chert
40.0 to 51.9	876.6 to 864.7	1.0	N.R.	Cherty Limestone With Wash Away Materials
- Skin friction Should be ig	nored to a depth of 1 pier d	liameter below the	ground surface	

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 903.1	125	2,000	1,000	400	0.005
Shaley and Cherty Limestone/ Strong Rock	903.1 to 876.6	145	Unconfin	ed Compressive 4,000	Strength (psi)	
Cherty Limestone With Wash Away	876.6 to Bottom of Pier	125	1,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>115</u>
Grid Line Location:	<u>2-D</u>
Top Elevation (ft.):	915.9
Total Depth (ft.):	<u>43.2</u>
Bottom of Boring	
Elevation (ft.):	<u>872.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.4	N.R.	N.R.	Clay/Cherty Clay		
2.5 to 27.5	913.4 to 888.4	N.R.	N.R.			
27.5 to 43.2	888.4 to 872.7	4.0	40	Chert		
- Pier depth should meet	gnored to a depth of 1 pier or exceed a D/B ratio of 5 b ble below a depth of 1.5 tir	below the ground	surface			
 End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended Skin friction factor of safety of 2 End bearing factor of safety of 3 						

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 888.4	125	1,000	500	200	0.007
Chert/Strong Rock	888.4 to Bottom of Pier	135	Unconfin	ed Compressive	Strength (psi)	
	888.4 to Bottom of Pier	135		2,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>116</u>
Grid Line Location:	<u>3-D</u>
Top Elevation (ft.):	915.5
Total Depth (ft.):	<u>42.2</u>
Bottom of Boring	
Elevation (ft.):	<u>873.3</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 913.0	N.R.	N.R.	
is shallower	00 10 910.0			Clay
2.5 to 14.5	913.0 to 901.0	N.R.	N.R.	
14.5 to 16.5	901.0 to 899.0	1.5	N.R.	Shale
16.5 to 17.5	899.0 to 898.0	4.0	100	Shaley Limestone
17.5 to 24.0	898.0 to 891.5	4.0	N.R.	Shaley Limestone Over Wash Away
24.0 to 25.5	891.5 to 890.0	1.5	N.R.	Wash Away
25.5 to 30.0	890.0 to 885.5	4.0	50	Weathered Shaley Limestone
30.0 to 32.0	885.5 to 883.5	5.0	100	Charty Limesters
32.0 to 38.0	883.5 to 877.5	5.0	40	Cherty Limestone
38.0 to 40.0	877.5 to 875.5	3.0	40	Weathered Cherty Limestone
40.0 to 42.2	875.5 to 873.3	5.0	40	Limestone
- Skin friction Should be ig	nored to a depth of 1 pier d	liameter below the	ground surface	

Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 901.0	125	1,000	500	200	0.007
Shaley & Cherty			Unconfin	ed Compressive	Strength (psi)	
Shaley & Cherty Limestone / Strong Rock	901.0 to Bottom of Pier	145		4,000		



Project:	<u> Pier Pre-Drill - WW Hastin</u>	ngs Replacement Hospital
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:	<u>117</u>	
Grid Line Location:	4-D	
Top Elevation (ft.):	915	
Total Depth (ft.):	26.8	
Bottom of Boring		
Elevation (ft.):	888.2	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.5	N.R.	N.R.	Clay
2.5 to 11.0	912.5 to 904.0	N.R.	N.R.	
11.0 to 16.5	904.0 to 898.5	2.5	40	Weathered Shaley Limestone
16.5 to 26.8	898.5 to 888.2	5.0	100	Shaley Limestone/Limestone
- Pier depth should meet or	ored to a depth of 1 pier diam exceed a D/B ratio of 5 below below a depth of 1.5 times th	the ground surface		ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	y of 2			
- End bearing factor of safety	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 904.0	125	1,000	500	200	0.007
Shaley Limestone/ Strong	904.0 to 898.5	135	Unconfi	ined Compressive	Strength (psi)	
Rock	904.0 10 898.5	155		2,000		
Shaley Limestone/ Strong Rock	898.5 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>118</u>
Grid Line Location:	<u>5-D</u>
Top Elevation (ft.):	914.5
Total Depth (ft.):	<u>34.4</u>
Bottom of Boring	
Elevation (ft.):	<u>880.1</u>

Pre-Drill Information

Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Up to 912.0	N.R.	N.R.	Clay	
912.0 to 902.5	N.R.	N.R.		
902.5 to 896.0	2	40	Weathered Shaley Limestone	
896.0 to 890.5	3.5	N.R.	Limestone	
890.5 to 886.5	1.5	N.R.	Weathered Shaley Limestone With Wash Away	
886.5 to 880.1	5.0	60	Cherty Limestone	
-	Up to 912.0 912.0 to 902.5 902.5 to 896.0 896.0 to 890.5 890.5 to 886.5	Applicable Elevation (ft.) Friction (ksf) Up to 912.0 N.R. 912.0 to 902.5 N.R. 902.5 to 896.0 2 896.0 to 890.5 3.5 890.5 to 886.5 1.5	Applicable Elevation (ft.) Friction (ksf) Bearing (ksf) Up to 912.0 N.R. N.R. 912.0 to 902.5 N.R. N.R. 902.5 to 896.0 2 40 896.0 to 890.5 3.5 N.R. 890.5 to 886.5 1.5 N.R.	

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 902.5	125	1,000	500	200	0.007
Shaley Limestone/ Strong	902.5 to 886.5	135	Unconfi	ned Compressive	Strength (psi)	
Rock	902.5 10 880.5	155		2,000		
Shaley & Cherty Limestone/ Strong Rock	886.5 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>119</u>
Grid Line Location:	<u>6-D</u>
Top Elevation (ft.):	<u>914.1</u>
Total Depth (ft.):	<u>24.3</u>
Bottom of Boring	
Elevation (ft.):	<u>889.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.6	N.R.	N.R.	Clay		
2.5 to 11.3	911.6 to 902.8	N.R.	N.R.			
11.3 to 16.5	902.8 to 897.6	3.5	N.R.	Weathered Shaley Limestone		
16.5 to 24.3	897.6 to 889.8	5.0	100	Shaley Limestone		
- Skin friction Should be i	gnored to a depth of 1 pier	diameter below t	he ground surface	2		
- Pier depth should meet	or exceed a D/B ratio of 5 I	below the ground	surface			
- End bearing not applica	ble below a depth of 1.5 tir	nes the pier diame	eter above the bot	ttom of the pre-drill Boring.		
- N.R. = Not Recommende	- N.R. = Not Recommended					
- Skin friction factor of sa	fety of 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 902.8	125	1,000	500	200	0.007
Weathered Shaley			Unconfin	ed Compressive	Strength (psi)	
Limestone/ Strong Rock	902.8 to 897.6	135		2,000		
Shaley Limestone/ Strong Rock	897.6 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital			
Client:	Foreman Manhattan			
Project #:	280212			
Pre Drill Boring #:	120			
Grid Line Location:	7-D			
Top Elevation (ft.):	913.9			
Total Depth (ft.):	34.3			
Bottom of Boring				
Elevation (ft.):	879.6			

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.4	N.R.	N.R.	Clean Clay
2.5 to 10.0	911.4 to 903.9	N.R.	N.R.	
10.0 to 16.0	903.9 to 897.9	1.5	N.R.	Shaley Limestone With Wash Away Zones
16.0 to 17.5	897.9 to 896.4	5.0	100	Shaley Limestone
17.5 to 24.5	896.4 to 889.4	4.0	N.R.	Shaley Limestone With Was Away Zone
24.5 to 34.3	889.4 to 879.6	5.0	100	Shaley Limestone to Limestone

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 903.9	125	2,000	1,000	400	0.005
Shaley Limestone and	903.9 to Bottom of Pier	145	Unconfin	ed Compressive	Strength (psi)	
Shale/ Strong Rock		145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>121</u>
Grid Line Location:	<u>8-D</u>
Top Elevation (ft.):	914.1
Total Depth (ft.):	<u>29.3</u>
Bottom of Boring	
Elevation (ft.):	<u>884.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.9	N.R.	N.R.	Clay		
2.5 to 14.0	911.9 to 902.4	N.R.	N.R.			
14.0 to 29.3	902.4 to 884.8	5.0	100	Shaley to Cherty Limestone		
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. 						
- N.R. = Not Recommende	- N.R. = Not Recommended					
- Skin friction factor of sa	- Skin friction factor of safety of 2					
- End bearing factor of sa	fety of 3					

Deep Foundation - Lateral Loading

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Soft Clay	1 Pier Diameter to 902.4	125	500	30	N/A	0.020
Shaley Limestone and	902.4 to Bottom of Pier	145	Unconfin	ed Compressive	Strength (psi)	
Chert/ Strong Rock	902.4 to Bottom of Pier	145		4,000		

November 7, 2022



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>122</u>
Grid Line Location:	<u>10-D</u>
Top Elevation (ft.):	914.4
Total Depth (ft.):	<u>29.3</u>
Bottom of Boring	
Elevation (ft.):	<u>885.1</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.9	N.R.	N.R.	Clay		
2.5 to 12.0	911.9 to 902.4	N.R.	N.R.			
12.0 to 29.3	902.4 to 885.1	5.0	100	Shaley & Cherty Limestone		
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. 						
- N.R. = Not Recommended						
- Skin friction factor of sa	fety of 2					
- End bearing factor of sa	fety of 3					

Deep Foundation - Lateral Loading

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 902.4	125	2,000	1,000	400	0.005
Shaley Limestone and	902.4 to Bottom of Pier	145	Unconfin	ed Compressive	Strength (psi)	
Shale/ Strong Rock	902.4 to bottom of Pier	145		4,000		

November 7, 2022



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>124</u>
Grid Line Location:	<u>1-C</u>
Top Elevation (ft.):	<u>916.6</u>
Total Depth (ft.):	<u>46.8</u>
Bottom of Boring	
Elevation (ft.):	<u>869.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.1	N.R.	N.R.	Clay		
2.5 to 13.0	914.1 to 903.6	N.R.	N.R.			
13.0 to 25.0	903.6 to 891.6	N.R.	N.R.	Shale to Shaley Limestone with Wash Away		
25.0 to 27.5	891.6 to 889.1	5.0	100	Cherty Limestone		
27.5 to 34.0	889.1 to 882.6	5.0	N.R.			
34.0 to 35.0	882.6 to 881.6	1.5	N.R.	Limestone with Clay Seam		
35.0 to 46.8	881.6 to 869.8	5.0	100	Limestone		
- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

		Unit Weight			Cyclic K _h	
Soil Type	Applicable Elevation (ft.)	(pcf)	Cohesion (psf)	Static K _h (pci)	(pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 903.6	125	2,000	1,000	400	0.005
Stiff Clay Without Free Water	903.6 to 892.1	125	4,000	2,000	800	0.004
			Unconfin	ed Compressive	Strength (psi)	
Shaley & Cherty Limestone/ Strong Rock	892.1 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>125</u>
Grid Line Location:	<u>2-C</u>
Top Elevation (ft.):	915.9
Total Depth (ft.):	<u>36.7</u>
Bottom of Boring	
Elevation (ft.):	<u>879.2</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 913.4	N.R.	N.R.	
is shallower	Op to 913.4	N.K.	N.K.	Clay
2.5 to 12.5	913.4 to 903.4	N.R.	N.R.	
12.5 to 15.0	903.4 to 900.9	1.5	N.R.	Shale
15.0 to 18.0	900.9 to 897.9	2.0	N.R.	Shaley Limestone
18.0 to 21.0	897.9 to 894.9	0	N.R.	Void
21.0 to 25.0	894.9 to 890.9	5.0	100	Shaley Limestone
25.0 to 33.0	890.9 to 882.9	3.0	60	Weathered Shaley Limestone
33.0 to 36.7	882.9 to 879.2	5.0	100	Cherty Limestone

- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 903.4	125	1,000	500	200	0.007
Shaley & Cherty Limestone/ Strong Rock	903.4 to Bottom of Pier	145	Unconfined Compressive Strength (psi) 4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>126</u>
Grid Line Location:	<u>3-C</u>
Top Elevation (ft.):	915.5
Total Depth (ft.):	<u>36.9</u>
Bottom of Boring	
Elevation (ft.):	<u>878.6</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.0	N.R.	N.R.	Clay
2.5 to 12.5	913.0 to 903.0	N.R.	N.R.	
12.5 to 22.5	903.0 to 893.0	3.5	N.R.	Weathered Shaley/Cherty Limestone
22.5 to 28.5	893.0 to 887.0	3.5	40	Weathered Shaley/Cherty Limestone
28.5 to 36.9	887.0 to 878.6	5.0	100	Cherty Limestone
- Skin friction Should be igno	ored to a depth of 1 pier diam	eter below the grou	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ie pier diameter abo	ve the bottom of th	e pre-drill Boring.
- N.R. = Not Recommended				

N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 903.0	125	1,000	500	200	0.007
			Unconfined Compressive Strength (psi)			
Shaley & Cherty Limestone/ Strong Rock	903.0 to 887.0	135		2,000		
Cherty Limestone/ Strong Rock	887.0 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>127</u>
Grid Line Location:	<u>4-C</u>
Top Elevation (ft.):	914.9
Total Depth (ft.):	<u>39.8</u>
Bottom of Boring	
Elevation (ft.):	<u>875.1</u>

Pre-Drill Information

	Friction (ksf)	Bearing (ksf)	General Material
Up to 912.4	N.R.	N.R.	Clay
912.4 to 905.1	N.R.	N.R.	
905.1 to 897.9	2.0	N.R.	Weathered Shaley Limestone
897.9 to 895.4	0	N.R.	VOID
895.4 to 884.9	3.5	40	Shaley Limestone With Wash away Zones
884.9 to 875.1	5.0	100	Cherty Limestone
-	912.4 to 905.1 905.1 to 897.9 897.9 to 895.4 895.4 to 884.9 884.9 to 875.1	912.4 to 905.1 N.R. 905.1 to 897.9 2.0 897.9 to 895.4 0 895.4 to 884.9 3.5 884.9 to 875.1 5.0	912.4 to 905.1 N.R. N.R. 905.1 to 897.9 2.0 N.R. 897.9 to 895.4 0 N.R. 895.4 to 884.9 3.5 40

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 905.1	125	1,000	500	200	0.007
Shaley Limestone/ Strong	905.1 to 884.9	135	Unconfi	ned Compressive	Strength (psi)	
Rock	903.1 (0 884.9	155		2,000		
Shaley & Cherty Limestone/ Strong Rock	884.9 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>128</u>
Grid Line Location:	<u>5-C</u>
Top Elevation (ft.):	914.4
Total Depth (ft.):	<u>33.8</u>
Bottom of Boring	
Elevation (ft.):	<u>880.6</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.9	N.R.	N.R.	Cherty Clay / Clay
2.5 to 22.4	911.9 to 892.0	N.R.	N.R.	
22.4 to 24.5	892.0 to 889.9	2.5	N.R.	Shaley Limestone with Wash Away
24.5 to 27.0	889.9 to 887.4	4.0	40	Shaley Limestone
27.0 to 33.8	887.4 to 880.6	5.0	100	Cherty Limestone
- Skin friction Should be igno	ored to a depth of 1 pier diam	eter below the grou	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	y of 2			
- End bearing factor of safety	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 892.0	125	2,000	1,000	400	0.005
Shaley Limestone and	892.0 to Bottom of Pier	145	Unconfi	ined Compressive	Strength (psi)	
Shale/ Strong Rock		145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>129</u>
Grid Line Location:	<u>6-C</u>
Top Elevation (ft.):	913.9
Total Depth (ft.):	<u>34.5</u>
Bottom of Boring	
Elevation (ft.):	<u>879.4</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material				
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.4	N.R.	N.R.	Clay				
2.5 to 14.5	911.4 to 899.4	N.R.	N.R.					
14.5 to 15.3	899.4 to 898.6	1.0	N.R.	Shaley Limestone				
15.3 to 17.0	898.6 to 896.9	N.R.	N.R.	VOID				
17.0 to 18.0	896.9 to 895.9	3.5	40	Fractured Shaley Limestone				
18.0 to 24.0	895.9 to 889.9	3.5	N.R.	Shaley Limestone Above Wash Away				
24.0 to 25.5	889.9 to 888.4	1.0	N.R.	Highly Weathered Shale/Wash Away				
25.5 to 34.5	888.4 to 879.4	5.0	100	Cherty Limestone				
- Skin friction Should be igno	- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface							

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 896.9	125	1,000	500	200	0.007
Shaley Limestone/ Strong	896.9 to 888.4	135	Unconfi	ned Compressive	Strength (psi)	
Rock	890.910 888.4	122		2,000		
Cherty Limestone/ Strong Rock	888.4 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>130</u>
Grid Line Location:	<u>7-C</u>
Top Elevation (ft.):	913.6
Total Depth (ft.):	<u>29.4</u>
Bottom of Boring	
Elevation (ft.):	<u>884.2</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.1	N.R.	N.R.	Clay
2.5 to 14.4	911.1 to 899.2	N.R.	N.R.	
14.4 to 20.5	899.2 to 893.1	3.5	40	Shaley Limestone
20.5 to 29.4	893.1 to 884.2	5.0	100	Shaley/Cherty Limestone
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface 				
	below a depth of 1.5 times th	ie pier diameter abo	ove the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended	()			
- Skin friction factor of safety				
- End bearing factor of safety	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 899.2	125	1,000	500	200	0.007
Shaley & Cherty Limestone/	899.2 to Bottom of Pier	145	Unconf	ined Compressive	Strength (psi)	
Strong Rock		145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>131</u>
Grid Line Location:	<u>8-C</u>
Top Elevation (ft.):	913.2
Total Depth (ft.):	<u>34.5</u>
Bottom of Boring	
Elevation (ft.):	<u>878.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 910.7	N.R.	N.R.	Clay		
2.5 to 14.5	910.7 to 898.7	N.R.	N.R.			
14.5 to 18.5	898.7 to 894.7	4.0	100	Shaley Limestone		
18.5 to 24.0	894.7 to 889.2	4.0	50	Shaley Limestone		
24.0 to 26.5	889.2 to 886.7	2.0	20	Highly Weathered Shaley Limestone		
26.5 to 34.5	886.7 to 878.7	5.0	100	Shaley/Cherty Limestone		
5	 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface 					
	below a depth of 1.5 times th	e	ove the bottom of th	ne pre-drill Boring.		
- Skin friction factor of safet	y of 2					

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 898.7	125	1,000	500	200	0.007
			Unconfi	ined Compressive	Strength (psi)	
Shaley & Cherty Limestone and Shale/ Strong Rock	898.7 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>132</u>
Grid Line Location:	<u>10-C</u>
Top Elevation (ft.):	913.4
Total Depth (ft.):	<u>27.9</u>
Bottom of Boring	
Elevation (ft.):	<u>885.5</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 910.9	N.R.	N.R.	Clay			
2.5 to 15.9	910.9 to 897.5	N.R.	N.R.				
15.9 to 22.5	897.5 to 890.9	3.5	60	Shaley Limestone			
22.5 to 27.9	890.9 to 885.5	5.0	100	Limestone			
- Pier depth should meet or	 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface 						
0 11	below a depth of 1.5 times th	ie pier diameter abo	ove the bottom of th	ne pre-drill Boring.			
- N.R. = Not Recommended							
	- Skin friction factor of safety of 2						
- End bearing factor of safety	y of 3						

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.5	125	1,000	500	200	0.007
Shaley Limestone/ Strong	897.5 to 890.9	135	Unconfi	ined Compressive	Strength (psi)	
Rock	097.310 890.9	122		2,000		
Limestone/ Strong Rock	890.9 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>133</u>
Grid Line Location:	<u>1-B.3</u>
Top Elevation (ft.):	916.4
Total Depth (ft.):	<u>37</u>
Bottom of Boring	
Elevation (ft.):	<u>879.4</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.9	N.R.	N.R.	Clay
2.5 to 9.3	913.9 to 907.1	N.R.	N.R.	
9.3 to 28.0	907.1 to 888.4	1.5	N.R.	Shaley Limestone/Limestone with Wash Away Zones
28.0 to 37.0	888.4 to 879.4	5.0	100	Shaley & Cherty Limestone
- Skin friction Should be igno	ored to a depth of 1 pier diam	eter below the grou	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safet	y of 2			
- End bearing factor of safet	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 907.1	125	2,000	1,000	400	0.005
Shaley Limestone/ Strong	907.1 to 888.4	135	Unconfi	ined Compressive	Strength (psi)	
Rock	907.1 (0 888.4	122		2,000		
Cherty & Shaley Limestone/ Strong Rock	888.4 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>134</u>
Grid Line Location:	<u>1-B</u>
Top Elevation (ft.):	916.5
Total Depth (ft.):	<u>31.8</u>
Bottom of Boring	
Elevation (ft.):	<u>884.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.0	N.R.	N.R.	Cherty Clay/Clay
2.5 to 17.3	914.0 to 899.2	N.R.	N.R.	
17.3 to 20.0	899.2 to 896.5	2.0	N.R.	Shaley Limestone
20.0 to 22.0	896.5 to 894.5	N.R.	N.R.	VOID
22.0 to 31.8	894.5 to 884.7	5.0	100	Shaley Limestone
- Skin friction Should be igno	red to a depth of 1 pier diam	eter below the grou	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	y of 2			
- End bearing factor of safety	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 899.2	125	1,000	500	200	0.007
Shaley Limestone/ Strong	899.2 to 895.0	135	Unconfi	ined Compressive	Strength (psi)	
Rock	899.2 10 895.0	122		2,000		
Shaley Limestone/ Strong Rock	895.0 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>135</u>
Grid Line Location:	<u>2-B</u>
Top Elevation (ft.):	915.8
Total Depth (ft.):	<u>36.8</u>
Bottom of Boring	
Elevation (ft.):	879.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.3	N.R.	N.R.	Clay
2.5 to 14.3	913.3 to 901.5	N.R.	N.R.	
14.3 to 16.5	901.5 to 899.3	3.0	50	Weathered Shaley Limestone
16.5 to 18.5	899.3 to 897.3	5.0	100	Shaley Limestone
18.5 to 25.5	897.3 to 890.3	4.0	60	Shaley Limestone with Weathered Shale Seam
25.5 to 36.8	890.3 to 879.0	5.0	100	Shaley to Cherty Limestone
- Skin friction Should be ignor	red to a depth of 1 pier diame	ter below the ground	l surface	

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 901.5	125	1,000	500	200	0.007
Shaley Limestone/ Strong	901.5 to 899.3	135	Unconfi	ned Compressive	Strength (psi)	
Rock	901.5 (0 899.5	122		2,000		
Shaley & Cherty Limestone/ Strong Rock	899.3 to Bottom of Pier	145		4,000		



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

Project:	Pier Pre-Drill - WW Hasting	s Replacement Hospital
Client:	Foreman Manhattan	
Project #:	280212	
Pre Drill Boring #:	136	
Grid Line Location:	3-В	
Top Elevation (ft.):	915.3	
Total Depth (ft.):	36.8	
Bottom of Boring		
Elevation (ft.):	878.5	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 912.8	N.R.	N.R.	
is shallower	00 10 912.8	N.R.		Cherty Clay/Clay
2.5 to 12.8	912.8 to 902.5	N.R.	N.R.	
12.8 to 17.0	902.5 to 898.3	1.5	N.R.	Shaley Limestone/Shale
17.0 to 21.0	898.3 to 894.3	N.R.	N.R.	VOID/Clay Seam
21.0 to 25.5	894.3 to 889.8	5.0	100	Limestone
25.5 to 31.5	889.8 to 883.8	5.0	40	Shaley/Cherty Limestone
31.5 to 32.5	883.8 to 882.8	1.5	40	Highly Weathered Cherty Limestone
32.5 to 36.8	882.8 to 878.5	5.0	100	Cherty Limestone
- Skin friction Should be igno	red to a depth of 1 pier diame	eter below the grour	nd surface	
- Pier depth should meet or e	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	e pier diameter abo	ve the bottom of th	e pre-drill Boring.
N.D. Net Deserve and ad				

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static Kh (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 902.5	125	2,000	1,000	400	0.005
Shaley Limestone and	902.5 to 898.3	125	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	902.5 10 898.3	135	1,500			
VOID	898.3 to 894.3	0	0			
Cherty Limestone/ Strong Rock	894.3 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>137</u>
Grid Line Location:	<u>4-B</u>
Top Elevation (ft.):	914.7
Total Depth (ft.):	<u>39.9</u>
Bottom of Boring	
Elevation (ft.):	<u>874.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 912.2	N.R.	N.R.	
is shallower				Cherty Clay/Clay
2.5 to 15.6	912.2 to 899.1	N.R.	N.R.	
15.6 to 16.6	899.1 to 898.1	1.0	N.R.	Shale
16.6 to 21.0	898.1 to 893.7	N.R.	N.R.	VOID
21.0 to 29.5	893.7 to 885.2	4.0	N.R.	Shaley Limestone/Limestone with Wash Away
29.5 to 39.9	885.2 to 874.8	5.0	80	Limestone to Cherty Limestone
- Skin friction Should be igno	ored to a depth of 1 pier diam	eter below the grou	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
Skip friction factor of cafety	af 2			

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 898.1	125	2,000	1,000	400	0.005
VOID	898.1 to 893.7	0	0			
Shaley Limestone and	893.7 to 885.5	135	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	895.7 10 885.5	122	2,000			
Cherty Limestone/ Strong Rock	885.5 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>138</u>
Grid Line Location:	<u>5-B</u>
Top Elevation (ft.):	<u>914.2</u>
Total Depth (ft.):	<u>41.8</u>
Bottom of Boring	
Elevation (ft.):	<u>872.4</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.7	N.R.	N.R.	Cherty Clay
2.5 to 23.0	911.7 to 891.2	N.R.	N.R.	
23.0 to 26.5	891.2 to 887.7	1.5	N.R.	Shaley Limestone and Wash Away
26.5 to 31.0	887.7 to 883.2	3.0	N.R.	Fractured Cherty Limestone
31.0 to 41.8	883.2 to 872.4	5.0	80	Cherty Limestone
- Skin friction Should be igno	ored to a depth of 1 pier diam	eter below the grou	nd surface	
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	y of 2			
- End bearing factor of safety	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 891.2	125	4,000	2,000	800	0.004
Shaley Limestone and	891.2 to 887.7	135	Unconf	ined Compressive	Strength (psi)	
Shale/ Strong Rock	091.2 (0 007.7	133		1,500		
Cherty Limestone/ Strong Rock	887.7 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>139</u>
Grid Line Location:	<u>6-B</u>
Top Elevation (ft.):	913.6
Total Depth (ft.):	<u>39.5</u>
Bottom of Boring	
Elevation (ft.):	<u>874.1</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 911.1	N.R.	N.R.	Clay/Shale
2.5 to 21.9	911.1 to 891.7	N.R.	N.R.	
21.9 to 24.0	891.7 to 889.6	2.5	N.R.	Shaley Limestone
24.0 to 32.5	889.6 to 881.1	3.5	50	Weathered Cherty Limestone
32.5 to 39.5	881.1 to 874.1	5	100	Cherty Limestone
- Pier depth should meet or	ored to a depth of 1 pier diam exceed a D/B ratio of 5 below below a depth of 1.5 times th	the ground surface		ne pre-drill Boring.
- N.R. = Not Recommended	·	·		
- Skin friction factor of safet	y of 2			
- End bearing factor of safet	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 891.7	125	1,000	500	200	0.007
Shaley Limestone/ Strong	891.7 to 881.1	135	Unconfi	ined Compressive	Strength (psi)	
Rock	891.7 (0 881.1	122		2,000		
Cherty Limestone/ Strong Rock	881.1 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>140</u>
Grid Line Location:	<u>7-B</u>
Top Elevation (ft.):	913.2
Total Depth (ft.):	<u>37</u>
Bottom of Boring	
Elevation (ft.):	<u>876.2</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 910.7	N.R.	N.R.	Clay		
2.5 to 21.3	910.7 to 891.9	N.R.	N.R.			
21.3 to 26.5	891.9 to 886.7	5.0	60	Shaley Limestone		
26.5 to 37.0	886.7 to 876.2	5.0	100	Cherty Limestone		
Ű	ored to a depth of 1 pier diam exceed a D/B ratio of 5 below	e e	nd surface			
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ve the bottom of th	ne pre-drill Boring.		
- N.R. = Not Recommended						
- Skin friction factor of safety of 2						
- End bearing factor of safet	y of 3					

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 891.9	125	1,000	500	200	0.007
Shaley Limestone/ Strong	891.9 to 886.7	135	Unconfi	ined Compressive	Strength (psi)	
Rock	891.910 880.7	135		2,000		
Cherty Limestone/ Strong Rock	886.7 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>141</u>
Grid Line Location:	<u>8-B</u>
Top Elevation (ft.):	912.6
Total Depth (ft.):	<u>29.8</u>
Bottom of Boring	
Elevation (ft.):	<u>882.8</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 910.1	N.R.	N.R.	Clean Clay			
2.5 to 18.3	910.1 to 894.3	N.R.	N.R.				
18.3 to 22.5	894.3 to 890.1	3.5	40	Shaley Limestone/Shale			
22.5 to 29.8	890.1 to 882.8	5.0	100	Cherty Limestone			
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. 							
- N.R. = Not Recommended	- N.R. = Not Recommended						
- Skin friction factor of safety	- Skin friction factor of safety of 2						
- End bearing factor of safety	y of 3						

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 894.3	125	1,000	500	200	0.007
Shaley Limestone and	894.3 to 890.1	135	Unconfi	ined Compressive	Strength (psi)	
Shale/ Strong Rock	894.5 10 890.1	135		1,500		
Cherty Limestone/ Strong Rock	890.1 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>143</u>
Grid Line Location:	<u>3-A.6</u>
Top Elevation (ft.):	915.1
Total Depth (ft.):	<u>32.9</u>
Bottom of Boring	
Elevation (ft.):	<u>882.2</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material		
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.6	N.R.	N.R.	Cherty Clay/Clay		
2.5 to 12.9	912.6 to 902.2	N.R.	N.R.			
12.9 to 18.0	902.2 to 897.1	2.5	N.R.	Shaley Limestone		
18.0 to 23.0	897.1 to 892.1	N.R.	N.R.	VOID		
23.0 to 32.9	892.1 to 882.2	5.0	75	Shaley/Chert Limestone		
- Skin friction Should be igno	red to a depth of 1 pier diam	eter below the grou	nd surface			
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface				
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ove the bottom of th	ne pre-drill Boring.		
- N.R. = Not Recommended						
- Skin friction factor of safety	y of 2					
- End bearing factor of safety	y of 3					

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀	
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	lgnore	Ignore	Ignore	
Stiff Clay Without Free Water	1 Pier Diameter to 902.2	125	2,000	1,000	400	0.005	
Shaley Limestone/ Strong	902.2 to 897.1	135	Unconfined Compressive Strength (psi)				
Rock	902.2 (0 897.1	122		2,000			
VOID	897.1 to 892.1	0	0				
Shaley & Cherty Limestone/ Strong Rock	892.1 to Bottom of Pier	145	4,000				



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

Project:	Pier Pre-Drill - WW Hastings Replacement Hospital		
Client:	Foreman Manhattan	_	
Project #:	280212	_	
Pre Drill Boring #:	144	-	
Grid Line Location:	2-A		
Top Elevation (ft.):	915.6	-	
Total Depth (ft.):	36.9	-	
Bottom of Boring		-	
Elevation (ft.):	878.7	-	

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.1	N.R.	N.R.	Clay	
2.5 to 14.0	913.1 to 901.6	N.R.	N.R.		
14.0 to 19.0	901.6 to 896.6	2.0	N.R.	Weathered Shale and Shaley Limestone	
19.0 to 24.5	896.6 to 891.1	N.R.	N.R.	VOID/Clay Seam	
24.5 to 26.0	891.1 to 889.6	3.0	40	Weathered Shaley Limestone	
26.0 to 31.5	889.6 to 884.1	3.5	60	Shaley Limestone	
31.5 to 36.9	884.1 to 878.7	5.0	100	Shaley to Cherty Limestone	
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface 					

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static Kh (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	lgnore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 901.6	125	1,000	500	200	0.007
Shaley Limestone and	001 6 to 006 6	125	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	901.6 to 896.6	135		1,500		
VOID	896.6 to 891.1	0	0			
Shaley & Cherty Limestone/ Strong Rock	891.1 to Bottom of Pier	145	4,000			



Pier Pre-Drill - WW Hastings Replacement Hospital
Foreman Manhattan
280212
<u>145</u>
<u>4-A</u>
914.5
<u>29.8</u>
<u>884.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material					
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.0	N.R.	N.R.	Clay					
2.5 to 14.0	912.0 to 900.5	N.R.	N.R.						
14.0 to 16.0	900.5 to 898.5	1.5	N.R.	Weathered Shale & Limestone					
16.0 to 18.0	898.5 to 896.5	N.R.	N.R.	VOID					
18.0 to 22.5	896.5 to 892.0	5.0	N.R.	Shaley Limestone/Limestone					
22.5 to 24.0	892.0 to 890.5	N.R.	N.R.	Limestone w/ Clay Seam/Wash Away					
24.0 to 29.8	890.5 to 884.7	5.0	100	Limestone to Shaley/Cherty Limestone					
- Skin friction Should be igno	red to a depth of 1 pier diam	- Skin friction Should be ignored to a depth of 1 nier diameter below the ground surface							

Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 900.5	125	1,000	500	200	0.007
Shaley Limestone and	900.5 to 896.5	135	Unconfi	ned Compressive	Strength (psi)	
Limestone/ Strong Rock	900.5 (0 890.5	133		1,500		
Shaley & Cherty Limestone/ Strong Rock	896.5 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>146</u>
Grid Line Location:	<u>1-A</u>
Top Elevation (ft.):	916.3
Total Depth (ft.):	<u>39.8</u>
Bottom of Boring	
Elevation (ft.):	<u>876.5</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.8	N.R.	N.R.	Clay
2.5 to 18.4	913.8 to 897.9	N.R.	N.R.	
18.4 to 20.7	897.9 to 895.6	1.5	N.R.	Limestone
20.7 to 24.8	895.6 to 891.5	N.R.	N.R.	VOID
24.8 to 32.0	891.5 to 884.3	3.0	N.R.	Shaley Limestone with Possible Void from 29.2 to 29.6
32.0 to 39.8	884.3 to 876.5	5.0	75	Cherty Limestone/Chert
- Pier depth should meet or	ored to a depth of 1 pier diam exceed a D/B ratio of 5 below below a depth of 1.5 times th	the ground surface		ne pre-drill Boring.

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 897.9	125	1,000	500	200	0.007
Shaley Limestone and	907 0 to 905 C	897.9 to 895.6 135	Unconfined Compressive Strength (psi)			
Shale/ Strong Rock	897.910895.0	135		2,000		
VOID	895.6 to 891.5	0	0			
Cherty Limestone/ Strong Rock	891.5 to Bottom of Pier	135	3,000			



4168 W. Kearney St. Springfield, MO 65803 Ph: (417) 864-6000 www.ppimo.com

Project:	<u> Pier Pre-Drill - WW Hastin</u>	gs Replacement Hospital
Client:	Foreman Manhattan	_
Project #:	280212	_
Pre Drill Boring #:	150	<u>.</u>
Grid Line Location:	<u>3-R</u>	_
Top Elevation (ft.):	915	_
Total Depth (ft.):	35.5	_
Bottom of Boring		
Elevation (ft.):	879.5	<u>.</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 912.5	N.R.	N.R.	Cherty Clay/Clay			
2.5 to 16.5	912.5 to 898.5	N.R.	N.R.				
16.5 to 19.0	898.5 to 896.0	1.5	N.R.	Shaley Limestone/Shale			
19.0 to 20.0	896.0 to 895.0	N.R.	N.R.	VOID/Clay Seam			
20.0 to 23.5	895.0 to 891.5	2.5	N.R.	Shaley Limestone/Shale			
23.5 to 24.7	891.5 to 890.3	N.R.	N.R.	VOID/Clay Seam			
24.7 to 28.0	890.3 to 887.0	2.5	N.R.	Fractured Cherty Limestone			
28.0 to 35.5	887.0 to 879.5	5.0	75	Cherty Limestone			
- Skin friction Should be igno	- Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface						

- Pier depth should meet or exceed a D/B ratio of 5 below the ground surface

- End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring.

- N.R. = Not Recommended

- Skin friction factor of safety of 2

- End bearing factor of safety of 3

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 898.5	125	2,000	1,000	400	0.005
Shaley Limestone and	898.5 to 887.0	135	Unconfi	ned Compressive	Strength (psi)	
Shale/ Strong Rock	898.5 10 887.0	133		1,500		
Cherty Limestone/ Strong Rock	887.0 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>152</u>
Grid Line Location:	<u>2-R</u>
Top Elevation (ft.):	915.6
Total Depth (ft.):	<u>36.9</u>
Bottom of Boring	
Elevation (ft.):	<u>878.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material			
Ground Surface to 1 Pier							
Diameter or 2.5' whichever is shallower	Up to 913.1	N.R.	N.R.	Cherty Clay/Clay			
2.5 to 16.0	913.1 to 899.6	N.R.	N.R.				
16.0 to 21.0	899.6 to 894.6	3.5	N.R.	Shaley Limestone/Limestone			
21.0 to 23.0	894.6 to 892.6	N.R.	N.R.	VOID			
23.0 to 27.0	892.6 to 888.6	0.5	N.R.	Clay/Highly Weathered Shale			
27.0 to 30.5	888.6 to 885.1	4.0	40	Weathered Cherty Limestone			
30.5 to 36.9	885.1 to 878.7	5.0	100	Cherty Limestone			
- Skin friction Should be igno	red to a depth of 1 pier diame	eter below the grou	nd surface				
- Pier depth should meet or	exceed a D/B ratio of 5 below	the ground surface					
- End bearing not applicable	below a depth of 1.5 times th	e pier diameter abo	ve the bottom of the	e pre-drill Boring.			
- N.R. = Not Recommended							
- Skin friction factor of safety	- Skin friction factor of safety of 2						
- End bearing factor of safety	y of 3						

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	lgnore	lgnore	Ignore	lgnore	lgnore
Stiff Clay Without Free Water	1 Pier Diameter to 899.6	125	2,000	1,000	400	0.005
Shaley Limestone and	2020 6 1 2024 6 145		Unconfi	ned Compressive	Strength (psi)	
Shale/ Strong Rock	899.6 to 894.6	145		2,000		
VOID	894.6 to 892.6	0	0			
Stiff Clay Without Free			Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Water	892.6 to 888.6	125	4,000	2,000	800	0.004
Cherty Limestone/Strong			Unconfi	ned Compressive	Strength (psi)	
Rock	888.6 to 885.1	135		2,000		
Cherty Limestone/ Strong Rock	885.1 to Bottom of Pier	145	4,000			



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>154</u>
Grid Line Location:	<u>1-R</u>
Top Elevation (ft.):	916.3
Total Depth (ft.):	<u>41.9</u>
Bottom of Boring	
Elevation (ft.):	<u>874.4</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material	
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 913.8	N.R.	N.R.	Cherty Clay/Clay	
2.5 to 17.5	913.8 to 898.8	N.R.	N.R.		
17.5 to 18.5	989.8 to 897.8	1.0	N.R.	Shaley Limestone	
18.5 to 26.0	897.8 to 890.3	N.R.	N.R.	VOID	
26.0 to 28.9	890.3 to 887.4	3.5	N.R.	Cherty Limestone	
28.9 to 32.0	887.4 to 884.3	N.R.	N.R.	Wash Away Clay Seam	
32.0 to 41.9	884.3 to 874.4	3.5	50	Highly Fractured Cherty Limestone	
 Skin friction Should be ignored to a depth of 1 pier diameter below the ground surface Pier depth should meet or exceed a D/B ratio of 5 below the ground surface End bearing not applicable below a depth of 1.5 times the pier diameter above the bottom of the pre-drill Boring. N.R. = Not Recommended Skin friction factor of safety of 2 					
 End bearing factor of safety 	v of 3				

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	Ignore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 898.8	125	1,000	500	200	0.007
Shaley Limestone and	898.8 to 897.8	130	Unconfined Compressive Strength (psi) 1,500			
Shale/ Strong Rock	090.010097.0	150				
VOID	897.8 to 891.1	0	0			
Shale & Cherty Limestone/ Strong Rock	891.1 to 887.4	135	2,000			
Stiff Clay Without Free	887.4 to 885.4	90	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Water	007.410003.4	90	500	100	N/A	0.010
Cherty Limestone/Strong		145	Unconfined Compressive Strength (psi)			
Rock	885.4 to Bottom of Pier			3,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>163</u>
Grid Line Location:	BR-1-BR-B offset 12' East and 3' South Top
Elevation (ft.):	917 +/- 1 foot due to offset
Total Depth (ft.):	37
Bottom of Boring	
Elevation (ft.):	880.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever	Up to 914.5	N.R.	N.R.	
is shallower	00 10 914.5	N.N.	N.K.	Cherty Clay/Clay
2.5 to 22.0	914.5 to 895.0	N.R.	N.R.	
22.0 to 29.0	895.0 to 888.0	3.5	50	Cherty Limestone With Highly Weathered Zones
29.0 to 37.0	888.0 to 880.0	3.5	30	Highly Weathered Cherty Limestone/Wash Away
- Skin friction Should be ignor	red to a depth of 1 pier diame	ter below the ground	l surface	
- Pier depth should meet or e	exceed a D/B ratio of 5 below t	the ground surface		
- End bearing not applicable I	below a depth of 1.5 times the	e pier diameter above	e the bottom of the	pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	of 2			
- End bearing factor of safety	of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	lgnore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 895.0	125	1,000	500	200	0.007
Cherty Limestone/ Strong	005.0 +- 004.0	125	Unconfined Compressive Strength (psi)			
Rock	895.0 to 884.0	135		1,500		
Stiff Clay Without Free	884.0 to 880.0	125	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Water	004.0 10 000.0	125	4,000	2,000	800	0.004



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>164</u>
Grid Line Location:	BR-2-BR-B
Top Elevation (ft.):	917.5
Total Depth (ft.):	<u>39.8</u>
Bottom of Boring	
Elevation (ft.):	<u>877.7</u>

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 915.0	N.R.	N.R.	Cherty Clay/Clay
2.5 to 21.2	915.0 to 896.3	N.R.	N.R.	
21.2 to 25.5	896.3 to 892.5	1.5	N.R.	Shaley/Cherty Limestone With VOID From 23.8' to 24.4'
25.5 to 39.8	892.5 to 877.7	5.0	80	Cherty Limestone/Chert
- Pier depth should meet or	pred to a depth of 1 pier diam exceed a D/B ratio of 5 below	the ground surface		
 End bearing not applicable N.R. = Not Recommended 	below a depth of 1.5 times the	ne pier diameter abc	ove the bottom of the	ne pre-drill Boring.
- Skin friction factor of safet	y of 2			
- End bearing factor of safet	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 896.3	115	500	100	N/A	0.010
Shaley Limestone and	896.3 to 893.1	135	Unconf	ined Compressive	Strength (psi)	
Shale/ Strong Rock	890.5 10 893.1	135		1,500		
Cherty Limestone/ Strong Rock	893.1 to Bottom of Pier	145		4,000		



Project:	Pier Pre-Drill - WW Hastings Replacement Hospital
Client:	Foreman Manhattan
Project #:	280212
Pre Drill Boring #:	<u>165</u>
Grid Line Location:	BR-1-BR-A offset 12' East and 3' South
Top Elevation (ft.):	917 +/- 1 foot due to offset
Total Depth (ft.):	42
Bottom of Boring	
Elevation (ft.):	875.0

Pre-Drill Information

Applicable Depth (ft.)	Applicable Elevation (ft.)	Allowable Skin Friction (ksf)	Allowable End Bearing (ksf)	General Material
Ground Surface to 1 Pier Diameter or 2.5' whichever is shallower	Up to 914.5	N.R.	N.R.	Cherty Clay/Clay
2.5 to 25.5	914.5 to 891.5	N.R.	N.R.	
25.5 to 31.0	891.5 to 886.0	3.5	50	Cherty Limestone/Chert
31.0 to 42.0	886.0 to 875.0	3.5	30	Chert & Chert Clay Matrix
- Pier depth should meet or	ored to a depth of 1 pier diam exceed a D/B ratio of 5 below	the ground surface		
- End bearing not applicable	below a depth of 1.5 times th	ne pier diameter abo	ove the bottom of th	ne pre-drill Boring.
- N.R. = Not Recommended				
- Skin friction factor of safety	y of 2			
- End bearing factor of safety	y of 3			

Soil Type	Applicable Elevation (ft.)	Unit Weight (pcf)	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Stiff Clay Without Free Water	Ground Surface to 1 Pier Diameter	Ignore	lgnore	Ignore	Ignore	Ignore
Stiff Clay Without Free Water	1 Pier Diameter to 892.5	125	2,000	1,000	400	0.005
Cherty Limestone/ Strong	892.5 to 882.5	135	Unconfi	ned Compressive	Strength (psi)	
Rock	892.5 10 882.5	122		1,500		
Stiff Clay Without Free	882.5 to 875.0	125	Cohesion (psf)	Static K _h (pci)	Cyclic K _h (pci)	e ₅₀
Water	002.3 10 873.0	125	4,000	2,000	800	0.004

SECTION 00 72 00

GENERAL CONDITIONS

- A. The General Conditions of this Contract are the American Institute of Architects Document A201, "General Conditions of the Contract for Construction", 2017 Edition, hereinafter referred to as the "General Conditions." <u>Cherokee Nation Standard Construction Terms and</u> <u>Conditions.</u>
- B. A copy of the Document follows this page and shall apply to each and every Section of the Work as though written in full therein.

END OF SECTION

Exhibit A to Construction Management Agreement

STANDARD CONSTRUCTION TERMS AND CONDITIONS

Contract# 201440

Cherokee Nation 17675 South Muskogee Avenue Tahlequah, Oklahoma 74464 Telephone: (918) 453-5000

Table of Contents

CH	ERO	KEE NATION STANDARD CONSTRUCTION TERMS AND CONDITIONS	9
1		Contract Documents	9
2	2.	The Work	9
3	3.	The Project	9
4	l.	The Drawings	9
5	5.	The Specifications	. 9
6	5.	The Project Manual	. 9
7	•	Execution, Correlation and Intent	. 9
	Α.	Representation by Contractor	. 9
	Β.	Intent of the Contract Documents	. 9
	C.	Organization of Specifications	10
	D.	Terminology	10
8	•	Project Representatives	10
	Α.	Cherokee Nation's Representative	10
	Β.	Construction Manager's Representatives	10
9	•	Shop Drawings, Product Data, and Samples	
	Α.	Shop Drawings	
	Β.		
	C.	Samples	
	D.	Review by Contractor	10
	Ε.	Approval by the Architect	10
	F.	Representation by Contractor	1
G.		Deviations	11
	Η.	Specific Attention	1
	0.	Use of Job Site	11
1	1.	Review of Contract Documents and Field Conditions by Contractor	11
	A.	Examination of the Job Site	11
	В.	Verification of Field Conditions	2
12	2.	Supervision and Construction Procedures	12
	А. Ъ	Supervision of the Work	12
	Β.	Responsibility of the Contractor	2

C.	Performance of the Work	12
D.	Inspections of the Work	12
13.	Labor and Materials	12
Α.	Payment	12
8.	Enforcement of Discipline	12
C.	Sufficient Labor, Materials, and Other Supplies	. 13
14.	Permits, Fees and Notices	. 13
Α.	Permits and Licenses	. 13
8.	Compliance With Laws	. 13
C.	Responsibility of Contractor	. 13
15.	Schedule, Pre-Construction Meeting, and Superintendent	. 13
Α.	Schedule	. 13
8.	Preliminary Meeting	. 14
C.	Superintendent	. 14
16.	Time of the Essence	. 15
17.	Furnishing and Ownership of Documents	. 15
Α.	Copies of Drawings and Specifications	. 15
8.	Property of Cherokee Nation	. 15
C.	Forms	. 15
D. F	Requirements Provided by Cherokee Nation	. 15
18.	Invoicing and Payment	. 16
Α.	Payment	. 16
8.	Schedule of Values	. 16
C.	Payment Applications	. 16
D.	Unconditional Progress Payment Releases	. 16
E.	Payment Including Change Order	.17
F.	Contractor's Affidavit	.17
G.	Payment to Third Parties	.17
Н.	Payment for Materials Stored On Site and Off Site	.17
I.	Certificate for Payment	.18
J.	Decisions to Withhold Payment	.18
К.	Final Payment	19
19.	Completion	20

Α.	Substantial Completion	20
В.	Right to Occupy before Substantial Completion	20
C.	Inspections by Contractor and Punch List	20
D.	Inspections by Cherokee Nation and Punch List.	20
E.	Certificate of Substantial Completion	21
F.	Cherokee Nation's Receipt of Fixtures and Equipment	21
G.	Exterior Closed and Locked	21
Н.	Final Completion	21
20.	Construction by Cherokee Nation or by Special Subcontractors	21
Α.	Cherokee Nation's Right to Perform Construction and to Award Separate Contracts	21
В.	Mutual Responsibility	22
21.	Subcontractors and Suppliers	22
Α.	Subcontractor Relations	
В.	Award of Subcontracts and Other Contracts for Portions of the Work	23
C.	Contractor's Subcontracts	23
D.	Certificates of Insurance	23
E.	Contingent Assignment of Subcontracts	23
22.	Insurance	24
Α.	Contractor's Liability Insurance	24
В.	Waiver of Subrogation	24
C.	Additional Insured	25
D.	Primary and Non-Contributory	25
E.	Non-renewal or Cancellation	25
F.	Evidence of Insurance	25
G.	Non-Liability for Contractor's Loss	25
Н.	Builder's Risk	25
I.	Other Risks	25
J.	Insurance Company Ratings	26
23.	Contractor's Bond	26
24.	Safety Regulations and Safety of Persons and Property	26
Α.	Safety Plan	26
В.	Safety Representations	26
C.	Protective Equipment	26

D.	Right to Know	26
E.	Drug Testing	27
25.	Cooperation with Other Contractors	27
26.	Representations and Warranties	27
Α.	General Representations and Warranties	27
В.	Warranty Exclusions	27
C.	Warranty Period	28
D.	Named Products	28
E.	Other Specified Products	28
F.	Warranty on Substantial Completion	28
G.	Third Party Suppliers Warranty	28
Н.	Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters	29
27.	Liens	29
28.	Inspection and Correction of Work	29
29.	Interference, Clean-up, Defective Work, Inspection of Facilities, and Cutting and Patching	30
Α.	Interference	30
В.	Cleaning Up	30
C.	Cherokee Nation's Right to Clean Up	30
D.	Correction of Defective Work	30
E.	Remedies for Failure to Cure Defective Work	30
F.	Inspection Facilities and Cost	31
G.	Cutting and Patching	31
Н.	Non-waiver	31
30.	Environmental Protection and Hazardous Materials	31
Α.	NEPA	31
В.	Environmental Concerns	31
C.	Non-Compliance and Corrective Action	32
D.	Protection of Land Resources	32
F.	Burning	33
G.	Dust and Debris	33
Н.	Hazardous Materials Brought Onto or Produced On the Job Site	33
I.	Hazardous Materials Found on the Site	33
Α.	Changes in the Work	34

В.	Change Order	34
C.	Construction Change Directives	35
D.	Adjustment to Contract Price	35
Ε.	Information Required	35
F.	Contractor to Proceed with the Work	36
G.	Failure to Agree	36
Н.	Contract Price Decrease	37
I.	Pending Final Determination of Total Cost	37
J.	Agreement between Contractor and Cherokee Nation	37
K.	Claim for Additional Costs or Time	37
34.	Term	37
35.	Stop Work	37
36.	Cherokee Nation's Right to Carry Out the Work	38
37.	Termination for Cause	38
38.	Suspension and Termination for Convenience	38
39.	Title	39
40.	Uncovering and Correction of Work	39
Α.	Uncovering of Work Contrary to Request	39
В.	Uncovering of Work Not Specifically Requested	39
C.	Prompt Correction of Covered Work	39
D.	Long Term Correction of Covered Work	39
E.	Removal of Work From the Job Site by Contractor	40
F.	Correction of the Work by Cherokee Nation	40
G.	Cost of Correcting the Work	40
Н.	No Established Limitation	40
I.	Acceptance of Nonconforming Work	40
41.	Tests and Inspections	41
Α.	Compliance With Laws	41
В.	Additional Testing	41
C.	Testing Which Reveals Nonconforming Work	41
D.	Required Certificates	41
E.	Prompt Testing	41
42.	Claims and Disputes	41

Α.	Claims	41
В.	Referral to the Architect	42
C.	Timing of Making a Claim	42
D.	Diligent Performance of the Work Pending a Claim	42
Ε.	Claims for Additional Cost	42
F.	Claims for Additional Time	42
G.	Notice of a Claim	42
43.	Resolution of Claims and Disputes	43
Α.	Review of Claims by the Architect	43
В.	Documentation of the Resolution of a Claim	43
C.	Additional Information for Unresolved Claims	43
D.	Architect's Decision Relating to Unresolved Claims	43
E.	Governing Law, Jurisdiction and Waiver of Venue	43
44.	Indemnification	43
Α.	Indemnification-General	43
В.	Indemnification-Taxes	44
C.	Participation by Cherokee Nation Group	44
D.	Patent Infringement	44
45.	Waiver of Consequential Loss or Damage	45
46.	Patents	45
47.	Work Product	45
Α.	New Work Created	45
В.	Drawings and Specifications	45
C.	As-Built Drawings	46
48.	Delay	46
Α.	Force Majeure	46
В.	Normal Weather Conditions	46
C.	Delay Caused by Cherokee Nation or Others	
D.	Time for Claim Submission	46
E.	Claims for Additional Costs	47
49.	Independent Contractor	47
Α.	Independent Contractor	47
В.	Payment of Taxes	47

C.	Reporting Requirements
D.	Waiver of Benefits
50.	Contractor's Personnel4
51.	Improper Payments
52.	Alcohol, Drug, and Tobacco Policy44
53.	Audit
54.	Publicity
55.	Confidential and Proprietary Information
Α.	Confidentiality
8.	Return of Confidential Information
C.	Fiduciary Trust
D.	Protection of Proprietary and Confidential Information
56.	Assignment of Contract
56. 57.	Assignment of Contract
57.	Notices
57. 58.	Notices
57. 58. 59.	Notices 50 Litigation Costs; Attorneys' Fees 50 Headings; Severability 50
57. 58. 59. 60.	Notices 50 Litigation Costs; Attorneys' Fees 50 Headings; Severability 50 Incorporation by Reference; Survival 50
57. 58. 59. 60. 61.	Notices 50 Litigation Costs; Attorneys' Fees 50 Headings; Severability 50 Incorporation by Reference; Survival 50 Waiver 57
57. 58. 59. 60. 61. 62.	Notices 50 Litigation Costs; Attorneys' Fees 50 Headings; Severability 50 Incorporation by Reference; Survival 50 Waiver 50 Notice of Claims 50
 57. 58. 59. 60. 61. 62. 63. 	Notices 50 Litigation Costs; Attorneys' Fees 50 Headings; Severability 50 Incorporation by Reference; Survival 50 Waiver 50 Notice of Claims 57 Reference to Liens Shall Not be Construed to Create Right to a Lien 57
 57. 58. 59. 60. 61. 62. 63. 64. 	Notices 50 Litigation Costs; Attorneys' Fees 50 Headings; Severability 50 Incorporation by Reference; Survival 50 Waiver 50 Notice of Claims 57 Reference to Liens Shall Not be Construed to Create Right to a Lien 57 No Waiver of Sovereign Immunity 57

CHEROKEE NATION STANDARD CONSTRUCTION TERMS AND CONDITIONS

The following are Cherokee Nation's Standard Construction Terms and Conditions, which shall be incorporated by reference in any agreement, contract, letter of intent, or understanding of any kind or nature whatsoever (hereinafter referred to as "**Contract**") between Cherokee Nation, Architect, Construction Manager, and any contractor, subcontractor, supplier, design professional, consultant or any other person or persons who perform services or provide materials in connection with any Work performed in furtherance of the completion of the Project (hereinafter referred to as "**Contractor**").

- 1. <u>Contract Documents.</u> The Contract Documents shall consist of the Contract, including these Cherokee Nation's Standard Construction Terms and Conditions which are incorporated therein; any general, supplementary or other conditions adopted by Cherokee Nation and agreed to by Contractor; the Drawings and Specifications for the Work; addenda issued prior to execution of the Contract; and agreed modifications issued after execution of the Contract.
- 2. <u>The Work.</u> The "Work" shall include all necessary construction services of any kind or nature in connection with the construction for Cherokee Nation of New Cherokee Nation Hospital (the "**Project**"), in accordance with the Contract Documents. (The location of the Project is also referred to as the "Job Site.")
- **3.** <u>**The Project.**</u> The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by Cherokee Nation or by Contractor.
- 4. <u>The Drawings.</u> The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, general including plans, elevations, sections, details, schedules and diagrams.
- 5. <u>The Specifications</u>. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.
- 6. <u>The Project Manual.</u> The Project Manual is the volume usually assembled for the Work which may include the bidding requirements, sample forms, Cherokee Nation Standard Construction Terms and Conditions, the Contract, and Specifications.

7. <u>Execution, Correlation and Intent.</u>

- A. <u>Representation by Contractor.</u> Execution of the Contract by Contractor is a representation that Contractor has visited the Job Site, become familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.
- **B.** <u>Intent of the Contract Documents.</u> The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by

Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; provided, however, performance by Contractor shall only be required to the extent consistent with the Contract Documents.

- C. <u>Organization of Specifications</u>. Organization of the Specifications into divisions, sections, and articles and arrangement of Drawings shall not control Contractor in dividing the Work among its contractors or subcontractors or in establishing the extent of Work to be performed by any trade.
- **D.** <u>**Terminology.**</u> Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

8. <u>Project Representatives</u>.

- A. <u>Cherokee Nation's Representative</u> for purposes of the Project shall be the Sr. Construction Administrator ("Owner's Representative"). The designation of the Sr. Construction Administrator as Owner's Representative shall not serve to assign any of Cherokee Nation's right title or interest in the Projects as Owner to the Sr. Construction Administrator.
- **B.** <u>**Construction Manager's Representatives**</u> for the purposes of the Project and administration of this agreement shall be Kenny Foreman and Ryan Haynie.

9. Shop Drawings. Product Data. and Samples.

- A. <u>Shop Drawings.</u> Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by Contractor or its subcontractor, subsubcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
- **B.** <u>**Product Data.**</u> Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate materials or equipment for some portion of the Work.
- C. <u>Samples.</u> Samples are physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
- **D.** <u>**Review by Contractor.**</u> Contractor shall review, approve and submit to the Architect and Construction Manager Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of Cherokee Nation or of separate contractors.
- E. <u>Approval by the Architect.</u> Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples, or similar submittals until the respective submittal has been approved by the Architect

and Owner's Representative. Such Work shall be in accordance with approved submittals.

- **F.** <u>**Representation bv Contractor.</u>** By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals, Contractor represents that it has determined and verified materials, field measurements, and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.</u>
- **G. Deviations.** Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's and Owner's Representative's approval of Shop Drawings, Product Data, Samples, or similar submittals unless Contractor has specifically informed the Architect and Owner's Representative in writing of such deviation at the time of submittal and the Architect and Owner's Representative have given written approval to the specific deviation. Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals by the Architect's and Owner's Representative's approval thereof.
- **H.** <u>Specific Attention.</u> Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect or Owner's Representative on previous submittals.
- 10. <u>Use of Job Site</u>. Contractor shall confine operations at the Job Site to areas permitted by law, ordinances, permits, and the Contract Documents and shall not unreasonably encumber the Job Site with materials or equipment.

11. <u>Review of Contract Documents and Field Conditions by Contractor:</u>

Examination of the Job Site. Contractor is expected to carefully examine the Job A. Site of the proposed Work, the Plans, Specifications, and Contract forms. Contractor shall satisfy itself as to the character, quality, and quantities of Work to be performed, materials to be furnished, and as to the requirements of the proposed Contract. The submission of a bid and the execution of a Contract between Cherokee Nation and any contractor, subcontractor, supplier, design professional, consultant, or any other person or persons who perform services or provide materials in connection with any Work performed in furtherance of the completion of the Project shall be prima facie evidence that such Contractor has made such examination and is satisfied as to the conditions to be encountered in performing the Work and as to the requirements of the proposed Contract, Plans, and Specifications. Boring logs and other records of subsurface investigations and tests are available for inspection by Contractor. It is understood and agreed that such subsurface information, whether included in the Plans, Specifications, or otherwise made available to Contractor, was obtained and is intended for Cherokee Nation's design and estimating purposes only. Such information has been made available for

the convenience of all contractors. It is further understood and agreed that each contractor is solely responsible for all assumptions, deductions, or conclusions which it may make or obtain from its examination of the boring logs and other records of subsurface investigations and tests that are furnished by Cherokee Nation. If any ambiguity is alleged to exist in the Plans or Specifications, Contractor is required to offer the more expensive option.

B. <u>Verification of Field Conditions.</u> Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported at once to Owner's Representative.

12. <u>Supervision and Construction Procedures.</u>

- A. <u>Supervision of the Work.</u> Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. Contractor shall be responsible for control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.
- **B.** <u>**Responsibility of the Contractor.**</u> Contractor shall be responsible to Cherokee Nation for acts and omissions of Contractor's employees, contractors, subcontractors, and their agents and employees, and other persons performing portions of the Work under a contract or subcontract with Contractor.
- **C. Performance of the Work.** Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect or by tests, inspections, or approvals required or performed by persons other than Contractor.
- **D.** <u>Inspections of the Work.</u> Contractor shall be responsible for inspection of portions of Work already performed on the Project to determine that such portions are in proper condition to receive subsequent Work.

13. Labor and Materials.

- **A. Payment.** Unless otherwise provided in the Contract or the Contract Documents, Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.
- **B.** Enforcement of Discipline. Contractor shall enforce strict discipline and good order among Contractor's employees and other persons carrying out the Contract. Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

C. <u>Sufficient Labor. Materials. and Other Supplies.</u> Contractor shall diligently prosecute the Work, providing sufficient labor, materials, and other supplies at all times to assure performance of the Work in an orderly and expedient fashion and to ensure the Work is essentially complete by the date and time for Substantial Completion as defined in the Contract.

14. Permits. Fees and Notices.

- A. <u>Permits and Licenses.</u> Contractor shall secure or cause to be secured through its subcontractors all permits and licenses and shall pay all fees necessary for the lawful and proper performance of the Work. Contractor shall determine the amount of building permit fees, development impact fees, gas, sewer and/or water tap fees, and all other fees for water, sewer, and electric, including connection fees and deposits required for the Work. Contractor shall complete all required applications and obtain related permits on Cherokee Nation's behalf. The cost thereof shall be the sole responsibility of Contractor. Cherokee Nation will reimburse Contractor for this cost with no mark-up or pay directly at Cherokee Nation's option if time allows.
- **B.** <u>Compliance With Laws.</u> Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, codes, and lawful orders of public authorities bearing on performance of the Work, including, without limitation, the Tribal Employment Rights Office of the Cherokee Nation ("TERO").
- **C. <u>Responsibility of Contractor.</u>** If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes (including, without limitation, the applicable National Fire Protection Association Codes and the applicable local fire codes and ordinances), and rules and regulations, Contractor shall assume full responsibility for such Work and shall bear the attributable costs required to remedy such non-compliance.

15. <u>Schedule. Pre-Construction Meeting. and Superintendent.</u>

Schedule. Cherokee Nation and Contractor agree that a firm construction schedule A. is critical to project completion. Within the final GMP Amendment, Contractor shall deliver to Owner's Representative and the Architect its Critical Path Method (CPM) construction schedule ("Schedule") for the Work in a form approved by Cherokee Nation. For purposes hereof, a CPM Schedule is defined as a planning, scheduling, and control technique where a construction project is completely planned and scheduled and an arrow diagram drawn to show the interconnected individual tasks involved in constructing the Project, which permits determination of the relative significance of each event, and establishes the optimum sequence and duration of operations. The Schedule shall identify all milestones (including Contractorimposed milestones) and the. activities related thereto. The Schedule shall not exceed the time limits set forth under the Contract Documents. The Schedule shall be revised at appropriate intervals as required by the conditions of the Work, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. Owner's

Representative and the Architect shall review and approve the Schedule and thereafter may request that Contractor make further changes and modifications. Contractor shall perform the Work or cause the Work to be performed in accordance with the most recent Schedule submitted to and approved in writing by Cherokee Nation and Contractor. The Schedule shall be incorporated into the Contract as if fully set out therein. Contractor shall become obligated to complete or cause to be completed the various portions of the Work in accordance with starting and completion dates stated therein. During the performance of the Work, Contractor shall maintain at the Job Site a progress schedule showing the degree of completion of each segment of the Work. Contractor shall provide Owner's Representative with weekly progress reports as required by Cherokee Nation sufficient to allow Cherokee Nation to request revisions to the Schedule to ensure that the Project Work is completed by the time for Substantial Completion. Contractor shall promptly respond to schedule change requests within the time specified. The Schedule shall include the timing of any materials or work to be supplied by Cherokee Nation or Architect.

- **B.** <u>Preliminary Meeting.</u> Contractor, upon award of the Contract and before construction commences, shall schedule a meeting with Owner's Representative and the Architect. Contractor shall instruct all special contractors and subcontractors whose work is considered significant to the completion of the Project by Contractor or Cherokee Nation to attend this meeting. Contractor shall bring to this meeting the Schedule prepared pursuant to Paragraph 15(A) hereof, a complete list of subcontractors for all phases of the Work, including those not previously submitted on the Bid Form, and a completed Schedule of Values. The location of this meeting shall be Owner's Representative's office for the Project.
- C. Superintendent. Prior to commencement of the Work, Contractor shall designate a competent superintendent ("Superintendent") and will inform Cherokee Nation in writing of the Superintendent's name, qualifications, experience and address. Contractor shall also provide Cherokee Nation with the names, qualifications, experience and addresses of all persons who will assist the Superintendent. The Superintendent or his designated assistant will be present at the Job Site at all times during which Work is actually in progress and will have complete authority to represent and act for Contractor. The Superintendent shall supervise and direct the Work and shall not physically participate in the actual performance, assemblage or installation of the Work. All directions given to the Superintendent by Owner's Representative shall be as binding on Contractor as if they were given directly to Contractor. If Contractor's Superintendent or any of his assistants are or become unacceptable to Cherokee Nation then the Superintendent or the unacceptable assistants shall be promptly replaced upon request by Cherokee Nation. The Superintendent, as approved by Cherokee Nation, shall be appointed until completion of the Work and shall not be removed from the Project without the written consent of Cherokee Nation.

16. <u>**Time of the Essence.**</u> Time is of the essence. Contractor and the Architect shall coordinate their Work as may be directed by Cherokee Nation according to the accepted Schedule.

17. <u>Furnishing and Ownership of Documents.</u>

- A. <u>Copies of Drawings and Specifications</u>. Contractor will be furnished a sufficient number of reproducible construction Drawings and Specifications, either separately or in the form of a Project Manual. Contractor shall be responsible for distribution of documents to its subcontractors and suppliers involved with the Work in a timely manner to maintain the progress of the Work in accordance with the accepted Schedule.
- **B.** <u>**Property of Cherokee Nation.**</u> Drawings and specifications furnished by Cherokee Nation are the property of Cherokee Nation and shall not be used by Contractor on other work.
- C. <u>Forms.</u> Cherokee Nation will furnish, in electronic media, one set of forms as identified in the Contract Documents for parties with whom it has directly contracted. Contractor will not modify Cherokee Nation forms, but rather will input the relevant information onto the forms and thereafter use them for their intended purpose on the Project. Said forms are Cherokee Nation's property and shall not be used by Contractor on other work.
- **D.** <u>Requirements Provided by Cherokee Nation.</u> Cherokee Nation will furnish Contractor with complete information with respect to the requirements of the Project, including all necessary Contract Documents. To the extent available to Cherokee Nation or as required by law, Cherokee Nation will furnish to Contractor or cause to be furnished to Contractor the following items, at Cherokee Nation's expense:
 - (I) laboratory and environmental tests, inspections, and reports required by law;
 - (2) a sufficient quantity of Contract Documents;
 - (3) surveys describing physical characteristics, legal limitations, and utility locations for the site of the Project, and a written legal description of the Job Site; and
 - (4) (notwithstanding property held in Trust by the Federal Government) geotechnical reports and tests including, but not limited to, test borings, test pits, determination of soil bearing values, percolation tests with reports and reports on other subsurface conditions, and appropriate professional recommendations. It is understood and agreed that such reports, whether included in the Plans, Specifications, or otherwise made available to the Contractor, were obtained and are intended for Cherokee Nation's design and estimating purposes only. Such information has been made available

for the convenience of all contractors. It is further understood and agreed that each contractor is solely responsible for all assumptions, deductions, or conclusions which it may make or obtain from its examination of the reports and other records of subsurface investigations and tests that are furnished by Cherokee Nation.

18. <u>Invoicing and Payment.</u>

- A. **Payment.** Contractor's cost-to-date of labor and materials incorporated into the Work shall be paid monthly as the Work progresses <u>less</u> retainage of ten percent (10%). All such payments shall be made within a reasonable timeframe following Cherokee Nation's receipt of invoice. Retainage shall be withheld without interest and paid upon Substantial Completion. At Substantial Completion, the Owner may withhold from the Retainage payment a sum to allow for 200% of the amount, if any, determined in good faith by the Owner as reasonably necessary to cover costs to complete the punchlist or any incomplete Work. With approval from both the Construction Manager and the Cherokee Nation, all Retainage may be released to early completion subcontractors that have completed 100% of their work in an acceptable manner.
- **B.** <u>Schedule of Values.</u> Before the first application for payment, Contractor shall submit for Cherokee Nation's approval a Schedule of Values allocating the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as Cherokee Nation may require. This Schedule of Values shall be used as a basis for Contractor's application for payment as a method of showing progress on the Project; however, Cherokee Nation acknowledges that the amounts reflected on the Schedule of Values for specific items is not a representation or agreement by the Contractor as to the maximum cost of any one item.
- C. Payment Applications. Contractor shall invoice Cherokee Nation monthly in duplicate for Work completed and for materials stored on the site through at least the 25th day of the immediately preceding month on Cherokee Nation's Contractor Progress Payment Request form. Each application for payment shall be due on or before the 1st day of each month. Each application shall be based on ninety percent (90%) of the labor and materials incorporated into the Work and of materials suitably stored at the site thereof up to at least the 25th day of the immediately preceding month, less the aggregates of previous payments, and shall be accompanied by a form of an executed Progress Payment Release-Unconditional. Such Payment Application shall be submitted to the Architect for review within five (5) days following receipt of the Payment Application. Architect shall then have ten (10) days to review and provide written recommendation for approval of payment to Cherokee Nation.
- **D.** <u>Unconditional Progress Payment Releases.</u> Contractor's initial application for payment shall consist solely of the Progress Payment Request. Subsequent

applications shall be accompanied by properly executed Unconditional Progress Payment Release forms executed by all its subcontractors, material suppliers, and potential lienors. All Unconditional Progress Payment Releases for this Project shall be consistent in form and wording and shall be in the form agreed to by Cherokee Nation and Contractor.

- E. <u>Payment Including Change Order.</u> If a progress payment is to include payment for a Change Order, as that term is defined herein, a copy of the cover sheet of the fully executed Change Order shall accompany the Progress Payment Request.
- **F.** <u>Contractor's Affidavit.</u> When and if requested by Cherokee Nation, Contractor shall furnish, as a prerequisite to any progress payment and Final Payment, a Contractor's Affidavit reciting that all outstanding bills of labor, materials, or services then due, up to the date of the current application for payment, have been paid. The Contractor's Affidavit shall be consistent in form and wording as agreed to by Cherokee Nation and Contractor.
- **G.** <u>Payment to Third Parties.</u> Cherokee Nation reserves the right, without obligation, to withhold, reduce or recover payment if Contractor fails to pay any third party for labor, materials, or other costs incurred by Contractor in performance of the Work as and when due. Additionally, Cherokee Nation shall have the right, but no obligation, to make joint checks or withhold and or to require satisfactory lien releases for all suppliers and subcontractors of Contractor.
- **H. Payment for Materials Stored On Site and Off Site.** Payment, subject to retention for materials and equipment suitably stored and intended for incorporation in the Work, will be made by Cherokee Nation, subject to the following conditions:
 - (1) Contractor shall furnish to Owner's Representative satisfactory evidence that such materials have been properly received, inventoried, and stored at the Job Site or Off Site in accordance with applicable manufacturer's recommendations and special requirements of Cherokee Nation, to include that all such materials stored Off Site are clearly designated and marked for use in connection with the Project;
 - (2) Payment shall be conditioned upon submission by Contractor of bills of sale or such other documentation as will evidence the transfer to title to such materials or equipment to Cherokee Nation upon payment;
 - (3) Risk of loss of any materials stored on or adjacent to the Job Site shall remain the obligation of Contractor until such time as title has passed to Cherokee Nation. Notwithstanding anything contained in this provision, the primary source of recovery for any loss shall be the Builders Risk insurance; and

- (4) Payment will not be made for materials stored offsite unless authorized in writing by Cherokee Nation, and in no event shall Cherokee Nation be asked or required to pay, either directly or indirectly, the expense of such Off Site storage.
- I. <u>Certificate for Payment.</u> Cherokee Nation will, within a reasonable timeframe after the receipt of Contractor's Progress Payment Request, make payment or notify Contractor of Cherokee Nation reason for withholding the Request, or portions of the Request. Receipt by Cherokee Nation is defined to be delivery in person to Cherokee Nation's Sr. Construction Administrator at Cherokee Nation Planning & Development Offices located within the Cherokee Nation Tribal Complex, Tahlequah, OK 74464. Payment is defined to be by Cherokee Nation's mailing by first-class U.S. Mail a check for the amount of the Request for payment, subject to retention and adjustment as provided in the Contract Documents. If the pay date occurs on a Saturday, Sunday or holiday, Cherokee Nation will make payment on the next business day. Contractor's Progress Payment Requests are to be dated the 25th of the month as defined in other provisions of the Contract Documents.
- J. <u>Decisions to Withhold Payment.</u> Cherokee Nation may decline to make payment because of subsequently discovered evidence or subsequent observations, may nullify the whole or any part of any Progress Payment Request previously received and/or withhold payment to such extent as may be necessary to protect Cherokee Nation for loss because of:
 - (1) defective Work not remedied;
 - (2) third party claims filed or reasonable evidence indicating the probable filing of such claims;
 - (3) failure of Contractor to make payments properly to suppliers or subcontractors or for labor, materials or equipment;
 - (4) reasonable evidence that the Work cannot be completed for the unpaid balance of the subcontract amount;
 - (5) damage to Cherokee Nation or another contractor or property of another;
 - (6) reasonable evidence that the Work will not be completed within the time permitted for completion of the Project;
 - (7) failure to carry out the Work in accordance with the Contract Documents; or
 - (8) materially inaccurate or incomplete information provided with the Request or Certificate of Payment.

K. Final Payment.

- (1) Contractor shall submit application for Final Payment. Final Payment and retention shall not become due until Contractor submits to Cherokee Nation (i) a Contractor's Affidavit acceptable to Cherokee Nation that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which Cherokee Nation or its property or its sureties might in any way be responsible, have been paid or otherwise satisfied, (ii) consent of surety, if any, to Final Payment, (iii) when applicable, accurate record drawings for Contractor's Work, and (iv) if required by Cherokee Nation, other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of lien arising out the Contract, to the extent and in such form as may be designated by Cherokee Nation.
- (2) If any of Contractor's subcontractors or suppliers refuses to furnish a release or waiver required by Cherokee Nation, Contractor may furnish a bond satisfactory to Cherokee Nation to indemnify it against any such lien. If any lien remains unsatisfied after all payments are made, Contractor shall refund to Cherokee Nation all monies that the latter may be compelled to pay in discharging such lien.
- (3) Final Payment shall constitute a waiver of Claims by Cherokee Nation except those arising from: (i) liens, claims, or security interest encumbrances arising out of the Contract; (ii) failure of the Work to comply with the requirements of the Contract Documents; or (iii) terms of warranties required by the Contract Documents.
- (4) Acceptance of Final Payment by Contractor shall constitute waiver of any known claims, except those previously made in writing and identified as unsettled at the time of final Application for Payment. Final Payment (including retention) will be due no later than sixty (60) days after completion of the Work in accordance with the Contract Documents. Final Payment shall include payment of any conditional items to which Contractor may be entitled hereunder, including amounts earned by completion of the Project.
- (5) Any billings received later than sixty (60) days after Final Completion will not be processed. Failure to cause billings to be received by Cherokee Nation within sixty (60) days of Final Completion is agreed to be conclusive proof of a failure to mitigate damages and shall be a complete defense to the recovery of any damages associated with said billings and said defense shall apply to any theory of recovery, whether legal or equitable, in contract or tort, and including fraud, breach of contract, promissory estoppel or quantum meruit. Payment to a Contractor shall not operate as approval or acceptance of Work done or materials furnished under the Contract

Documents. In the event that any of those items identified on the Punch List remain undone or uncorrected within forty-five (45) days of Substantial Completion, Cherokee Nation may, after written notice, cause any of the items to be completed or corrected and back charge the Contractor for the actual cost incurred by Cherokee Nation.

19. <u>Completion.</u>

- A. Substantial Completion. Substantial Completion is defined as the stage in the progress of the Work when the Project or a designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the constructed facilities are suitable and capable of being operated for their intended use, and Contractor, if applicable, has received a final Certificate of Occupancy. If, however, the constructed facilities are not occupied or used for their intended use for reasons not due to the construction set forth in this Contract, Substantial Completion is still met. Cherokee Nation may occupy or use any completed or partially completed portion of the Work at any state acceptable to Cherokee Nation and allowed by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion has reached the Substantial Completion stage. Before Substantial Completion, among other things, construction signage, temporary fencing, office trailers, storage trailers and temporary utilities shall be removed. Contractor's traffic control measures shall be eliminated and removed, if safe to do so. Contractor's insurance obligations shall remain in force and effect until Final Completion; however, upon occupancy of the constructed facilities, the existence of the Builder's Risk Insurance shall be governed by the terms of the Builder's Risk policy.
- **B. Right to Occupy before Substantial Completion.** Cherokee Nation retains the right to occupy or to use any completed or partially completed portion of the Work at any stage acceptable to Cherokee Nation and Contractor and allowed by public authority having jurisdiction over the Work. Such partial occupancy or use may commence whether or not that portion is complete for Substantial Completion. Partial use or occupancy shall not constitute acceptance of the Work.
- C. Inspections by Contractor and Punch List. Upon the date for Substantial Completion as set forth in the Contract, Contractor shall prepare and submit to the Architect and Owner's Representative a punch list of items to be completed or corrected. Contractor shall then have thirty (30) days following the date for Substantial Completion to complete or correct the items on the punch list, unless such additional time is provided in writing by Owner's Representative to complete such items. Failure to include an item on the punch list does not relieve the Contractor of the obligation to perform the Work in accordance with the Contract Documents.
- **D.** <u>Inspections by Cherokee Nation and Punch List.</u> Within twenty (20) days following receipt of Contractor's punch list, the Architect, Owner's Representative

and designees will make an inspection of the Project to determine whether the Contractor's Work is substantially complete. If Cherokee Nation's inspection discloses any item, whether or not included on the Contractor's punch list, which is not in accordance with the requirements of the Contract Documents, Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item within thirty (30) days following notification by Owner's Representative. Within two (2) days thereafter, Contractor shall then submit a request for another inspection by the Architect, Owner's Representative and designees to determine Substantial Completion. Such subsequent inspection will be completed within five (5) days following such notification by Contractor. Contractor is not relieved from completing or correcting Work by Cherokee Nation's failure to inspect the Work within the time frame provided for herein.

- E. <u>Certificate of Substantial Completion.</u> When the Work or a designated portion thereof is substantially completed, the Architect will, within five (5) days thereafter, prepare a Certificate of Substantial Completion, which shall establish the date of Substantial Completion, the responsibilities of Cherokee Nation and Contractor for security, maintenance, heat, utilities, damage to the Work, and insurance, and shall fix the time within which Contractor shall finish all items on the punch list accompanying the Certificate, which time shall not exceed ten (10) days without the written consent of Owner's Representative. Completion of the above punch list items shall not affect the date of Substantial Completion.
- **F.** <u>Cherokee Nation's Receipt of Fixtures and Equipment.</u> Contractor understands, and shall take into consideration, that sixty (60) days prior to the date for Substantial Completion, Cherokee Nation may begin receiving fixtures and equipment to be stored in the facilities, and that Cherokee Nation and Cherokee Nation's separate contractor(s) may be installing fixtures and Cherokee Nation's furnished equipment or other equipment immediately thereafter.
- **G.** <u>Exterior Closed and Locked.</u> At least sixty (60) days prior to Contractor's scheduled date for Substantial Completion, all exterior openings shall be closed in, if required, exterior doors provided with locks, and the entire building sufficiently secure to protect Cherokee Nation fixtures.
- H. <u>Final Completion.</u> Upon receipt of written notice from Contractor that the Work is ready for final inspection and acceptance and upon receipt of a final application for payment, the Architect, Owner's Representative and designees will promptly make such inspections and, when they find the Work acceptable under the Contract Documents and the Contract fully performed, they will issue a Certificate of Final Acceptance and thereafter will approve Final Payment.

20. <u>Construction by Cherokee Nation or by Special Subcontractors</u>.

A. <u>Cherokee Nation's Right to Perform Construction and to Award Separate</u> <u>Contracts.</u> Cherokee Nation reserves the right to perform construction related to the Project and to award separate contracts in connection with other portions of the Project (hereinafter referred to as "**Special Subcontractors**"). Cherokee Nation shall provide for coordination of the activities of Cherokee Nation's own employees and of each of the Special Subcontractors with the Work of the Contractor. Contractor shall participate with each Special Subcontractor and Cherokee Nation in reviewing their respective construction schedules when directed to do so by Cherokee Nation. Contractor shall make any revisions to the Schedule and the Project budget after a joint review and mutual agreement between Cherokee Nation and Contractor.

B. <u>Mutual Responsibility</u>. Contractor shall afford Cherokee Nation or the Special Contractors the opportunity for introduction and storage of their materials and equipment and performance of their activities and shall coordinate Contractor's construction and operations with Cherokee Nation or the Special Subcontractors. If part of Contractor's Work depends upon construction by Cherokee Nation or the Special Subcontractors, Contractor shall, prior to proceeding with that portion of the Work, promptly report to Owner's Representative that such construction by Cherokee Nation or the Special Subcontractors is required in order to give Cherokee Nation adequate time to coordinate such construction. Costs caused by delays or by improperly timed activities shall be borne by the party responsible therefore.

21. <u>Subcontractors and Suppliers.</u>

Subcontractor Relations. By appropriate agreement, written where legally A. required for validity, Contractor shall require each of its contractors or subcontractors, to the extent of the Work to be performed by its contractors or subcontractors, to be bound to Contractor by terms of the Contract Documents and the Cherokee Nation Standard Construction Terms and Conditions, and to assume toward Contractor all the obligations and responsibilities which Contractor, by these Conditions, assumes toward Cherokee Nation. Each subcontract agreement shall preserve and protect the rights of Cherokee Nation under the Contract Documents with respect to the Work to be performed by the contractor or subcontractor so that subcontracting thereof will not prejudice such rights. Where appropriate, Contractor shall require each contractor or subcontractor to enter into similar agreements with sub-subcontractors. Contractor shall make available to each proposed contractor or subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the contractor or subcontractor will be bound, and, upon written request of the contractor or subcontractor identify to the contractor or subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Contractors or subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed sub- subcontractors.

B. Award of Subcontracts and Other Contracts for Portions of the Work.

- (1) Unless otherwise stated in the Contract Documents or the bidding requirements, Contractor, as soon as practicable after award of the Contract, shall furnish in writing to Cherokee Nation the names of persons or entities proposed for each principal portion of the Work. Owner's Representative will promptly reply to Contractor in writing stating whether or not Cherokee Nation, after due investigation, has reasonable objection to any such proposed person or entity.
- (2) Contractor shall not contract with a proposed person or entity to which Cherokee Nation has made reasonable and timely objection.
- (3) If Cherokee Nation has reasonable objection to a person or entity proposed by Contractor, Contractor shall propose another to whom Cherokee Nation has no reasonable objection.
- C. **Contractor's Subcontracts.** Contractor shall not subcontract any part of the Work except as specifically provided in the Contract Documents or as Cherokee Nation, in its sole discretion, agrees to in writing. If applicable, Contractor will evaluate bids from subcontractors and suppliers and present tabulation of bids and qualifications. As a condition to commencing Work, Contractor shall submit, in writing, a list of all subcontractors and suppliers to be used in connection with the Work and shall within a reasonable time thereafter supply subcontractor's signed contracts and vendor purchase orders to Cherokee Nation and Owner's Representative per the Project Schedule. Contractor shall immediately notify Cherokee Nation and Owner's Representative, in writing, of any change in their subcontractors and suppliers. Contractor shall have each subcontractor and supplier complete the Progress Payment forms and attach them to its monthly Progress Payment Requests. Failure to comply with this provision will delay processing of monthly progress payments. For purposes of this Section, identified subcontractors and suppliers shall mean all subcontractors and those suppliers whose total price(s) exceeds five percent (5%) of the estimated Cost of the Work.
- **D.** <u>Certificates of Insurance.</u> Contractor shall maintain acceptable certificates of policies of insurance for all contractors and subcontractors and make available to Cherokee Nation upon request.
- **E.** <u>Contingent Assignment of Subcontracts.</u> Each subcontract agreement for a portion of the Work is assigned by Contractor to Cherokee Nation provided that:
 - (1) Assignment is effective only after termination of the Contract by Cherokee Nation for cause or for convenience and only for those subcontract agreements which Cherokee Nation accepts by notifying the contractor or subcontractor in writing; and

(2) Assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

22. <u>Insurance.</u>

- A. <u>Contractor's Liability Insurance.</u> Unless more specifically delineated in the Construction Management Agreement or Exhibits thereto, in which case the types and limits of required coverage shall be as set forth therein, Contractor shall carry or cause to be carried and maintained in force throughout the entire term of this Contractor's Agreement insurance coverage as described below with insurance companies acceptable to Cherokee Nation. The limits set forth below are minimum limits and will not be construed to limit Contractor's liability. All costs and deductible amounts will be the sole responsibility of Contractor.
 - (1) <u>Worker's Compensation.</u> To the extent such coverage is required by law, worker's compensation insurance complying with the laws of the state or states having jurisdiction over each employee, whether or not Contractor is required by such laws to maintain such insurance, and Employer's Liability insurance with limits of \$500,000 each accident, \$500,000 disease each employee, and \$500,000 disease policy limit.
 - (2) <u>General Liability.</u> Commercial or Comprehensive General Liability insurance on an occurrence form with a combined single limit of \$2,000,000 each occurrence, \$2,000,000 Personal and Advertising Liability, \$4,000,000 General Aggregate, \$4,000,000 Products and Completed Operations Aggregate, and Ten (10) years Completed Operations Coverage from Substantial Completion.
 - (3) <u>Excess Liability.</u> Excess Liability Insurance coverage shall be maintained with the following limits: \$50,000,000 Each Occurrence; \$50,000,000 General Aggregate; \$50,000,000 Products and Completed Operations Aggregate, and Ten (10) years Completed Operations Coverage from Substantial Completion.
 - (4) <u>Automobile Insurance.</u> Automobile liability insurance with a combined single limit of \$1,000,000 each occurrence for bodily injury and property damage to include coverage for all owned, non-owned, and hired vehicles.
 - (5) <u>Errors and Omissions.</u> Contractor's Pollution Liability / Professional Liability / Errors and Omissions Liability insurance shall be maintained on a claims-made basis with limits of not less than \$5,000,000 for each claim and an annual aggregate of not less than \$5,000,000.
- **B.** <u>Waiver of Subrogation.</u> In the above-described policies, Contractor agrees to waive and shall require its insurers to waive any rights of subrogation or recovery they may have against Cherokee Nation.

- C. <u>Additional Insured.</u> Under the Automobile and General Liability insurance policies, Cherokee Nation shall be named as additional insured as respects Contractor's operations and as respects any Services performed under this Agreement. Any costs associated with naming Cherokee Nation as additional insured is included in the contract cost.
- **D.** <u>**Primary and Non-Contributory:**</u> The Automobile and General Liability insurance policies will include the following "other insurance" amendment: "This insurance is primary insurance with respect to Cherokee Nation, and any other insurance maintained by Cherokee Nation is excess and not contributory with this insurance."
- E. <u>Non-renewal or Cancellation.</u> Non-renewal, modification, or cancellation of policies described above will be effective only after written notice is received by Cherokee Nation from the insurance company thirty (30) days in advance of any such non-renewal, modification, or cancellation.
- **F. Evidence of Insurance.** Prior to commencing the Services to be provided hereunder, Contractor will deliver to Cherokee Nation certificates of insurance on an ACORD 25 or 25S form evidencing the existence of the insurance coverage required above. In the event of a loss or claim arising out of or in connection with the Services to be provided under this Agreement, Contractor agrees, upon request of Cherokee Nation, to submit the original or a certified copy of its insurance policies for inspection by Cherokee Nation.
- **G.** <u>Non-Liability for Contractor's Loss.</u> Cherokee Nation will not insure nor be responsible for any loss or damage, regardless of cause, to property of any kind, including loss of use thereof, owned, leased or borrowed by the Contractor, or its employees, servants or agents.
- H. <u>Builder's Risk.</u> If requested by Cherokee Nation, Contractor shall provide or cause to be provided Builders Risk Insurance on an "all risk" or equivalent policy form and shall include without limitation, terrorism coverage, insurance against perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, glass breakage, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss as well as all increased Cost of the Work, (including General Conditions) resulting from any related delay or disruption of the site and also portions of work in transit.
- I. <u>Other Risks.</u> If Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property

insurance policy, Cherokee Nation shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor.

- J. <u>Insurance Company Ratings.</u> All insurance to be provided by Contractor shall be written by insurance companies acceptable to the Cherokee Nation and carrying an AM Best rating of A- X or better.
- 23. Contractor's Bond. Contractor shall furnish Performance, Payment, and Maintenance Bonds as follows: Payment and Performance Bonds shall be in a sum equal to the contract price. If the Performance Bond provides a one (1) year warranty, a separate Maintenance Bond is not required. If the warranty period specified in the contract is for longer than one (1) year, a Maintenance Bond equal to ten percent (10%) of the contract price is required. Bonds shall be duly executed by a responsible corporate surety authorized to issue such bonds in the state where the project is located and the surety must be approved by Cherokee Nation. If Contractor is providing default insurance, then Contractor will provide a bond for a sum equal to the work not covered under the default insurance. Cherokee Nation has the right to fully review the default insurance and to decide if the default insurance provided is acceptable. At Cherokee Nation's request, Contractor shall disclose its cost (stated both as a percentage of total Project cost, and an estimated total cost) for said bonds. The bonds shall name Cherokee Nation as obligee and shall be included in the contract amount.

24. Safety Regulations and Safety of Persons and Property.

- **A.** <u>Safety Plan.</u> Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract Documents.
- **B.** <u>Safety Representations</u>. Contractor, its agents, employees, suppliers, and subcontractors shall perform all Work in a safe and responsible manner and shall comply with all applicable safety laws and regulations promulgated by any Federal, State or Local government authority and regulations and all other safety rules and regulations related to such Work promulgated by any governmental agency in the jurisdiction the Work is located.
- C. <u>Protective Equipment.</u> During all Work performed hereunder, Contractor shall provide and enforce the use of suitable safety barriers and provide employees, agents, subcontractors, etc., with appropriate personal protective equipment where required (e.g., hard hat, hand, eye, foot and respiratory protection). Such personal protective equipment shall be worn by all persons during their presence in posted areas.
- **D. <u>Right to Know.</u>** Contractor's employees present at Cherokee Nation Job Site shall be provided copies of Material Safety Data Sheets used on site for all toxic substances to which Contractor's employees may be routinely exposed. Contractor

shall provide Owner's Representative with Material Safety Data Sheets for any chemical substance used by Contractor on the Job Site.

- E. <u>Drug Testing.</u> Contractor, subcontractors, and supplier's employees may be subject to pre-employment and/or random drug testing.
- 25. <u>Cooperation with Other Contractors.</u> Contractor shall cooperate and coordinate its Work with other contractors employed by Cherokee Nation in order to insure that the Work of each shall be commenced and completed without delay.

26. Representations and Warranties.

- A. <u>General Representations and Warranties.</u> Contractor represents and warrants to Cherokee Nation that:
 - (1) all materials delivered hereunder are new and free from defects in material and workmanship;
 - (2) Contractor has good title to the material and has or shall convey such good title to Cherokee Nation;
 - (3) the material purchased or provided hereunder shall conform to the Contract Documents, including all applicable specifications, drawings, samples, or other descriptions provided by Cherokee Nation;
 - (4) the material purchased or provided hereunder will be suitable for the purposes intended under the Contract Documents;
 - (5) Contractor and its subcontractors have the requisite skill, experience, expertise, financial resources, and capability to perform properly and timely the Work as required by the Contract Documents;
 - (6) Contractor will provide and perform the Work in strict compliance with the Contract Documents, manufacturers' printed directions, and all applicable law; and
 - (7) Contractor and its subcontractors will perform the Work utilizing the skill and attention of experienced and competent contractors involved in the business of completing the Work and shall conduct the Work in a prudent, safe, and careful manner consistent with Cherokee Nation interests.
- **B.** <u>Warranty Exclusions.</u> Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

- C. Warranty Period. Such Representations and Warranties shall commence on the date of Substantial Completion and shall extend for a period one (1) year thereafter or such longer period as may be prescribed in the Contract Documents, or by law. Work not conforming to these standards will be considered defective. Any Work replaced or repaired pursuant to such warranty shall be further warranted for one (1) year after the completion of such repair or replacement. If any of the Work is defective in materials or workmanship, or is otherwise not in conformity with the requirements of the Contract Documents, Contractor shall promptly correct or replace such defect or nonconformity at Contractor's sole cost and expense and at a time or times convenient to Cherokee Nation and shall be liable for any damage to other work or property caused by such defects. After ten (10) days' written notice to Contractor of its intent to do so, Cherokee Nation may correct such defects and back charge Contractor for the actual cost of correcting the defect or nonconformity. Contractor's warranty shall include all labor, materials, shipping costs, and other associated costs regardless of the manufacturer's limited warranty, and shall be nonexclusive of other warranties or remedies available to Cherokee Nation.
- **D.** <u>Named Products.</u> Where products named in the specifications are accompanied by the term "or equal," or other language of similar effect, the products shall comply with those Contract Document provisions concerning substitutions for obtaining Cherokee Nation approval (or Change Order) to provide an unnamed product.
- E. <u>Other Specified Products.</u> Whenever any product is specified or shown by describing proprietary items, model numbers, catalog numbers, manufacturer trade names or similar reference, Contractor obligates himself to the use of the product and no substitutes or equals shall be allowed. Where two or more products are shown or specified, Contractor has the option of which to use.
- F. <u>Warranty on Substantial Completion.</u> The warranties stated in this Contract commence on the date of Substantial Completion and shall survive any inspection, delivery, acceptance, payment, expiration, or earlier termination of this Contract and such warranties shall run to Cherokee Nation and its successors and assigns. Neither written acceptance by Cherokee Nation nor payment to Contractor shall release Contractor from its responsibility or liability for defective Work or for failure to comply with the warranties set forth herein.
- **G. Third Party Suppliers Warranty.** Contractor shall obtain from third party suppliers and manufacturers the required extensive warranties and guarantees for equipment and materials and shall assign, and hereby assign the same to Cherokee Nation. Contractor shall cooperate with Cherokee Nation in the enforcement of such warranties and, if so requested by Cherokee Nation or Owner's Representative, assist in obtaining proper servicing, repair, or replacement from each manufacturer under the provisions of the warranties. Contractor shall furnish Cherokee Nation and Owner's Representative with a complete list of such third

party suppliers and manufacturers, together with a copy of complete warranties from such suppliers and manufacturers on or before Final Completion of the Work hereunder.

- H. Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters. Contractor certifies to the best of its knowledge and belief that neither Contractor nor any of its principals are presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any federal, state, local, or tribal agency. Contractor also certifies to the best of its knowledge and belief that it has not, within a three-year-period preceding this Agreement, been convicted of, or had a civil judgment rendered against it for: commission of a fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state, local, or tribal) contract or subcontract; violation of federal or state antitrust statutes relating to submission of offers or commissions or embezzlement, theft, forgery, bribery, falsifications or destruction of records, and/or making false statements; and is not presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in this provision. Contractor certifies it has not within a three-year period preceding this Agreement, had one or more contracts terminated for default by a federal, state, local, or tribal agency.
- 27. Liens. Contractor shall have the affirmative duty to keep Cherokee Nation property free from mechanic and materialmen's liens of any person or entity supplying any portion or the Work and shall not permit any such lien to be filed or maintained in connection with the Work. Cherokee Nation may recoup, offset or retain out of payments due or to become due to Contractor an amount sufficient to fully protect Cherokee Nation from any such lien, claim of lien, or claim against bond. This clause shall be inserted in all of Contractor's purchase orders and subcontract agreements. Contractor further agrees to defend (including attorney fees), indemnify and hold harmless Cherokee Nation from any and all loss of use as a result of any lien filed upon the property of Cherokee Nation unless the lien is due to the failure of Cherokee Nation to pay a valid request for payment.
- **28. Inspection and Correction of Work.** All Work shall be subject to inspection by Cherokee Nation, its Owner's Representative, and/or the Architect at all reasonable times and at all places. Any such inspections are for the sole benefit of Cherokee Nation and shall not relieve Contractor of the responsibility for providing quality control measures to assure that the Work strictly complies with the Contract Documents. No inspection by Cherokee Nation or its Representatives shall be construed as constituting or implying either a waiver or acceptance. Inspections shall not relieve Contractor of responsibility for damage to or loss of material prior to acceptance, nor in any way affect the continuing rights of Cherokee Nation after acceptance of the completed Work.

• 29. <u>Interference, Clean-up, Defective Work, Inspection of Facilities, and Cutting and Patching.</u>

- A. <u>Interference.</u> Cherokee Nation or Owner's Representative shall, at all times, have access to the Work. Contractor shall perform all Work without interference or interruption to Cherokee Nation and other persons completing other work at the Job Site, and Cherokee Nation and its representatives shall perform inspections and site visits without interference or interruption of others performing Work at the Job Site. Contractor shall fully cooperate and coordinate its Work with such other persons or entities. Contractor, before proceeding with the Work, will accurately check and verify all previous and surrounding work done by others, if any, and shall determine the correctness of the same.
- **B.** <u>Cleaning Up.</u> Contractor shall at all times avoid creating dust, fumes, vibration, contamination and excess noise. If dust, fumes, vibration, contamination, or excess noise are unavoidable, Contractor shall give prior written notice of such fact to Cherokee Nation and Owner's Representative, and Contractor shall proceed with such Work only upon Cherokee Nation written authorization. Contractor shall maintain the Job Site in a safe, clean condition free from accumulations of waste material or rubbish on a daily basis.
- C. <u>Cherokee Nation's Right to Clean Up.</u> If a dispute arises among Contractor, separate contractors and Cherokee Nation as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, Cherokee Nation may, after five (5) days' written notice, clean up and allocate the cost among those responsible.
- **D.** <u>Correction of Defective Work.</u> Contractor shall, without charge, replace any material or correct any workmanship which does not conform to the Work to be provided by the Contractor under the Contract Documents. Contractor shall promptly segregate and remove rejected material from the Job Site. Contractor shall bear all cost of damages to the property of Cherokee Nation or the property of any other contractor in the removal or replacement of defective or nonconforming Work; however, Contractor shall retain the right to seek the cost and related expenses from any subcontractor or suppliers providing defective or nonconforming work.
- E. <u>Remedies for Failure to Cure Defective Work.</u> If the material and/or workmanship are not in accordance with the Contract Documents and Contractor does not promptly replace rejected material or correct rejected workmanship, Cherokee Nation may, after five (5) days' written notice:
 - (1) by contract or otherwise, replace such material or correct such workmanship and back charge to Contractor the cost thereof together with any resulting damage;

- (2) terminate Contractor's right to proceed under Termination for Cause; or
- (3) issue a written order to Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated.
- F. <u>Inspection Facilities and Cost.</u> Contractor shall promptly furnish, as part of the Work, all facilities, labor, and material reasonably needed for performing such safe and convenient inspection as may be required by the Contract Documents. All inspections by Cherokee Nation and its Representatives shall be performed to the extent feasible in such manner as to not unnecessarily delay the Work. Contractor shall pay any additional cost, including, but not limited to, additional fees of inspection when material or workmanship is not ready at the time specified by Contractor for inspection or when re-inspection is necessitated by prior rejection.
- **G.** <u>**Cutting and Patching.</u>** Contractor shall be responsible for cutting, fitting or patching required to complete the Work or make its parts fit together properly. Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Project by Cherokee Nation or Special Subcontractors by cutting, patching or otherwise altering such construction or by excavation.</u>
- **H.** <u>Non-waiver.</u> The cost of testing all defects or non-complying Work shall be paid by Contractor if the Work is found to be defective or nonconforming. The inspection or the occupancy or acceptance of Work, shall not waive or impair Cherokee Nation right to reject or revoke its acceptance of nonconforming Work, or to avail itself of any other remedies.

30. <u>Environmental Protection and Hazardous Materials.</u>

- A. <u>NEPA.</u> If extraordinary or exceptional circumstances involving the National Environmental Policy Act (NEPA) and related environmental considerations are encountered in the project, or if there is any change in the project which could change the project environmental determination, the Contractor agrees to stop construction in affected areas and to notify the Cherokee Nation.
- **B.** <u>Environmental Concerns.</u> The work covered by this section consists of furnishing all labor, materials, and equipment, and performing all work required for the prevention of environmental pollution during, and as a result of, construction operations under this contract except for those measures set forth in other technical provisions of these specifications. For the purpose of these specifications, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance of human life; affect other species of importance to man; or degrade the utility of the environmental pollution requiring consideration of air, water, and land, and involves noise and solid wastemanagement, as well as other pollutants. This Section applies to work at all sites.

- **C**. Non-Compliance and Corrective Action. In order to prevent, and to provide for abatement and control of, any environmental pollution arising from construction activities of Contractor and sub-contractors in the performance of the Contract, they shall comply with all applicable Federal, State, Local, Tribal laws, and regulations concerning environmental pollution control and abatement. Cherokee Nation will notify Contractor of any observed or perceived non- compliance with the foregoing provisions. Contractor shall, after receipt of such notice, immediately take corrective action. Such notice when delivered to Contractor or its authorized representative at the Job Site shall be deemed sufficient for the purpose. If the Contractor fails or refuses to promptly take corrective action, Cherokee Nation may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time, for excess costs or damages by Contractor unless it is later determined that Contractor was in compliance. Compliance with the provisions of this Section by subcontractors will be the responsibility of Contractor.
- D. Protection of Land Resources. The resources within the scope of work under this Contract shall be preserved in their present condition or be restored to a condition after completion of construction that will appear to be natural and not detract from the appearance of the Project. Insofar as possible, Contractor shall confine construction activities to areas defined by the plans or specifications. At the onset of ditch grading, topsoil shall be saved for use in restoring the ditch areas. Waste and borrow areas shall be leveled or trimmed to regular lines and shaped to provide a neat appearance. In all instances the restored area shall be well drained, so as to prevent the accumulation of stagnant water. Except in areas shown on the plans or specified to be cleared, Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without written authority from the Cherokee Nation. Any trees or other landscape features scarred or damaged by Contractor's equipment or operations, including those of its sub-contractors, shall be restored as nearly as possible to original condition at Contractor's expense. Contractor shall obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction, as directed by the Cherokee Nation, and disturbed areas shall be graded and filled as required with sufficient topsoil spread to provide minimum depth of four (4) inches of suitable soil for the growth of grass, and the entire area seeded.
- E. <u>Protection of Water Resources.</u> Contractor shall not pollute streams, lakes or reservoirs with fuel, oils, bitumens, calcium chloride, acids, construction wastes, or other environmentally harmful materials. It is the responsibility of Contractor to investigate and comply with all applicable Federal, State, County, Local and Tribe water laws concerning pollution of rivers and streams. Special measures shall be taken to prevent chemicals, fuels, oils, bituminous materials, waste washings, and cement from entering drainage ditches. Contractor shall at all times perform all

work and take such steps required to prevent any interference or disturbance to fish and wildlife. Fouling or polluting of water will not be permitted. Wash waters and wastes shall be processed, filtered, ponded, or otherwise treated pursuant to all applicable rules and regulations prior to their release into a river or other body of water.

- **F.** <u>**Burning.**</u> No material shall be burned at the project site unless otherwise specified in the contract or authorized by the NATION and any other appropriate regulatory body.
- **G. Dust and Debris.** Contractor will be required to maintain all work areas within the project boundaries free from dust or debris that would cause a hazard or nuisance to others. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.
- H. Hazardous Materials Brought Onto or Produced On the Job Site. Except to the extent required by the Contract Documents, Contractor shall not introduce, use or otherwise cause the presence of Hazardous Materials of any kind at the location of the Project. Notwithstanding the foregoing, Contractor shall be responsible for any and all Hazardous Materials brought on to the Job Site or produced by Contractor at the Job Site. Here, "Hazardous Materials" means any substance which, by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful, may cause injury or death. Contractor shall comply with all laws, regulations and procedures regarding Hazardous Materials. Contractor shall immediately notify Cherokee Nation and Owner's Representative of any Hazardous Materials present at the Job Site. Contractor's employees present at the Job Site shall be provided with copies of Material Safety Data Sheets used on the Job Site for all Hazardous Materials that Contractor's employees may be exposed to. Contractor shall provide Cherokee Nation and Owner's Representative with Material Safety Data Sheets for any Hazardous Materials it uses on the Job Site. Contractor is responsible for the disposal of all Hazardous Materials it or its subcontractor(s) bring onto or produce at the Job Site. Contractor agrees that all such dispositions shall be made under the rules and regulations of the U.S. Environmental Protection Agency and any state or local agencies or entities performing similar functions. Contractor shall not dispose of any Hazardous Materials on the Job Site or on any of Cherokee Nation property.
- I. <u>Hazardous Materials Found on the Site</u>. In the event Contractor encounters material reasonable believed to be asbestos, polychlorinated biphenyl ("PCB") or any other Hazardous Material that has not been rendered harmless, Contractor shall immediately stop Work in the area affected and promptly report the condition to Cherokee Nation and Owner's Representative by telephone and in writing. Contractor shall use its best effort to continue Work in other areas of the Project so as to not delay completion of the Project. Cherokee Nation and its Representatives shall take such steps as may be reasonable to verify the present or absence of

Hazardous Material or substance and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Cherokee Nation shall employ such consultants and experts as may be deem appropriate to perform tests and render lawfully contain, remediate or deal with such materials.

- **31.** <u>**Taxes.**</u> All contract amounts include, and the Contractor shall be solely responsible for paying, all taxes, excises, duties and assessments arising out of the Contractor's performance of the Work in any manner levied, assessed or imposed by a government or agency having jurisdiction. Cherokee Nation represents that it enjoys tax-exempt status. As such, Contractor and any subcontractor agree, where appropriate and at the sole option of Cherokee Nation to permit Cherokee Nation to purchase goods and materials utilized in the performance of this Contract on a tax-exempt basis and pass those savings on to Cherokee Nation for the benefit of the Cherokee Nation.
- **32.** <u>Compliance with Laws.</u> Contractor shall strictly observe, comply with, and give all notices required by, all local, municipal, state, tribal and federal laws, ordinances, rules, directives, orders, and regulations related to the Work, including, without limitation, the Cherokee Nation Employment Right Acts as administered by the Tribal Employment Rights Office ("TERO") of the Cherokee Nation. All work that is in addition to the Work specifically required by this Contract, but necessary to fully comply with such Laws, shall be deemed part of the Work. Contractor will keep and have available all necessary records and make all payments, reports, collections, and deductions, and otherwise do any and all things so as to comply fully with all such laws, including, but not limited to:
 - (a) the production, purchase and sale, furnishing and delivering, pricing and use or consumption of materials, supplies, and equipment;
 - (b) the hire, tenure, or conditions of employment of employees and their hours of work and rates and payment of their wages; and
 - (c) the keeping of records, making of reports, and the payment collection, and deduction of federal, state, and municipal taxes and contributions, all so as to fully relieve Cherokee Nation from and protect it against any and all responsibility or liability therefor or in regard thereto.

33. <u>Changes in the Work; Change Orders.</u>

- A. <u>Changes in the Work.</u> All changes in the Work must be in writing. Cherokee Nation may, at any time, by written Change Order or written Construction Change Directive, make changes in, additions to, and omissions from the Work. Contractor shall promptly proceed with the Work as so changed by the Change Order.
- **B.** <u>Change Order.</u> A Change Order is a written instrument prepared by Cherokee Nation or the Architect at Cherokee Nation's direction and signed by Cherokee Nation, the Architect and Contractor stating their agreement upon all of the following:

- (1) change in the Work;
- (2) the amount of the adjustment, if any, in the subcontract price; and
- (3) the extent of the adjustment, if any, in the time for Substantial Completion.
- C. <u>Construction Change Directives.</u> A Construction Change Directive is a written order prepared by the Architect or Cherokee Nation, directing a change in the Work prior to agreement and adjustment, if any, in the subcontract amount or time for Substantial Completion or both. Cherokee Nation may issue a signed Construction Change Directive without invalidating the Contract, order changes in the Work within the general scope of this Contract; the subcontract price and time for Substantial Completion being adjusted accordingly. A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.
- **D.** <u>Adjustment to Contract Price.</u> If the Construction Change Directive provides for an adjustment to the subcontract price, the adjustment shall be based on one of the following methods:
 - (1) mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
 - (2) unit prices stated in the Contract Documents or subsequently agreed upon; or
 - (3) cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee.
- **E.** <u>Information Required.</u> Upon Receipt of a Construction Change Directive, the following information shall be provided by Contractor for review by Cherokee Nation and the Architect upon receipt of a Construction Change Directive.
 - (1) The separate costs between building, site and equipment as noted on the Schedule of Values.
 - (2) Complete backup on all costs including but not limited to:
 - (a) Subcontractors or employee time records;
 - (b) Material invoices or purchase orders;
 - (c) Rental receipts for specialized equipment or tools;
 - (d) Time relationships to progress of work for delay of Project; and/or

- (e) Validity of quantity of work and requested price (i.e. cost per square foot, gallons of material, etc.).
- (3) Backup for reason or basis of Construction Change Directive.
 - (a) Not shown on documents;
 - (b) Requested by Cherokee Nation, Owner's Representative and/or the Architect;
 - (c) Local jurisdictional requirements; and/or
 - (d) Material or item is no longer made.
- (4) Initiation date and any limitations on time that will affect the amount of the Construction Change Directive. Complete package shall be submitted to Cherokee Nation with a copy to the Architect.
- **F.** <u>Contractor to Proceed with the Work.</u> Upon receipt of a Construction Change Directive, Contractor shall promptly proceed with the change in the Work involved and inform Cherokee Nation and the Architect in writing of Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the subcontract price or time for Substantial Completion.
- **G. Failure to Agree.** If Contractor does not respond promptly or disagrees with the method for adjustment in the subcontract price, the method and the adjustment shall be initially determined by Cherokee Nation, Owner's Representative, and/or the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the subcontract price, an allowance for overhead and profit in accordance with the schedule set forth below:
 - (1) costs of labor;
 - (2) costs of materials, supplies and equipment, including cost of transportation;
 - (3) rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
 - (4) costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work;
 - (5) overhead and profit as used herein to include supervision, superintendence, wages of timekeepers, wages of watchmen and clerks, hand tools, incidentals, general office expense, and all other expenses not included in "cost" above; and

- (6) any other cost which would have been included as part of the Cost of the Work as set forth in the Construction Management Agreement between Cherokee Nation and Contractor as it pertains to this Project.
- **H.** <u>Contract Price Decrease.</u> The amount of credit to be allowed by Contractor to Cherokee Nation for a deletion or changed which results in a net decreased in the subcontract price shall be actual net cost as confirmed by Cherokee Nation. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.
- I. <u>Pending Final Determination of Total Cost.</u> Pending final determination of the total cost of a Construction Change Directive to Cherokee Nation, amounts not in dispute for such changes in the Work shall be included in applications for payment accompanied by a Changer Order indicating the parties' agreement with part or all of such costs.
- J. <u>Agreement between Contractor and Cherokee Nation.</u> When Cherokee Nation and Contractor agree as to the adjustments in the subcontract price and time for Substantial Completion, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.
- K. <u>Claim for Additional Costs or Time.</u> In any instance in which Cherokee Nation has issued a Construction Change Directive, or in which Contractor for any reason believes he is entitled to additional cost or compensation, Contractor shall, within twenty-one (21) days after issuance of a Construction Change Directive, submit such claim for additional compensation in the form of a Proposal Request. If all information is not available within twenty-one (21) days after Contractor has incurred a substantial portion of the costs involved in the change, Contractor shall submit a Proposal Request outlining costs then available to the Contractor within such twenty-one (21) days. If information available to Contractor is not submitted within twenty-one (21), the claim shall be deemed to be waived by Contractor.
- 34. <u>Term.</u> This Contract shall commence on the date it is executed by both parties and shall continue in effect until the Work contemplated thereto has been performed and all payments received, unless sooner terminated, with or without cause, at Cherokee Nation's sole discretion. If Contractor has commenced performance of any Work before the execution of this Contract, this Contract shall be effective retroactively to the date the Work was first performed.
- **35.** <u>Stop Work.</u> If Contractor fails to correct Work which is not in accordance with the requirements of the Contact Documents as required herein or fails to carry out Work in accordance with the Contract Documents, Cherokee Nation may issue a written order to Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of Cherokee Nation to stop the Work shall not give rise to a

duty on the part of Cherokee Nation to exercise this right for the benefit of Contractor or any other person or entity, except to the extent required in this Contract.

- 36. Cherokee Nation's Right to Carry Out the Work. If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails to commence and continue correction of such default or neglect with diligence and promptness, Cherokee Nation may, after five (5) days' written notice, without prejudice to any other remedies it may have, either correct such deficiencies or terminate this Contract in whole or in part. In such case, Cherokee Nation may provide written notice to Contractor that it will deduct from payments then or thereafter due the Contractor the reasonable costs of correcting such deficiencies, including Cherokee Nation expenses and compensation for design professionals, as well as all additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, Contractor shall pay the difference to Cherokee Nation within ten (10) days following written demand for such payment. Any such unpaid amounts due under this Section shall bear interest at the prime rate of interest as set by the Bank of Oklahoma plus two (2) percentage points until paid in full.
- 37. **Termination for Cause.** If Contractor files for or is adjudged bankrupt, or makes a general assignment for the benefit of its creditors, or should a receiver be appointed because of its insolvency, or should it fail to make reasonable prompt payment to its subcontractors or for materials or labor, or should it disregard laws, ordinances or other governmental regulations, or substantially violate any other provisions of this Agreement, or if Contractor neglects to proceed properly with the Work or fails to perform the Work, then Cherokee Nation after five (5) days' written notice to Contractor and Contractor's surety, in addition to any other remedy, may (i) make good the deficiencies and deduct the cost thereof from the payment then or thereafter due Contractor, or (ii) terminate this Contract and take possession of all materials, tools, and equipment and finish the Work by such means as may be required. If the unpaid balance of the amounts due to Contractor hereunder exceed the expense of finishing the Work (after completion and cost calculation), Cherokee Nation shall pay the Contractor the difference, but if such cost of the Work exceeds the unpaid balance, Contractor shall immediately pay Cherokee Nation the difference within ten (10) days following written demand for such payment. Any such unpaid amounts due under this Section shall bear interest at the prime rate of interest set by the Bank of Oklahoma plus two (2) percentage points per annum until paid. In the event of termination pursuant to this Section or Section 38, below, Contractor, at its cost, shall remove from the Job Site any material designated by Cherokee Nation to be removed therefrom. Any termination for cause by Cherokee Nation that is determined in accordance with the procedures set forth in Subparagraph 43(E) to be wrongful for any reason shall be deemed for all purposes to be a termination for convenience as provided herein.
- **38.** <u>Suspension and Termination for Convenience.</u> Cherokee Nation may suspend or terminate the Work in whole or in part at any time for its convenience. Such suspension or termination shall be effective by written notice to Contractor stating the extent and effective time of such suspension or termination. Contractor shall continue to perform any part of

the Work not so suspended or terminated if the Work is terminated under this Section. Contractor shall be paid for the Work completed up to the effective date of termination and no more. Cherokee Nation and Contractor shall execute a Change Order regarding adjustments to the price of the subcontracts, scope of Work, and any other matters affected by such suspension or termination. Upon material breach of Cherokee Nation obligations hereunder, Contractor may suspend performance if Contractor provides fourteen (14) day's written notice to Cherokee Nation.

39. <u>**Title.**</u> Title to all Work completed or in the course of being provided, and title to all material and supplies provided under the Contract Documents, except tools, equipment, and vehicles owned by or rented to Contractor or its Subcontractors, shall pass to Cherokee Nation immediately after delivery to the Job Site or payment therefore by Cherokee Nation, whichever occurs first.

40. <u>Uncovering and Correction of Work.</u>

- A. <u>Uncovering of Work Contrary to Request.</u> If a portion of the Work is covered contrary to Cherokee Nation's request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by Cherokee Nation, be uncovered for Cherokee Nation's observation and be replaced at Contractor's expense.
- **B.** <u>Uncovering of Work Not Specifically Requested.</u> If a portion of the Work has been covered which Cherokee Nation has not specifically requested to observe prior to its being covered, Cherokee Nation may request to see such Work and it shall be uncovered by Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to Cherokee Nation. If such Work is not in accordance with the Contract Documents, Contractor shall pay such costs.
- C. **Prompt Correction of Covered Work.** Contractor shall promptly correct Work rejected by Cherokee Nation or the Architect or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensation for Cherokee Nation and the Architect's services and expenses made necessary thereby.
- **D.** Long Term Correction of Covered Work. If, within one (1) year after the date of Substantial Completion of the Work or designed portion thereof, or after the date for commencement of warranties or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, Contractor shall correct it promptly after receipt of written notice from Cherokee Nation to do so unless Cherokee Nation has previously given Contractor a written acceptance of such condition. This period of one (I) years shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time

between Substantial Completion and the actual performance of the Work. This obligation shall survive acceptance of the Work under the Contract and termination of the Contract. Cherokee Nation shall give such notice promptly after discovery of the condition.

- E. <u>Removal of Work From the Job Site by Contractor.</u> Contractor shall remove from the site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by Contractor nor accepted by Cherokee Nation.
- F. Correction of the Work by Cherokee Nation. If Contractor fails to correct nonconforming Work within a reasonable time, Cherokee Nation may correct such work at Contractor's expense. If Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from Cherokee Nation, Cherokee Nation may remove it and store the salvable materials or equipment at Contractor's expense. If Contractor does not pay costs of such removal and storage within ten (10) days after written notice, Cherokee Nation may, upon ten (10) additional days after written notice, sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by Contractor, including compensation for the Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which Contractor should have borne, the Contract Fee shall be reduced by the deficiency. If payments then or thereafter due Contractor are not sufficient to cover such amount, Contractor shall pay the difference to Cherokee Nation.
- **G.** <u>**Cost of Correcting the Work.</u>** Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of Cherokee Nation or separate contractors caused by Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.</u>
- H. <u>No Established Limitation</u>. Nothing contained in this Paragraph shall be construed to establish a period of limitation with respect to other obligations which Contractor might have under the Contract Documents. Establishment of the time period of one (I) year relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than specifically to correct the Work.
- I. <u>Acceptance of Nonconforming Work.</u> If Cherokee Nation prefers to accept the Work that is not in accordance with the Contract Documents, Cherokee Nation may do so instead of requiring that the Work be corrected. In this instance, the subcontract price will be equitably reduced by the value of the nonconforming Work as compared to the value of the Work had it been performed in accordance

with the Contract Documents. Such adjustment shall be effected whether or not Final Payment has been made.

41. <u>Tests and Inspections.</u>

- A. <u>Compliance With Laws.</u> Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations, or orders of public authorities having jurisdiction shall be made at an appropriate time. Contractor shall make arrangements for all such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to Cherokee Nation, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. Contractor shall give Cherokee Nation advance and timely notice of the dates, times, and locations of tests and inspections so that Cherokee Nation may observe such procedures. Contractor and its sub-contractors shall, in addition to the above, comply with Cherokee Nation's job site procedures and regulations.
- **B.** <u>Additional Testing.</u> If the Architect, Owner's Representative, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included hereunder, Cherokee Nation will instruct Contractor to make arrangements for such additional testing, inspection, or approval by an entity acceptable to Cherokee Nation, and Contractor shall give advance and timely notice to Cherokee Nation, Owner's Representative, and the Architect of the dates, times, and locations of tests and inspections so that Cherokee Nation, Owner's Representative and the Architect may observe such procedures.
- C. <u>Testing Which Reveals Nonconforming Work.</u> If such procedures for testing, inspection or approval hereunder reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, Contractor shall bear all costs made necessary by such failure in accordance with the Cherokee Nation Standard Construction Terms and Conditions.
- **D.** <u>**Required Certificates.**</u> Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by Contractor and promptly delivered to Cherokee Nation.
- **E.** <u>**Prompt Testing.**</u> Tests or inspections conducted pursuant to the Contract Document shall be made promptly to avoid unreasonable delay in the Work.

42. <u>Claims and Disputes.</u>

A. <u>Claims.</u> A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between Cherokee Nation and Contractor arising out of or relating to the Contract. Claims must be made by written notice.

- В. **Referral to the Architect.** All Claims, excluding Claims for breach of warranty, but including those alleging an error or omission by the Architect, shall be referred initially to the Architect for action as provided below. A decision by the Architect, which decision shall be made in an expeditious and timely manner, shall be required as a condition precedent to initiating the dispute resolution procedure set forth in Paragraph 43 of a Claim between Contractor and Cherokee Nation as to all such matters arising prior to the date Final Payment is due, regardless of (a) whether such matters relate to execution and progress of the Work or (b) the extent to which the Work has been completed. The decision by the Architect in response to a Claim shall not be a condition precedent to initiating such dispute resolution in the event (a) the position of Architect is vacant, (b) the Architect has not received evidence or has failed to render a decision within agreed time limits, (c) the Architect has failed to take the required action within thirty (30) days after the Claim is made, (d) forty-five (45) days have passed after the Claim has been referred to the Architect, or (e) the Claim relates to a mechanic's and materialman's lien.
- C. <u>Timing of Making a Claim.</u> Claims by Contractor must be made within twentyone (21) days after occurrence of the event giving rise to such Claim or within twenty-one (21) days after Contractor first recognizes the condition giving rise to the Claim, whichever is later. There shall be no limitation on when a Claim may be made by Cherokee Nation. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.
- **D.** <u>Diligent Performance of the Work Pending a Claim.</u> Pending final resolution of a Claim in accordance with Paragraph 43, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Contract.
- E. <u>Claims for Additional Cost.</u> If Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given. Contractor's Claim shall include an estimate of the proposed increased cost.
- **F.** <u>Claims for Additional Time.</u> If Contractor wishes to make a Claim for increases in the time to complete the Work, written notice as provided herein shall be given. Contractor's Claim shall include an estimate of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction.
- **G.** <u>Notice of a Claim.</u> If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to

the other party. The notice shall provide sufficient detail to enable the other party to investigate the matter.

43. <u>Resolution of Claims and Disputes.</u>

- A. <u>Review of Claims by the Architect.</u> The Architect will review Claims and take one or more of the following preliminary actions within ten (10) days of receipt of a Claim: (i) request additional supporting data from the claimant, (ii) submit a schedule to the parties indicating when the Architect expects to take action, (iii) reject the Claim in whole or in part, stating reasons for rejection, (iv) recommend approval of the Claim by the other party, or (v) suggest a compromise.
- **B.** <u>Documentation of the Resolution of a Claim.</u> If a Claim has been resolved, the Architect will prepare or obtain appropriate documentation.
- C. <u>Additional Information for Unresolved Claims.</u> If a Claim has not been resolved, the party making the Claim shall, within ten (10) days after the Architect's preliminary response, take one or more of the following actions: (i) submit additional supporting data requested by the Architect, (ii) modify the initial Claim, or (iii) notify the Architect that the initial Claim stands.
- **D.** <u>Architect's Decision Relating to Unresolved Claims</u>. If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven (7) days, which decision shall be nonbinding on the parties. Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim. If there is a surety and there appears to be a possibility of Contractor's default, the Architect may, but is not obligated to notify the surety and request the surety's assistance in resolving the controversy.</u>
- E. <u>Governing Law. Jurisdiction and Waiver of Venue.</u> The rights and obligations of the parties to this Contract shall be governed by and construed in accordance with the laws of the United States and, where applicable, the laws of the Cherokee Nation. Any Claim arising under this Contract that remains unresolved after referral to the Architect, as provided herein, shall be adjudicated in the Courts of the Cherokee Nation.

44. <u>Indemnification</u>.

A. <u>Indemnification-General</u>. Contractor shall defend (at Cherokee Nation's option), indemnify and hold harmless Cherokee Nation, its officers, employees, representatives and agents and the Chief and Tribal Council of the Cherokee Nation (collectively referred to as the "Cherokee Nation Group") from and against any claim, demand, cause of action, judgment, settlement, penalty, lien, fine, liability, damages, loss or expense, including all expenses of litigation, court costs and attorneys' fees and expenses incurred by the Cherokee Nation Group in any Claim, action or proceeding between the Cherokee Nation Group and Contractor or

between the Cherokee Nation Group and any third party ansmg directly or indirectly from or related in any way to the Work provided under this Contract, including injury to or death of persons (including but not limited to employees, representatives and agents of the Cherokee Nation Group, Contractor, any personnel directly or indirectly employed by Contractor and third parties) or damage to or loss of property (including but not limited to property of the Cherokee Nation Group, Contractor, any personnel directly or indirectly employed by Contractor and third parties), to the extent that claim is caused by the negligence or failure of Contractor to perform its duties under the Contract Documents. This indemnity, defense and hold harmless provision does not apply to any claim or liability to the extent the Cherokee Nation Group is found to have been solely negligent by the Courts of the Cherokee Nation.

- Β. **Indemnification-Taxes.** Contractor accepts full and exclusive liability for the payment of any and all taxes and assessments which may now or hereafter be imposed by tribal, local, state, or federal governments, including without limitations, all applicable TERO fees, sales tax, use power, gross receipts, or other taxes levied with respect to materials furnished or work performed by Contractor, or payments made to the Contractor through issuance of a purchase order including but not limited to, building permits, Contractor's licenses, specialty permits required by law to be issued to Contractor, and/or transportation permits. Contractor, and its subcontractors shall, in addition to the above, comply with the Cherokee Nation's job site procedures and regulations. Further, Contractor agrees to defend, indemnify, and hold harmless Cherokee Nation Group for all taxes, contributions, penalties, fees and expenses (including but not limited to attorneys' fees and expenses) incurred by Cherokee Nation Group because of Contractor's failure to withhold federal and state income taxes, FICA taxes, or FETA taxes or any other such taxes or governmental charges, state or federal, including those taxes enumerated at Section 49(8) hereof, which Cherokee Nation Group may be required to pay on account of Contractor.
- C. <u>Participation by Cherokee Nation Group.</u> Any of Cherokee Nation Group hereto may, at their option and expense, participate in their/its own defense through separate counsel without relieving Contractor of any obligation hereunder.
- **D. Patent Infringement.** Contractor shall, and does hereby agree to, indemnify Cherokee Nation Group and to pay on demand, assume liability for, defend, protect, and hold the Cherokee Nation Group harmless from, against, and in respect of any and all Claims that the Work (or any process or apparatus supplied by Contractor as a part of the Work) or the use or operation of the Work infringes upon any patent, trade secret, copyright, or application therefor, or any other property right of a third party. If such a claim has been made or is likely to be made, Contractor, at its option and sole expense, may promptly procure the right for Cherokee Nation to continue using the Work in question or to modify or replace promptly the Work to Cherokee Nation satisfaction so that it becomes non-infringing. Contractor shall indemnify Cherokee Nation Group for all costs, damages, attorney fees and expenses that arise

or result from any such claim(s). The provisions of this paragraph shall survive the termination of this Contract and the completion of the Work.

- **45.** <u>Waiver of Consequential Loss or Damage.</u> The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes: 1) damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and 2) damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work. This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination.
- **46.** <u>**Patents.**</u> Contractor shall obtain, at its own expense, any license or other authorization for use of any copyright trademark, or patent that would be infringed by carrying out the Work or performing under the Contract Documents.

47. Work Product.

- A. <u>New Work Created.</u> All new or original Work created hereunder, and all Work obtained or acquired, shall be considered work for hire, and Cherokee Nation shall own all rights thereto, including, but not limited to, patents and applications therefore, copyrights, trademarks, trade names, mask works, and publication rights. Contractor shall assign all such intellectual property rights and other work product to Cherokee Nation or its designee. Documents and other written materials provided by Contractor pursuant to this Contract will forever remain Cherokee Nation or its designee's property.
- **B**. Drawings and Specifications. The drawings, specifications and other documents, including those in electronic form, prepared by Cherokee Nation and Cherokee Nation's Architect are and shall remain Cherokee Nation property through which the Work is to be executed by Contractor. Contractor may retain one record set. Neither Contractor nor any subcontractor, sub-subcontractor or material or equipment supplier shall own or claim a copyright in the drawings. Specifications and other documents prepared by Cherokee Nation or Cherokee Nation's Architect shall be deemed, unless otherwise indicated, to have been authored by Cherokee Nation, and Cherokee Nation will retain all common law, statutory and other reserved rights, in addition to the copyrights. All copies of the drawings and specifications, except the Contractor's record set, shall be returned or suitably accounted for to Cherokee Nation, on request, upon completion of the Work. The drawings, specifications, and other documents prepared by Cherokee Nation and Cherokee Nation's Architects or consultants, and copies thereof furnished to Contractor, are for use solely with respect to the Project. They are not to be used by Contractor or any subcontractor, sub-subcontractor or material or equipment supplier on other projects or for additions to this project outside the scope of the Work without the specific written consent of Cherokee Nation.

- C. <u>As-Built Drawings.</u> Contractor is to create an "as-built" record set of drawings in accordance with the Contract Documents, noting especially those items of Work that are hidden from view. Cherokee Nation reserves the right to withhold final payment to Contractor if, in Cherokee Nation sole opinion, accurate "as-built" drawings have not been delivered to Cherokee Nation by Contractor upon completion of Contractor's Work.
- 48. <u>Delay.</u>
 - A. **Force Majeure.** If Contractor is prevented from performing any of its obligations under these Contract Documents by reason of fire, flood, windstorm, earthquake, other acts of God, civil disturbance, riots, covid related delays, supply chain disruptions, order of any court or administrative body (not due to the fault of Contractor), or any other cause beyond the control of Contractor and without fault on the part of Contractor, the time allotted by the Contract Documents for performance of the obligations that are so prevented shall be extended one (1) day for each day of such delay. Contractor shall make no claim for extension of the time for Substantial Completion pursuant to this Section unless it shall notify Owner's Representative, in writing, of the existence of any delay excused herein within twenty-four (24) hours after the beginning of such period of delay and of the termination.
 - **B.** Normal Weather Conditions. Contractor has incorporated typical weather days as per the Tulsa International Airport FAA average rainfall schedule into the Project Schedule. If there are additional weather days greater than those provided for in the Schedule, Contractor may get the additional days above the average as an extension to the Substantial Completion date. No time for weather delays will be charged for days on which Contractor is capable of performing Work pursuant to the current Schedule for at least six (6) hours with a normal work force, and in the event that the normal work force is on a double shift, twelve (12) hours shall be used. There shall be no extension of time granted to Contractor for delay due to weather conditions unless agreed to by Cherokee Nation by written Change Order, which agreement shall not be unreasonably withheld.
 - C. <u>Delav Caused by Cherokee Nation or Others.</u> Should Contractor's progress be interfered with or the completion of this Contract be prevented through failure of Cherokee Nation to provide required services, or for any reason attributable to Cherokee Nation, its Special Subcontractors, agents, or others acting for, on behalf, or at the direction of Cherokee Nation, then Contractor will be entitled to an extension of time, day-for-day, within which to complete the Work, as reflected by Change Order.
 - **D.** <u>**Time for Claim Submission.**</u> All claims for extension of time shall be made in writing to Owner's Representative no more than twenty (20) days after the occurrence of the delay; otherwise they shall be waived. In the case of a continuing cause for delay, only one claim is necessary.

E. <u>Claims for Additional Costs.</u> Contractor shall be entitled to additional costs only insofar as such costs are a result of delays described in Section 42 and this Section. The reimbursable rates schedule stated in Exhibit C shall be utilized in calculating any adjustments.

49. Independent Contractor.

- A. <u>Independent Contractor.</u> Contractor hereby declares, acknowledges, and agrees that it is engaged in an independent business, and agrees to perform the Work as an independent contractor with full responsibility for the control and direction of its employees. Contractor, in its performance of this Contract, has and hereby retains the right to exercise full control and supervision over the accomplishment of the Work. Contractor shall not be, or be deemed for any purpose, an agent, employee, or servant for Cherokee Nation, and may not bind Cherokee Nation. This Contract is not intended to and shall not create a partnership of any kind or type. It is understood that Contractor is free to contract for similar services to be performed for others during the term of this Contract, subject to the conditions set forth herein.
- **B.** <u>**Payment of Taxes.**</u> Contractor shall be solely responsible for the payment of each of its employee's compensation and benefits, including, but not limited to, employment taxes, any similar taxes associated with employment, withholding of federal, state, or local taxes imposed on wages, deductions for social security, contributions for unemployment compensation funds, and all other regulations governing such matters. Contractor further warrants that it will comply with all other applicable, federal, state or local laws or regulations applicable to Contractor as an employer regarding compensation, hours of work, or other conditions of employment, including those applicable to minimum wage and overtime wages.
- C. **Reporting Requirements.** All amounts paid by Cherokee Nation to Contractor pursuant to this Contract will be reported as non-employee compensation by Cherokee Nation to the I.R.S. at the end of each calendar year. Contractor agrees to complete and execute the Form W-9, "Request for Taxpayer Identification Number and Certification," upon the execution of this Contract. Contractor represents that it is withholding federal and state income taxes, FICA, and FUTA taxes from the paychecks of all its employees who do work in furtherance of the Contract. Contractor further agrees to furnish Cherokee Nation upon request a certificate, or other evidence of proof of payment, or compliance with local, state, or federal laws covering contributions, taxes, and assessments imposed on wages and the employer.
- **D.** <u>Waiver of Benefits.</u> Contractor's personnel shall not be entitled to participate in or receive benefits under any Cherokee Nation programs maintained for its employees, including, without limitation, life, medical and disability benefits, pension, profit sharing or other retirement plans or other fringe benefits. Nor shall Contractor personnel be entitled to any direct or indirect compensation or remuneration of any kind from Cherokee Nation as a result of the performance of this Contract, except for Cherokee Nation's obligation to pay the charges to

Contractor provided for herein, and Contractor shall be responsible for all compensation of such Contractor personnel and shall indemnify Cherokee Nation for any claim by any Contractor personnel for such rights or benefits.

- **50.** <u>Contractor's Personnel.</u> Contractor shall, upon Cherokee Nation or its Owner's Representative's request, furnish Cherokee Nation with the names and addresses of its employees assigned to the Work. Cherokee Nation, in its sole discretion, may require Contractor to remove such employees from the Job Site whereupon Contractor shall replace the person so removed with those of equal or higher standing regarding work experience and position.
- **51.** <u>**Improper Payments.**</u> Contractor will not use any funds received under this Contract for illegal or otherwise improper purposes related to the Contract. Contractor will not pay any commissions, fees, or rebates to any employee of Cherokee Nation nor favor any employee of Cherokee Nation with gifts or entertainment of significant cost or value. If Cherokee Nation has reasonable cause to believe that the provisions of the preceding sentences have been violated, Cherokee Nation, its representatives, or auditors may audit the records of Contractor for the purpose of establishing compliance with such requirements. All costs of any such audit shall be the responsibility of Contractor.
- 52. Alcohol, Drug, and Tobacco Policy. Contractor's employees, while on Cherokee Nation's premises or engaged in Cherokee Nation's Work, shall refrain from unauthorized consumption or possession of alcoholic beverages, tobacco use, and the possession, sale, use, or distribution of unauthorized drugs. Any Contractor performing work for the Cherokee Nation agrees to publish a statement notifying all employees, subcontractors, and other workers that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the Contractor's workplace and specifying the actions that will be taken against violators of such prohibition. Contractor shall provide all persons engaged in performance of the Contract with a copy of said statement, and shall include a copy of said statement with any bid submitted hereunder, or shall be deemed to accept and agree to use the statement provided by Cherokee Nation. Notwithstanding any other provision of this Contract, violation of this provision by Contractor personnel will: (i) result in immediate removal of Contractor employees from the Cherokee Nation's premises, and (ii) constitute a material breach of this Contract. Contractor shall have the obligation to replace its employees with a suitable substitute or substitutes, within a reasonable time.
- **53.** <u>Audit.</u> Contractor shall keep all books and records on a consistent basis and in accordance with generally accepted accounting principles (GAAP). These books and records shall readily disclose the basis for any charges or credits, ordinary or extraordinary, billed or due to Cherokee Nation under this Contract and shall be made available for examination, audit and reproduction by Cherokee Nation and its agents during the term of this Contract and for a period of two (2) years after the receipt by Contractor of Final Payment. When requested by Cherokee Nation, Contractor shall permit Cherokee Nation's personnel or its duly authorized agent or representative access during normal working hours to Contractor's personnel, property, and records necessary to conduct the Cherokee Nation's audit. In the

event that the audit rights set forth in this Section conflict with any other terms of this Contract, this Section shall control. Contractor further agrees to include this right to audit clause in all subcontracts for services and materials furnished under the terms of this Contract, if any, entitling Cherokee Nation to a right to inspect books and records to validate subcontractor charges. All costs of such audit(s) shall be the responsibility of the Contractor.

54. <u>Publicity.</u> Contractor acknowledges and agrees that it is prohibited from referencing, directly or indirectly, Cherokee Nation as a customer or client in any manner, including, but not limited to, in any online materials, speeches, solicitations, marketing materials, advertisements, articles, interviews, news releases or other releases to any publication, or by self-publication on social media or otherwise without the express written permission of Cherokee Nation for each separate instance of such publication, secured at least three (3) business days in advance of any such publication. Contractor's confidentiality obligations set forth in this section survive and continue after the termination or expiration of this Contract.

55. <u>Confidential and Proprietary Information.</u>

- A. <u>Confidentiality</u>. In the course of Contractor's rendering services hereunder, Contractor will or may acquire valuable trade secrets, proprietary data, and sensitive confidential information, including but not limited to written information identified as "confidential" by a legend to that effect and verbal information identified by Cherokee Nation as "confidential" at the time of disclosure, with respect to Cherokee Nation (collectively, "Confidential Information"). The parties hereto agree that such trade secrets, proprietary data, and other Confidential Information include but are not limited to copyrights, inventions, models, processes, patents, and improvements thereon, Cherokee Nation's financial methods and practices, file or database materials, software listings or printouts, computer programs, credit and financial data of Cherokee Nation or subsidiary entities.
- **B. Return of Confidential Information.** Upon termination or expiration of this Contract for any reason, or upon request of Cherokee Nation, Contractor shall return, or certify as destroyed, written material and other media containing any Confidential Information, together with any copies thereof. Failure by Contractor to comply with this requirement shall be grounds for withholding any payment that may be due Contractor, except as needed for Contractor's business records for the Project.
- C. <u>Fiduciary Trust.</u> In addition, Contractor, on behalf of Cherokee Nation, may develop a personal acquaintance employees, advisors, consultants, vendors, and agents of Cherokee Nation, its subsidiary entities, and affiliates. As a consequence thereof, the parties hereto acknowledge that Contractor will occupy a position of trust and confidence with respect to Cherokee Nation's affairs, processes, plans,' strategies, finances, and services.

- **D.** <u>Protection of Proprietary and Confidential Information.</u> Neither Contractor, nor its employees or consultants, during the term of this Contract or at any time thereafter, shall, without the express written consent of Cherokee Nation, directly or indirectly communicate or divulge, or use for its or their own benefit, other than as a contractor of Cherokee Nation and to further the Cherokee Nation's interests, or for the benefit of any other person, firm, association or corporation, any of Cherokee Nation's proprietary data or other Confidential Information, except that Contractor may disclose such matters to the extent that disclosure is required (i) in the course of said relationship, or (ii) to enable Contractor's personnel to render services hereunder.</u>
- 56. <u>Assignment of Contract.</u> Contractor shall not assign, delegate, or sublet this Contract or any part thereof, or any money due or any money to become due hereunder, without the prior written consent of Cherokee Nation in each instance. Subject to the foregoing, this Contract shall be binding upon and shall inure to the benefit of the parties and their respective successors and assigns. Unless specifically provided in this Contract, none of the provisions of this Contract shall be enforceable by or for the benefit of any person or entity except the parties hereto and their successors and permitted assigns. Cherokee Nation may assign this Contract. No assignment shall relieve Cherokee Nation from any of its obligations hereunder unless specifically agreed to in writing by Contractor.
- **57.** <u>Notices.</u> All notices required or permitted to be given under this Contract shall be in writing and shall be given by personal delivery, verified facsimile transmission, receipted delivery services, or by registered or certified mail, first class postage prepaid, return receipt requested, and for Contractor and Cherokee Nation, shall be delivered or addressed as appears on the Contract Documents. Notice for all purposes under these Contract Documents, regardless of the form in which given, shall be deemed given when received by the addressee of such notice.
- **58.** <u>Litigation Costs: Attorneys' Fees.</u> The prevailing party in an action brought by either party to enforce the terms and conditions of the Contract shall be entitled to its reasonable costs of suit and expenses including reasonable attorneys' fees, including costs and attorney fees upon appeal.
- **59.** <u>Headings: Severability.</u> Headings in this Contract are for convenience only and shall not be used to interpret or construe the provisions of this Contract. If any provision of this Contract shall be held by a Court of the Cherokee Nation to be contrary to law, the remaining provisions of this Contract shall remain in full force and effect, and the parties agree to negotiate, in good faith, substitute enforceable provisions that most nearly effect the parties' intent in entering into the Contract.
- **60. Incorporation by Reference: Survival.** The Contract Documents referred to herein are hereby incorporated by reference into this Contract. All terms and conditions of this Contract which, by their nature, extend beyond the terms hereof shall survive acceptance, Final Payment, expiration, or earlier termination of this Contract.

- 61. <u>Waiver.</u> If, in one or more instances, either party fails to insist that the other party perform any of the terms of this Contract, such failure shall not be construed as a waiver by such party of any past, present, or future right granted under this Contract, and the obligations of both parties shall continue in full force and effect.
- 62. <u>Notice of Claims.</u> Contractor shall promptly notify Cherokee Nation in writing of any claims, demands, causes of action, or suits threatened, initiated, or anticipated against Contractor or Cherokee Nation, and shall do all things required by Cherokee Nation to protect Cherokee Nation's interests.
- **63.** <u>Reference to Liens Shall Not be Construed to Create Right to a Lien.</u> No reference to liens or lien claims contained herein shall be construed to create or acknowledge any lien or any rights on the part of Contractor or any subcontractor to file any sort of lien whatsoever against property of Cherokee Nation.
- 64. <u>No Waiver of Sovereign Immunity.</u> NO PROVISION OF THIS CONTRACT, THE CHEROKEE NATION'S STANDARD CONSTRUCTION TERMS AND CONDITIONS (INCLUDING, WITHOUT LIMITATION, THE PROVISIONS OF SUBPARAGRAPH 43(E)) OR THE CONTRACT DOCUMENTS SHALL CONSTITUTE, OR BE CONSTRUED TO BE, A WAIVER OF SOVEREIGN IMMUNITY BY CHEROKEE NATION.
- **65.** <u>Availability of Funds.</u> The NATION'S obligation for payment under this Agreement is contingent upon the availability of appropriated funds from which payment for services can be made. Funds are available for performance under this Agreement when appropriated or authorized by the Tribal Council of the Cherokee Nation. No legal liability on the part of the NATION for any payment may arise hereunder until funds are made available by the designated officer of the NATION for performance and until the CONTRACTOR receives notice of availability from the NATION'S designated officer, through the execution of a GMP and issuance of a purchase order.
- 66. <u>Cherokee Nation Indian Preference Policy.</u> Cherokee Nation shall, to the greatest extent feasible, give preference in the award of contracts to Indian organizations and Indianowned economic enterprises. All contracting is required to comply with procedures for selection of Contractors and sub-contractors as set forth in legislation pertaining to preference to Indians, Indian organizations, and Indian-owned economic enterprises in the awarding of contracts as detailed within 25 U.S.C. § 5307(b), as well as the Cherokee Nation Acquisition Management Policies and Procedures. Contractor shall include this clause in every subcontract in connection with the Project, and shall, at the direction of Cherokee Nation, take appropriate action pursuant to a finding by Cherokee Nation of a violation hereof by a contractor or subcontractor.
- 67. <u>Binding Agreement.</u> The terms and conditions herein stated may not be changed on behalf of a party except by a written agreement signed by both parties. This Contract shall be binding on the legal representatives, successors, heirs and assigns of the parties.

END OF CHEROKEE NATION'S STANDARD CONSTRUCTION TERMS AND CONDITIONS

SECTION 00 01 10

TABLE OF CONTENTS

ISSUES

07/29/22	Bid Package 01 (North Parking and Access)
08/17/22	Addendum 01
10/07/22	Bid Package 03 (Elevators)
10/21/22	Bid Package 02 (Site Demolition and Utilities)
10/24/22	ASI 01
12/08/22	Addendum 03
12/09/22	Bid Package 04 (Structural Concrete / Earthwork)

07/29/22		0	00 01 05	Certifications Page
12/09/22	\times	6	00 01 10	Table of Contents

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

12/08/22	3	00 31 00	 Available Project Information A. North Parking Lot Geotechnical Report B. Environmental Study and Assessment Report C. Combined Building Geotechnical Report
08/17/22	1	00 72 00	General Conditions AIA A201 General Conditions Cherokee Nation General Conditions

DIVISION 01 – GENERAL REQUIREMENTS

07/29/22	0	01 25 00	Substitution Procedures with Substitution Request Form
07/29/22	0	01 26 00	Contract Modification Procedures
07/29/22	0	01 29 00	Payment Procedures
07/29/22	0	01 31 00	Project Management and Control with Form 750 Request for Information
07/29/22	0	01 32 00	Construction Progress Documentation
07/29/22	0	01 32 33	Photographic Documentation
07/29/22	0	01 33 00	Submittal Procedures
07/29/22	0	01 40 00	Quality Requirements
07/29/22	0	01 42 00	References
08/17/22	1	01 50 00	Temporary Facilities and Controls
07/29/22	0	01 60 00	Product Requirements
07/29/22	0	01 73 00	Execution
08/17/22	1	01 74 19	Construction Waste Management and Disposal
08/17/22	0	01 81 13	Sustainable Design Requirements

DIVISION 02 – EXISTING CONDITIONS

07/29/22	0 02 41 13	Selective Site Demolition
----------	------------	---------------------------

DIVISION 03 – CONCRETE

12/09/22	\boxtimes	0	03 30 00	Cast-in-Place Concrete
12/09/22	\boxtimes	0	03 30 00.01	Cast-in-Place Concrete for Landscaping
12/09/22	\boxtimes	0	03 35 19	Decorative Concrete Paving
12/09/22	\times	0	03 45 01	Site Structures Precast Concrete

DIVISION 04 – MASONRY

12/09/22	\times	0	04 20 01	Unit Masonry for Landscaping
----------	----------	---	----------	------------------------------

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

08/17/22	0	07 84 23	Penetration Firestopping

DIVISION 12 – FURNISHINGS

	-			
12/09/22	\times	0	12 93 00	Site Furnishings

DIVISION 14 – CONVEYING SYSTEMS

10/07/22	0	14 21 00	Electric Traction Elevators
10/07/22	0	14 21 23	Machine-Room-Less Electric Traction Elevators

DIVISION 26 – ELECTRICAL

07/29/22		0	26 00 00	Electrical Requirements
07/29/22		0	26 05 19	Low-Voltage Electrical Power Conductors and Cables
07/29/22		0	26 05 26	Grounding and Bonding for Electrical Systems
07/29/22		0	26 05 33	Raceways and Boxes for Electrical Systems
07/29/22		0	26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
07/29/22		0	26 05 53	Identification for Electrical Systems
07/29/22		0	26 22 13	Low-Voltage Distribution Transformers
07/29/22		0	26 28 16	Enclosed Switches and Circuit Breakers
10/24/22	· 🗌 ·	1	26 56 13	Lighting Poles and Standards
10/24/22		1	26 56 19	LED Exterior Lighting

DIVISION 27 – COMMUNICATIONS

07/29/22	0	27 05 28	Pathways for Communications Systems

DIVISION 31 – EARTHWORK

07/29/22		0	31 10 00	Site Clearing
07/29/22		0	31 22 00	Grading
10/24/22		1	31 23 00	Excavation and Fill
07/29/22		0	31 25 00	Erosion and Sedimentation Control
12/09/22	\times	0	31 36 00	Gabions
07/29/22		0	31 37 00	Rip Rap
12/09/22	\boxtimes	0	31 63 29	Drilled Concrete Piers and Shafts

DIVISION 32 – EXTERIOR IMPROVEMENTS

07/29/22		0	32 11 00	Base Courses
07/29/22		0	32 12 00	Flexible Paving
07/29/22		0	32 13 00	Rigid Paving
07/29/22		0	32 13 73	Concrete Paving Joint Sealants
07/29/22		0	32 16 13	Curbs and Gutters
07/29/22		0	32 17 00	Paving Specialties
12/09/22	\times	0	32 32 23	Segmented Retaining Wall
07/29/22		1	32 92 19	Seeding (Native Drill)
07/29/22		1	32 92 23	Sodding

DIVISION 33 – UTILITIES

10/21/22	0	33 10 00	Water Utilities
10/21/22	0	33 30 00	Sanitary Sewer Utilities
07/29/22	0	33 31 23	Sanitary Sewerage Force Main Piping
07/29/22	0	33 40 00	Storm Drainage Utilities
10/21/22	0	33 46 00	Subdrainage

END OF TABLE OF CONTENTS

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for substitutions during construction. **Substitutions during the bidding process will not be reviewed or action taken**.

1.2 **DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Construction Manager.
 - 1. Substitutions for Cause: Changes proposed by Construction Manager that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Construction Manager or Owner that are not required in order to meet other Project requirements but may offer advantage to Construction Manager or Owner.

1.3 SUBMITTALS

- A. Substitution Requests: Submit electronic copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use scanned PDF electronic file of form provided at end of this section or annotated PDF electronic file of electronic form received from Architect matching form provided at end of this section.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. Detailed comparison of Construction Manager's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- I. Construction Manager's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Construction Manager's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, with reasonable promptness, Architect will request additional information or documentation for evaluation. Architect will notify Construction Manager of acceptance or rejection of proposed substitution with reasonable promptness. Acceptance of proposed substitution does not constitute approval or inclusion in Contract Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 **PROCEDURES**

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Prior to starting Substitution Process, review proposed recommendations with Architect.
- B. Construction Manager's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.
- C. Construction Manager Representations: By making substitution request, Construction Manager:
 - 1. Recognizes burden of proof of equality for requested substitution rests with Construction Manager.
 - 2. Represents and warrants that Construction Manager has personally investigated requested substitution and determined that it is equal to or superior in all respects to specified Work.
 - 3. Represents and warrants that Contractor will provide same warranties for requested substitution that Construction Manager would for specified Work.

- 4. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to requested substitution which may subsequently become apparent.
- 5. Will coordinate installation of accepted substitution, making such other changes as may be required to make Work complete in all respects.
- 6. Represents and warrants that accepted substitution will perform same as specified Work would have performed. Should accepted substitution fail to perform as required, Construction Manager shall replace accepted substitution with specified Work at no additional cost to Owner.
- D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.
 - 1. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Construction Manager's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
- E. Substitutions for Convenience:
 - 1. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Construction Manager's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SUBSTITUTION REQUEST FORM

Project Name

Specified Item

Section Page Paragraph Description

The undersigned Construction Manager requests consideration of the following:

Proposed Substitution

(Include all product data as indicated in Specification Section 01 2500 and any supplemental information as requested by the Architect.)

The undersigned Construction Manager warrants to the Architect and Owner that the following paragraphs, unless modified on attachments, are correct.

- 1. The Proposed Substitution does not affect dimensions shown on Drawings.
- The cost reduction/increase indicated in item 5 below includes costs for changes to the building design, including engineering, design, detailing and construction costs caused by the requested Substitution. Any additional costs resulting from this substitution will be reimbursed from the cost savings in item 5 or, in it's absence, funded as a project cost.
- 3. The Proposed Substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
- 4. Maintenance and service parts will be locally available for the Proposed Substitution.

The Construction Manager further warrants to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The Construction Manager further warrants that the intent of specification section 01 25 00, paragraph 2.1.C has been met.

- 5. Total Cost Savings/Increase to the Owner: \$_
- 6. Compensation to the Architect / Consultant for related Additional Service fee: \$

Manufacturer's Certification of Equal Quality

represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item.

Manufacturer's Representative	Date	Company
Acceptances		
1.		
Construction Manager Acceptance	Date	Company
2.		
Owner Acceptance	Date	Company
3.		
Architect Acceptance	Date	Company
4.		
Consultant Acceptance	Date	Company
Recommend Acceptance: 🗌 Yes 🗌 No		

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's Form 710 "Architect's Supplemental Instructions"; copy attached at the end of this Section.

1.3 **PROPOSAL REQUESTS**

- A. Owner-Initiated Proposed Change: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect's Form 709 "Proposed Change"; copy attached at the end of this Section. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposed Change or with reasonable promptness, when not otherwise specified, after receipt of Proposed Change, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Construction Manager's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Include updated Submittal Schedule showing effect of the change.
- B. Construction Manager-Initiated Proposed Change: If latent or changed conditions require modifications to the Contract, Construction Manager may initiate a claim by submitting a request for a change to Architect using Construction Manager's Standard Form.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.

- 5. Include an updated Construction Manager's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- 6. Include updated Submittal Schedule showing effect of the change.
- 7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: If applicable, see Division 01 Section "Allowances" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: If applicable, see Division 01 Section "Unit Prices" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of unit-price work.
- C. Alternates: If applicable, see Division 01 Section "Alternates" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of alternate work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Construction Manager on Architects Form 701 "Change Order"; copy attached at the end of this Section.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on Architects Form 714 "Construction Change Directive"; copy attached at the end of this Section. Construction Change Directive instructs Construction Manager to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Construction Manager's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Accepted Alternates.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide subschedules showing values coordinated with each phase of payment.
 - 4. Subschedules for Separate Elements of Work: Where the Construction Manager's construction schedule defines separate elements of the Work; provide subschedules showing values coordinated with each element.
 - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Division 01 Section "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Construction Manager's name and address.
 - e. Date of submittal.
 - 2. Arrange the schedule of values in tabular form, in format accepted by Architect, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders.

- g. Dollar value of the following, as a percentage of the Contract Sum to nearest onehundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
- 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
- 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.
- 6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
- 9. Change Orders: Provide a separate line item in the schedule of values for each change order.
- 10. Separate Owner-Consultant Contracts: Provide a separate line item in the schedule of values for each separate Owner-Consultant related Work item.
- 11. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Construction Manager.
- 12. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-inplace may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Construction Manager's option.
- 13. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Construction Manager. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

- 1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
- 2. Submit draft, or pencil, copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Construction Manager. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Construction Manager's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from Construction Manager, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Delays: Submit each Application for Payment with Construction Manager's waiver of mechanic's lien for construction period covered by the application.
 - a. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

- 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of values.
 - 3. Construction Manager's construction schedule (preliminary if not final).
 - 4. Products list (preliminary if not final).
 - 5. Schedule of unit prices.
 - 6. Submittal schedule (preliminary if not final).
 - 7. List of Construction Manager's staff assignments.
 - 8. List of Construction Manager's principal consultants.
 - 9. Copies of building permits.
 - 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 - 11. Initial progress report.
 - 12. Report of preconstruction conference.
 - 13. Certificates of insurance and insurance policies.
 - 14. Performance and payment bonds.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - 2. When applicable, this application shall reflect Certificate(s) of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 - 1. Evidence of completion of Project closeout requirements.
 - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 - 3. Updated final statement, accounting for final changes to the Contract Sum.
 - 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 - 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 - 6. AIA Document G707, "Consent of Surety to Final Payment."
 - 7. Evidence that claims have been settled.
 - 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 - 9. If applicable, final liquidated damages settlement statement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project Web site.
 - 5. Project meetings.

1.2 **DEFINITIONS**

- A. Project communications documents shall be defined as the following:
 - 1. Letters.
 - 2. Memoranda.
 - 3. E-Mail Communications/Internet Communications/Project Management Software Communications.
 - 4. RFI (Request for Information Construction Manager).
 - 5. RFI-A (Request for Information Architect).

1.3 FORMAT

- A. Letters and Memoranda: Submit in formats acceptable to the Architect.
- B. E–Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.
- C. RFI (Request for Information Construction Manager): Submit on forms furnished by the Architect, or on other forms as approved by the Architect. Unless otherwise approved use Architect's Form 750, "Request for Information"; copy attached at the end of this Section.
- D. RFI-A (Request for Information Architect), will be submitted by Architect to Construction Manager on Architects standard form.

1.4 PROJECT COMMUNICATIONS DOCUMENTS

A. Letters and Memoranda documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.

- B. E-Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect's and Owner's computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems, shall be by the Construction Manager. The Construction Manager shall keep written records and hard file copies of all electronic communications. Failure of the Construction Manager to keep such records shall waive the Construction Manager's right to rely on such communications and such communications shall be deemed to have not taken place.
- C. RFI (Request for Information Construction Manager) shall be defined and limited to a request from the Construction Manager seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:
 - 1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Construction Manager shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
 - 2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.
 - a. The Construction Manager shall include a "Proposed Solution" to the issue requiring interpretation or clarification.
 - 3. RFI's submitted to the Construction Manager by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Construction Manager prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Construction Manager, such requests will be returned to the Construction Manager for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
 - 4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Construction Manager without action by the Architect.
 - 5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Construction Manager determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Construction Manager shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
 - 6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Construction Manager. The Construction Manager shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.
 - 7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:
 - a. Project name.
 - b. Name and address of Construction Manager.
 - c. Name and address of Architect.

- d. RFI number including RFIs that were returned without action or withdrawn.
- e. RFI description.
- f. Date the RFI was submitted.
- g. Date Architect's response was received.
- 8. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Construction Manager disagrees with response.
 - a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- D. RFI-A (Request for Information Architect) shall be defined as a request by the Architect for information relating to the obligations of the Construction Manager under the Contract.
 - 1. After receipt of an RFI-A the Construction Manager shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
 - 2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.
- E. Revisions to Construction Documents: Responses to requests for information (RFI) shall not serve as construction documents; and the Construction Manager shall not incorporate RFI responses into construction of the Project, unless such answers bear the seal and signature of a licensed design professional.

1.5 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and Project Web site. Keep list current at all times.

1.6 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

- 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
- 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Construction Manager's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.7 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - e. Indicate required installation sequences.
 - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 - 1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 - 2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
 - 3. BIM File Incorporation: When applicable, develop coordination drawing files from Building Information Model (BIM) established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 - 4. If approved by Owner, Architect will furnish Construction Manager one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
 - c. Distribution: Digital data files shall only be distributed via the Procore project website with acceptance of Architect's data licensing agreement.

1.8 **PROJECT WEBSITE**

A. Use Procore project management software system for purposes of managing project communication and documentation until Final Completion.

1.9 **PROJECT MEETINGS**

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
 - 4. Attendance: Document attendance of all participants.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction.
 - 1. Conduct the conference to review responsibilities and personnel assignments.
 - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
- 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, and coordination with adjacent activities. Prepare agenda appropriate to Work.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
- 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
- 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, at a time to be decided prior to the scheduled date of Substantial Completion.
 - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. If applicable, requirements for completing sustainable design documentation.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Construction Manager's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. If applicable, coordination of separate contracts.
 - I. If applicable, Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at regular intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Construction Manager's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Manager's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following or as needed:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) If applicable, resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) If applicable, status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site utilization.
 - 10) Temporary facilities and controls.
 - 11) Work hours.
 - 12) Hazards and risks.
 - 13) Progress cleaning.
 - 14) Quality and work standards.
 - 15) Status of correction of deficient items.
 - 16) Field observations.
 - 17) Status of RFIs.
 - 18) Status of proposal requests.
 - 19) Pending changes.
 - 20) Status of Change Orders.
 - 21) Documentation of information for payment requests.
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Construction Manager's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 - 1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.

- 3) If applicable, resolution of BIM component conflicts.
- 4) Status of submittals.
- 5) Deliveries.
- 6) Off-site fabrication.
- 7) Access.
- 8) Site utilization.
- 9) Temporary facilities and controls.
- 10) Work hours.
- 11) Hazards and risks.
- 12) Progress cleaning.
- 13) Quality and work standards.
- 14) Change Orders.

PART 2 - PRODUCTS

2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

- A. General: So as to expedite electronic review process, process all documents through a web-based software service. Sending documents via email, FTP or paper will not be accepted.
 - 1. Basis of Design (Product Standard): Procore.
- B. Performance Requirements:
 - 1. Project License:
 - a. Cloud based (no hardware required).
 - b. Unlimited user accounts.
 - c. Functionality to support subcontractors, contractors, architects and consultants.
 - d. Provide access to data for all project team members at no cost to the individual users.
 - 2. Training and Support:
 - a. Dedicated project training.
 - b. Phone support.
 - 3. Archive:
 - a. Export all data to an offline archive at the completion of the project.
 - b. Provide archive to architect, Construction Manager and owner.
 - c. Archive shall include all attachments, meta data, review comments and time stamp history.
 - 4. Submittals and RFIs:
 - a. Customizable logs and reporting accessible by all users.
 - b. Logs shall automatically update as submittals and RFIs are processed.
 - c. Automated routing of submittals and RFIs to design team based on trade.
 - d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
 - e. Automated weekly email to design team users of overdue items.
 - f. Automatic sequential numbering per spec section for submittals.
 - g. Two sets of due dates one overall due date and a consultant due date.
 - h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.

- 5. Submittal Register:
 - a. Software vendor shall take specifications and build the required list of submittals and import into the software.
- 6. Drawing Management:
 - a. Provide current set of drawings and specifications through a centralized index.
 - b. Automated association of PDFs to the centralized index.
 - c. Manage drawing revisions with customizable review states.
 - d. Drawings shall be accessible offline via mobile devices.
- 7. File Sharing:
 - a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
 - b. Access permissions (view/edit) at a folder level.
- 8. Punch List and other Field Task Management:
 - a. Unlimited customizable field task types including punch list.
 - b. Locate and assign tasks from a mobile device.
 - c. No additional fees to individual users to access mobile apps.
 - d. Data shall be accessible offline on mobile devices.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

Form 750 Request for Information

Project	RFI No.		
Project No.	Receiver		
Sender			
Date Sent	Date Initiated	Date Initiated	
Copies To	Date Response R	equested	
Subject			
Request			
Senders Proposed Answer/Solution			
THE PROPOSED ANSWE	R/SOLUTION [] IS, [] IS NOT, INCLUDE	ED IN THE CONTRACT.	
Receivers Response			
Response By	Company	Date	
Distribution			

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work.
- B. Related Section:
 - 1. Provide Construction Photographs in accordance with Division 01 Section "Photographic Documentation".

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Major Area: A story of construction, a separate building, or a similar significant construction element.
- C. Milestone: A key or critical point in time for reference or measurement.
- D. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- E. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- F. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- G. Event: The starting or ending point of an activity.
- H. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Construction Manager, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

I. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

1.3 SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Construction Manager's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Construction Manager's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Construction Manager's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Construction Manager's construction schedule with submittal schedule.
 - 3. Startup and Testing Time: Include no fewer than 7 days for startup and testing.
 - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule (where applicable), and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 3. Products Ordered in Advance: Include a separate activity for each product.
 - 4. Owner-Furnished Products: Include a separate activity for each product.
 - 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.

- j. Adjusting.
- k. Curing.
- I. Building flush-out.
- m. Startup and placement into final use and operation.
- 7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- 8. Other Constraints include but are not limited to the following:
 - a. Roads.
 - b. Parking.
 - c. Landscape.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, punch list activities, Substantial Completion, and final completion.
- E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Construction Manager intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 14 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. Startup Network Diagram may be submitted in lieu of Bar-Chart Schedule.

2.3 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE (BAR CHART/GANTT CHART)

- A. Bar Chart/Gantt Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Construction Manager's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Construction Manager's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Construction Manager from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Purchase of materials.
 - c. Delivery.
 - d. Fabrication.
 - e. Installation.
 - f. Punch list and final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment, fragnet, to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early starttotal float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Construction Manager or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
 - 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 - 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 - 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 - 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 5. Accidents.
 - 6. Meetings and significant decisions.

- 7. Unusual events (see special reports).
- 8. Stoppages, delays, shortages, and losses.
- 9. Meter readings and similar recordings.
- 10. Emergency procedures.
- 11. Orders and requests of authorities having jurisdiction.
- 12. Change Orders received and implemented.
- 13. Construction Change Directives received and implemented.
- 14. Services connected and disconnected.
- 15. Equipment or system tests and startups.
- 16. Partial completions and occupancies.
- 17. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Construction Manager's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 - 1. In-House Option: Owner may waive the requirement to retain a consultant if Construction Manager employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Construction Manager's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

- 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect-Owner, separate contractors, testing and inspecting agencies, and other parties identified by Construction Manager with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.2 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified professional commercial photographer to take electronic construction photographs.
- B. Minimum Digital Camera Resolution: 1800 x 1200 dpi (dots per inch) @ 72 dpi resolution.
- C. Acceptable Electronic File Format: .jpg, .tif., .tiff., .tga., jpe., or .png.
- D. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- E. Image File Naming Convention (separate by an underscore _):
 - 1. Project Job Number / Year-Month-Day / Image Number . file extension
- F. Print Format: 8 in (200 mm) by 10 in (250 mm) smooth surface matte prints on single-weight commercial-grade stock, mounted on linen or card stock to allow a 1 in (25 mm) wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
- G. Print Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
 - 1. Name of Project.
 - 2. Name and address of photographer.
 - 3. Name of Architect.
 - 4. Name of Construction Manager.
 - 5. Date photograph was taken.
 - 6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- H. Preconstruction Photographs: Before starting construction, take 4 photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property. Submit prints and JPEG electronic files as required under "Submittals" Article.
- I. Periodic Construction Photographs: Take 4 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Submit prints and JPEG electronic files as required under "Submittals" Article.
 - 1. Field Office Prints: In addition to prints required to be submitted under "Submittals" Article, make and retain in field office at Project site available at all times for reference, one set of prints of periodic construction photographs. Identify photographs the same as for those submitted to Architect.

J. Final Completion Construction Photographs: Take 8 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points. Submit prints and JPEG electronic files as required under "Submittals" Article.

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
 - 4. Preconstruction video recordings.
 - 5. Periodic construction video recordings.
 - 6. Web-based construction photographic documentation.

1.2 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For photographer and Web-based photographic documentation service provider.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within 3 days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 12 megapixels.
 - 2. Format: Minimum 4288 by 2848 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Image File Naming Convention (separate by an underscore _):
 - a. Project Job Number / Year-Month-Day / Image Number . file extension
 - 4. Identification: Provide the following information with each image description in file metadata tag:
 - a. Architect's Job Number.
 - b. Name of Project.
 - c. Name and contact information for photographer.
 - d. Name of Architect.
 - e. Name of Construction Manager.
 - f. Date photograph was taken.
 - g. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - h. Unique sequential identifier keyed to accompanying key plan.
- D. Video Recordings: Submit video recordings within 7 days of recording.
 - 1. Video Recordings, General:
 - a. Submit in digital video disc format acceptable to Architect.
 - b. Submit by posting to Project Web site.

- c. Submit by posting to Web-based photographic documentation service provider's Web site.
- 2. Identification: With each submittal, provide the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Weather conditions at time of recording.
- 3. Transcript: Provide Portable Data (PDF) Electronic File. Include a cover page with same label information as corresponding video recording. Include name of Project and date of video recording on each page.
- E. Web-Based Photographic Documentation: Submit time-lapse sequence video recordings simultaneously with recording.
 - 1. Real-time posting: Post in real-time, time-lapse sequence video recordings:
 - a. Post to Project Web site.
 - b. Post to Web-based photographic documentation service provider's Web site.
 - 2. Periodic Posting: Monthly on digital video disc.
 - 3. Identification: For each recording, provide the following information:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Date(s) and time(s) video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Weather conditions at time of recording.

1.3 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
- B. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.4 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of megapixels, and at an image resolution of not less than 4288 by 2848 pixels.
- B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Architect.

2.2 WEB-BASED PHOTOGRAPHIC DOCUMENTATION

- A. Project Camera: Provide fixed exterior camera installation, mounted to provide unobstructed view of construction site from location approved by Architect.
 - 1. Provide 4 fixed-location camera(s), with the following characteristics:
 - a. Remotely controllable view with mouse-click user navigation for horizontal pan, vertical tile, and optical zoom of 500 percent minimum.
 - b. Capable of producing minimum 3 megapixel pictures.
 - c. Provide power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.
- B. Web-Based Image Access: Password-protected access for Project team administered by Construction Manager, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
 - 1. Provide public viewer open access to most recent project camera image.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take a minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.

- 3. Take a minimum of 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
- 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
 - 1. Frequency: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment.
 - 2. Vantage Points: Following suggestions by Architect and Construction Manager, photographer to select vantage points. During each of the following construction phases, take not less than 2 of the required shots from same vantage point each time to create a time-lapse sequence as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 - d. Interior Work, through date of Substantial Completion.
- G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
 - 1. Do not include date stamp unless directed otherwise by Architect.
- H. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
 - 1. Three days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

3.2 CONSTRUCTION VIDEO RECORDINGS

- A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.
- B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.

- C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
 - 1. Confirm date and time at beginning and end of recording.
 - 2. Begin each video recording with name of Project, Construction Manager's name, videographer's name, and Project location.
- D. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.
- E. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.
 - 1. Flag construction limits before recording construction video recordings.
 - 2. Show existing conditions adjacent to Project site before starting the Work.
 - 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of construction.
 - 4. Show protection efforts by Construction Manager.
- F. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).
- G. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.
 - 1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every 5 minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 - 2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.
 - 3. Vantage Points: Following suggestions by Architect and Construction Manager, photographer shall select vantage points.

3.3 WEB-BASED CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

- A. Live Streaming Construction Site Images: Provide Web-accessible image of current site image from viewercontrolled location camera(s), updated at 15 minute intervals during daytime operation.
- B. Time-Lapse Sequence Construction Site Recordings: Provide video recording from a fixed-location camera to show status of construction and progress.
 - 1. Frequency: Record one frame of video recording every 15 minutes, from same vantage point each time, to create a time-lapse sequence of construction activities.
 - 2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.

C. Maintain cameras and Web-based access in good working order according to Web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's review. Architect's responsive action is required.
- B. Digital Signature: A digital signature or digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.
- C. Electronic Signature: An electronic signature is any legally recognized electronic means that indicates that a person adopts the contents of an electronic message.
- D. Informational Submittals: Written and graphic information other than action submittals that require Architect's review. Architect's responsive action is required on informational submittals that do not comply with the information given and design concept expressed in the Drawings and Specifications.
- E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Construction Manager's construction schedule.
 - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Construction Manager's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.

- d. Name of subcontractor.
- e. Description of the Work covered.
- f. Scheduled date for Architect's final release or approval.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: If approved by the by Owner, Architect will furnish Contractor one set of digital data files of Drawing files for use in preparing submittals. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow sufficient and reasonable time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review.
- D. Paper Submittals: Architect reserves the right to require paper submittals.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number, including revision identifier.
 - a. File Naming Convention (separate by dashes or underscores _):
 - 1) Specification Number / Revision Number / Submittal Sequence (A, B, C, etc.).pdf
 - 3. Provide means for insertion to permanently record Construction Manager's review and approval markings and action taken by Architect.
 - 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
 - a. Project name.

- b. Date.
- c. Name and address of Architect.
- d. Name of Construction Manager.
- e. Name of firm or entity that prepared submittal.
- f. Names of subcontractor, manufacturer, and supplier.
- g. Category and type of submittal.
- h. Submittal purpose and description.
- i. Specification Section number and title.
- j. Specification paragraph number or drawing designation and generic name for each of multiple items.
- k. Drawing number and detail references, as appropriate.
- I. Location(s) where product is to be installed, as appropriate.
- m. Related physical samples submitted directly.
- n. Indication of full or partial submittal.
- o. Transmittal number, numbered consecutively.
- p. Submittal and transmittal distribution record.
- q. Other necessary identification.
- r. Remarks.
- 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Architect's Job Number.
 - b. Project name.
 - c. Number and title of appropriate Specification Section.
 - d. Manufacturer name.
 - e. Product name.
 - f. Submittal revision number.
- 6. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Refer to Division 01 Section "Project Management and Coordination" for description of electronic project management software.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On page, prepared on Construction Manager's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in file name and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with notation from Architect's action stamp not requiring additional submittals.
- I. Distribution: Furnish electronic copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with appropriate notation from Architect's action stamp indicating for construction. Retain a separate copy for Owner to be delivered to Owner with Project Closeout documents.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals as PDF electronic files directly to Architect's Project Web site specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. Provide PDF electronic files from scanned paper originals at 300 dpi, minimum.
 - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. When one or more individual Specification Sections includes requirements for notarized signature on certificates and certifications, provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's installation instructions.
 - c. Mill reports.
 - d. Standard product operating and maintenance manuals.
 - e. Certification that products are appropriate for installation indicated.
 - f. Manufacturer's catalog cuts.
 - g. Manufacturer's product specifications.
 - h. Standard color charts.
 - i. Statement of compliance with specified referenced standards.
 - j. Testing by recognized testing agency.
 - k. Application of testing agency labels and seals.
 - I. Notation of coordination requirements.
 - m. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before or concurrent with Samples.

- 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Dimensions.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Design calculations.
 - i. Schedules.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - I. Notation of dimensions established by field measurement.
 - m. Relationship and attachment to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer.
 - 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (212 by 275 mm), but no larger than 30 by 42 inches (750 by 1050 mm).
 - 4. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - 5. BIM File Incorporation: When applicable, develop and incorporate Shop Drawing files into Building Information Model established for Project.
 - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
 - b. Refer to Division 01 Section "Project Management and Coordination" for requirements for coordination drawings.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.

- 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record. This is in addition to physical samples.
- 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Construction Manager.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 4 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 4 sets of paired units that show approximate limits of variations.
- E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- F. Construction Manager's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

- K. Sustainable Construction Submittals: Where applicable, comply with requirements specified in Division 01 sustainable construction requirements Section.
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-ENGINEERING SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Construction Manager by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Engineering Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Construction Manager to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Where applicable, incorporate delegated-design drawing and data files into Building Information Model established for Project.
 - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Construction Manager's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp and mark submittal appropriately, as

follows:

- 1. Final but Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
- 2. Returned for Resubmittal: When submittal is marked "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.
- 3. Submittals Not Required: Where a submittal is primarily for other Construction Manager activity, the submittal will be returned, marked "Not Reviewed; Submittal not required by Contract Documents".
- B. Architect's acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.
- C. Informational Submittals: Architect will review submittal, and return it in accordance with submittal Processing Time indicated if it does not comply with requirements. Architect will stamp and mark submittal appropriately.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. Review shall not be final until complete submittal has been reviewed by Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.
- G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Construction Manager's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Construction Manager to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 **DEFINITIONS**

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Mockups establish the standard by which the Work will be judged.
 - 1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
 - 3. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL (Nationally Recognized Testing Laboratories), an NVLAP (National Voluntary Laboratory Accreditation Program), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- A. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction and with the qualification requirements of individual specification section governing their work.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 CONSTRUCTION MANAGER'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Construction Manager's quality-assurance and quality-control responsibilities. Coordinate with Construction Manager's construction schedule.

- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may be the Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Construction Manager-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Construction Manager-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority when Commissioning is included in the Project.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results, including Owner acceptance of nonconforming work. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.5 **REPORTS AND DOCUMENTS**

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.

- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Statement whether conditions, products, and installation exceed manufacturer's statements.
 - 8. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Construction Manager responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Construction Manager. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- K. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Construction Manager shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 - 2. Clean exposed faces of mock-up.
 - 3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Protect accepted mock-up from the elements with weather-resistant membrane.
 - 6. Obtain Architect's acceptance of mock-ups before starting fabrication.
 - 7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
 - 8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Construction Manager, submitted to Architect in writing, and accepted by Architect in writing.
 - 9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.
- L. Integrated Exterior Mockups: See Division 01 Section "Visual Mock-Up Requirements".
- M. Room Mockups: See Division 01 Section "Visual Mock-Up Requirements".
- N. Laboratory Mockups: See Division 01 Section "Testing Mock-Up for Building Enclosure System".

1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Construction Manager with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Construction Manager.
- B. Construction Manager Responsibilities: Tests and inspections not explicitly assigned to Owner are Construction Manager's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Construction Manager by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Construction Manager's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Construction Manager shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

- 3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
- 4. Where quality-control services are indicated as Construction Manager's responsibility, submit a certified written report, in duplicate, of each quality-control service.
- 5. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager's responsibility.
- 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Construction Manager's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 3. Submit a certified written report, in duplicate, of each test, inspection, and similar qualitycontrol service through Construction Manager.
 - 4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 5. Do not perform any duties of Construction Manager.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar qualitycontrol services required by the Contract Documents. Coordinate and submit concurrently with Construction Manager's construction schedule.
 - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
 - a. Prepare in tabular form and include the following:
 - 1) Specification Section number and title.
 - 2) Entity responsible for performing tests and inspections.
 - 3) Description of test and inspection.
 - 4) Identification of applicable standards.
 - 5) Identification of test and inspection methods.
 - 6) Number of tests and inspections required.
 - 7) Time schedule or time span for tests and inspections.
 - 8) Requirements for obtaining samples.
 - 9) Unique characteristics of each quality-control service.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner may engage a qualified to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
 - 1. Notifying Architect and Construction Manager promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Construction Manager and to authorities having jurisdiction.
 - 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 5. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Construction Manager's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 **DEFINITIONS**

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Construction Manager's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. Submitted: The terms "submitted", "reported", "satisfactory" and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.
- J. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
UBC	Uniform Building Code (See ICC)	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission	(888) 225-5322

	www.fcc.gov	
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department	(202) 647-4000

- www.state.govTRBTransportation Research Board
http://gulliver.trb.org(202) 334-2934USDADepartment of Agriculture
www.usda.gov(202) 720-2791USPSPostal Service
www.usps.com(202) 268-2000
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-todate as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office	(866) 512-1800 (202) 512-1800

www.gpoaccess.gov/cfr/index.html

DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dps.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
 - 1. Cost or use charges for temporary facilities are not chargeable to Owner or Architect.
- B. Sewer Service: Arrange with utility company for sewer service for the project to be put in the Owner's name.
- C. Water Service: Arrange with utility company for water service for the project to be put in the Owner's name.
- D. Electric Power Service: Arrange with utility company for electrical power service for the project to be put in the Owner's name.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Site Temporary Fence Plan: Show temporary fence location including access gates.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- D. Dust- and HVAC-Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.

- 5. Other dust-control measures.
- E. Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- F. Implementation and Termination Schedule: Make available on request a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".
 - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- D. Accessible Temporary Egress at Renovation Work: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department and Rescue Squad rules.
 - 5. Environmental protection regulations.
 - 6. City ordinances and regulations.

1.5 **PROJECT CONDITIONS**

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

- C. Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chainlink fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top rails.
- D. Portable Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanizedsteel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (40 mm) OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- E. Wood Enclosure Fence: Plywood, 8 feet (2.4 m) high, framed with four 2 by 4 inch (50 by 100 mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
- F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- G. Polyethylene Sheet: Reinforced, fire-resistive sheet, 6 mil (0.14 mm) minimum thickness, with Class A flame-spread rating per ASTM E 84 and passing NFPA 701 Test Method 2.
 - 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; SAFE-FLEX ICRA Awareness Barrier.
- H. Dust Containment Barrier for Doors: Reinforced, fire-resistive polyethylene sheet, 10 mil (0.25 mm) minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.
 - 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.
- I. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (900 by 1500 mm).
- J. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site.
 - Conference room of sufficient size to accommodate. Provide electrical power service and 120-V ac duplex receptacles. Furnish room with conference table, chairs, and tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor.
 - 5. Lighting fixtures capable of maintaining average illumination at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- D. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- E. Air-Filtration Units for Renovation Work: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.
- B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.
- C. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

- 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
- 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
 - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Connect temporary sewers to municipal system as directed by sewer department officials.
 - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 - 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- E. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Sterilize temporary water piping before use in accordance with requirements of authorities having jurisdiction.
- F. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Existing Toilets in Occupied Facilities: Use of Owner's existing toilet facilities will not be permitted or allowed.
- G. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- H. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dustproducing equipment. Isolate limited work within occupied areas using portable dustcontainment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

- I. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Provide telephone line(s) for each field office.
- M. Electronic Communication Service: Provide internet access of not less than 15-Mbps download and 5-Mbps upload speed for use by Architect and Owner to access Project electronic documents and maintain electronic communications

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Provide dust-control that is nonpolluting and nontracking. Reapply as required to minimize dust.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Coordinated parking with Owner's requirements.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.

- 3. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Coordinated signs with Owner's requirements and requirements of authorities having jurisdiction.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- H. Comply with progress cleaning requirements in Division 01 Section "Execution."
- I. Existing Elevator Use in Occupied Facilities: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - 1. Do not load elevators beyond their rated weight capacity.
 - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- J. Existing Stair Usage in Occupied Facilities: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
- K. Temporary Enclosures: Provide temporary, weathertight, enclosures for protection of construction, in progress and completed, including, but not limited to, vertical and horizontal openings, from exposure, foul weather, other construction operations, and similar activities.
- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (450 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1200 mm) between doors. Maintain walk-off mats in vestibule, for dust control.
 - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 5. Protect air-handling equipment.
 - 6. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and authorities having jurisdiction; manage fire-prevention program.

3.5 MOISTURE CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of discoloration that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard, replace, or clean stored or installed material that begins to show discoloration.
 - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use permanent HVAC system to control humidity.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may

have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

- 1. Materials and facilities that constitute temporary facilities are property of Contractor.
- 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
- 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 **DEFINITIONS**

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Construction Manager. Refer to Division 01 Section "Substitution Procedures".
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers
- D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.
- E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Construction Manager's services are rendered, any amendments for Construction Manager's services rendered after the effective date of any such amendments.

1.3 SUBMITTALS

A. Comparable Product: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.
- C. Construction Manager shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Construction Manager is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Compliance: Construction Manager shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 **PRODUCT WARRANTIES**

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Construction Manager of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.
 - 2. Warranties: Prepare a written document, on manufacturer's standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.
- B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - 6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will not be considered.

- 3. Products:
 - a. Restricted List (Acceptable Manufacturers/Fabricators and Products): Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators and Products): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
- 4. Manufacturers:
 - a. Restricted List (Acceptable Manufacturers/Fabricators): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators): Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
- 5. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers, or unnamed manufacturer's product.
- C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.
- D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.
 - 1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
- F. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

- G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - 1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - 2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
 - 3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.
- A. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Construction Manager's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents; that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION

3.1 **RESTRICTION OF HAZARDOUS SUBSTANCES**

A. Construction Manager agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Construction Manager shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Construction Manager engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Construction Manager hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.

- B. In the event Construction Manager observes on the Project Site any substance which Construction Manager reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Construction Manager shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Construction Manager fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Construction Manager hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Construction Manager's failure to stop the Work.
- C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Construction Manager or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Construction Manager shall be responsible for the cost of such studies to the extent that Construction Manager or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.

1.2 **DEFINITIONS**

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 SUBMITTALS

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

- 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
- 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
- D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.
- A. Retention System Certification: Submit a statement certified by the Construction Manager's registered structural engineer that the design of components of the excavation support system is in compliance with provisions of the Contract Documents and the local building code, and is in keeping with generally accepted engineering practice.
 - 1. Submit, if requested, design calculations, specifications and erection drawings, bearing the Construction Manager's registered structural engineer's stamp, to the local building code official.
 - 2. Submit complete excavation support system shop drawings for information coordination purposes only.
 - 3. Architect/Engineer will neither review nor approve excavation support system shop drawings.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Retention System Engineering: Each component of the excavation support system shall be designed by a registered structural engineer, in accordance with the local building code, and registered structural engineer shall be engaged by the Construction Manager.
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 3. Miscellaneous Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - a. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- D. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential

interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable construction requirements Section.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

- C. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- A. Existing Utility Interruptions at Renovation Work: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Construction Manager, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.4 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

- C. Certified Survey: 30 days after completion of each work component/activity, including, but not limited to, foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.6 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated, unless indicated otherwise in the Contract Documents.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located, aligned, and coordinated with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.7 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

- 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
- 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
- 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.
- 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.8 OWNER-INSTALLED PRODUCTS

- A. Site Access: As applicable, provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 1. Construction Schedule: Inform Owner of Construction Manager's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.9 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).

- 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers specifically intended for holding types of waste materials indentified where applicable, e.g. blue colored containers with labeling and symbols for bio-waste.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills immediately.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive.
- H. Remove construction markings not required and graffiti immediately, repairing or replacing damaged material.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

- A. As applicable, coordinate startup and adjusting of equipment and operating components with commissioning requirements in Division 01 specification sections.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.11 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 74 13

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 DEFINITIONS

- A. Alternative Daily Cover: Material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter and scavenging. Generally, these materials must be processed so they do not allow gaps in the exposed landfill face.
- B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- G. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- H. Trash: Any product or material unable to be recycled, salvaged, or reused.

1.02 **PERFORMANCE REQUIREMENTS**

- A. General Requirements
 - 1. Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight or volume of total demolition and construction waste generated by the Work.

1.03 SUBMITTALS

- A. Waste Management Plan: Submit one copy of plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner. Include the following information:
 - 1. Project Name and Location
 - 2. Project Site Contact
 - 3. Establish waste diversion goals for the project by identifying materials (both structural and nonstructural) targeted for diversion.
 - 4. Specify whether materials will be separated or commingled and describe the diversion strategies planned for the project.

- 5. Describe where the material will be taken and how the recycling facility will process the material including expected diversion rates for each material stream. Include the names, addresses, and telephone numbers for the locations of the landfill and recycling facilities.
- 6. Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler. Materials sent to a commingled recycling facility for processing must take the facility average recycling rate, per month, and must include alternative daily cover as landfill waste.
- 7. Include how soil, land clearing debris, hazardous materials, or other materials not contributing to diversion will be handled.
- 8. Include how alternative daily cover will be addressed.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit an electronic copy of report. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Location of waste or recycling facility.
 - 4. Total quantity of waste in tons for at least five target categories.
 - 5. Quantity of waste salvaged, both estimated and actual in tons.
 - 6. Quantity of waste recycled, both estimated and actual in tons.
 - 7. Quantity of landfilled trash, both estimated and actual in tons.
 - 8. Total quantity of all waste generated (salvaged, recycled, and landfilled trash) in tons.
 - 9. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit an electronic copy of calculated end-of-Project rates for salvage, recycling, and landfill trash disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

PART 2 - NOT USED

PART 3 - EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or person responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site supervisor, each trade contractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling and recycling, salvage, reuse and return methods to be used by all parties at the appropriate states of the project.

3.02 LEED DOCUMENTATION

A. Provide requested documentation to project's Sustainability Consultant for review and upload to LEED Online.

END OF SECTION 01 7419

SECTION 01 81 13

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C for Healthcare) Silver certification based on USGBC's LEED v4 and v4.1 BD+C requirements.
 - 1. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 2. A copy of the LEED Project checklist is attached at the end of this Section for information only.
 - a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on aspects of Project that are not part of the Work of the Contract.
 - 3. Definitions included in the "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) Reference Guide and online amendments apply to this Section.

1.03 DEFINITIONS

- A. Bio-Based Materials: Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials. For the purposes of LEED, this excludes leather and other animal hides. Products must meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Testing Method D6866 and be legally harvested, as defined by the exporting and receiving country.
- B. Chain-of-Custody (COC): A procedure that tracks a product form the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.
- C. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resins, including all particleboard, medium density fiberboard (MDF), hardwood veneer plywood, structural composite wood, millwork substrates, and wood door cores.
- D. Cradle to Cradle: For LEED purposes, product has a Material Health Certificate or is Cradle to Cradle Certified under standard version 3 or later with a Material Health achievement level at the Bronze level or higher.

- E. Declare: For LEED purposes, product has a Declare Label that is designated as Red List Free or Declared or LBC Compliant that demonstrates content inventory to 0.1% (1000 ppm).
- F. Environmental Product Declaration (EPD): A statement that the product meets the environmental requirements of ISO 14021-1999, ISO 14025-2006 and EN15804, or ISO 21930-2007.
 - 1. Product-Specific Declaration: A product with a publicly available, critically reviewed lifecycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 - 2. Product-Specific Type III EPD Internally Reviewed: A product with an internally, critically reviewed life-cycle assessment in accordance with ISO 14071 and conforms to ISO 14025, and EN15804 or ISO 21930 and has at least a cradle to gate scope.
 - 3. Industry-Wide (Generic) Type III EPD: Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 - 4. Product-Specific Type III EPD: Products with a third-party certification, including external verification and external critical review, in which the manufacturer is explicated recognized as the participant by the program operator. EPD must conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
- G. Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life.
- H. Freestanding furniture and medical furnishings: examples include mattresses, foams, panel fabrics, cubicle curtains, window coverings, other textiles.
- I. Health Product Declaration (HPD): A published declaration with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard.
- J. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "IAQ Guidelines for Occupied Buildings Under Construction."
- K. Inherently Nonemitting Sources: Product that contains no inherently emitting sources of VOCs (stone, ceramic, powder-coated metals, plated, or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood) and has no integral organic-based surface coatings, binders, or sealants.
- L. Life Cycle Impact Reduction Action Plan: The manufacturer has produced a product-specific lifecycle assessment using EN 15804 or ISO 21930 for the product and has provided a publicly available action plan to mitigate or reduce life-cycle impacts. The action plan must be productspecific using the specified PCR functional unit, be critically reviewed, and must include the following information:
 - 1. Description of the life-cycle assessment conducted including the dataset, software, or platform used by manufacturer to complete the analysis.
 - 2. Identification of the largest life cycle impact areas identified in the analysis and a narrative description of the impact areas targeted for reduction in the action plan.
 - 3. Description of specific steps anticipated in implementation of the action plan. Include proposed changes in formulation or manufacturing processes that are planned as part of impact reduction strategy.
 - 4. Specific dates and a full timeline for completion of all the steps outlined in the action plan.

- M. Life-Cycle Impact Reductions in Embodied Carbon: Demonstration of environmental impact reductions for the specified functional unit based on a current third-party EPD or verified life-cycle assessment that conforms to the comparability requirements of ISO 14025 and ISO 21930. Impact reduction in the global warming potential (GWP) impact category (of 10% or 20%) and at least a 5% reduction in two additional impact categories must be demonstrated. A narrative describing how reductions in impacts were achieved must be included and the published comparisons must be third-party verified.
- N. Manufacturer Inventory: A publicly available inventory of all ingredients in a product identified by name and Chemical Abstract Service Registration Number (CASRN) and/or European Community Number (EC Number).
- O. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor/ installation costs.
- P. Materials Reuse: Reuse includes salvaged, refurbished, or reused products.
- Q. Multi-Attribute Optimization: Third party certified products that have a life cycle impact reduction action plan or demonstrate life cycle impact reductions in embodied carbon.
- R. Recycled Content: Defined in accordance with ISO 14021. Recycled content is the sum of postconsumer recycled content plus one-half the preconsumer recycled content, based on cost.
 - 1. "Postconsumer" material is defined as waste generated by households or commercial, industrial, and institutional facilities in their role as end users of a product that can no longer be used for its intended purpose.
 - 2. "Preconsumer" material is defined as matter diverted from the waste stream during the manufacturing process, determined as the percentage of material, by weight. Examples include planer shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventory. The designation excludes rework, regrind, or scrap materials capable of being reclaimed within the same process that generated them (ISO 14021). Formerly known as post-industrial content.
- S. Regional Materials: Materials that are extracted/harvested/recovered, manufactured, and purchased within 100 miles of the project site.
- T. Responsible Sourcing of Raw Materials: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.
- U. Salvaged or Reused Materials (in regards to Low-Emitting Materials): Products that are more than one (1) year old at the time of use.
- V. Volatile Organic Compounds (VOC) Emissions Test: Product has been tested according to California Department of Public Health (CDPH) Standard Method v1.2-2017 and complies with the VOC limits in Table 4-1 of the method. Additionally, the range of total VOCs (TVOCs) after 14 days (336 hours) was measured as specified in the CDPH Standard Method v1.2 and reported (TVOC ranges: 0.5 mg/m³ or less, between 0.5 and 5 mg/m³, or 5 mg/m³ or more). Laboratories that conduct the tests must be accredited under ISO/IEC 17025 for the test methods they use. Products used must be evaluated using the default private office scenario. Statement of product compliance must include the exposure scenario used, the amount of wet-applied product applied in mass per surface area (if applicable), the range of total VOCs, and follow guidelines in CDPH

Standard Method v1.2-2017, Section 8. Organizations that certify manufacturers' claims must be accredited under ISO Guide 17065.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Work of this project includes completed building and application for LEED certification. Work is not complete until Owner has accepted USGBC's final review of LEED certification.
 - 1. Provide documentation required by LEED and LEED review.
- B. Provide materials and procedures necessary to obtain LEED prerequisites and credits required in this Section.
- C. Respond to questions and requests for additional information from Architect and the USGBC regarding LEED credits until the USGBC has made its determination on the project's LEED certification application.

1.05 ACTION SUBMITTALS

- A. Sustainable design submittals are in addition to other submittals.
- B. Sustainable Design Documentation Submittals:
 - 1. LEED v4 Product Information Form: Project submittals must be accompanied by a completed LEED v4 Product Information Form. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the LEED v4 Product Information Form.
 - MRp Construction and Demolition Waste Management Planning / MRc Construction and Demolition Waste Management: Comply with submittal requirements of Section 01 74 19 "Construction Waste Management and Disposal."
 - 3. MRc Building Product Disclosure and Optimization: Environmental Product Declarations, Option 1. Environmental Product Declaration (EPD).
 - a. EPDs complying with LEED requirements.
 - 4. MRc Building Product Disclosure and Optimization: Sourcing of Raw Materials, Responsible Sourcing of Raw Materials.
 - a. Extended Producer Responsibility: Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program.
 - b. Bio-Based Materials: Product data and certification for bio-based materials, indicating that they comply with requirements.
 - c. Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include vendor invoice indicating cost for each new wood product.
 - d. Materials Reuse: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.
 - e. Recycled Content: Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.

- f. Regionally Sourced Products: For products that are extracted/harvested/salvaged, manufactured, and were purchased within 100 miles of the project site only – Letter from product manufacturer stating product's extraction/harvest/salvage location(s), and manufacturing location. Vendor invoice or receipts showing location of purchase.
- 5. MRc Building Product Disclosure and Optimization: Material Ingredients, Option 1. Material Ingredient Reporting.
 - a. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting, including but not limited to the following:
 - 1) Manufacturer Inventory.
 - 2) Health Product Declaration.
 - 3) Cradle to Cradle Certification showing Material Health Level achievement.
 - 4) Declare Product Label.
 - 5) ANSI/BIFMA e3 Furniture Sustainability Standard compliance.
 - 6) Product Lens Certification.
 - 7) Facts NSF/ANSI 336: Sustainability Assessment for Commercial Furnishings Fabric certification.
- 6. EQc Low-Emitting Materials: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, for the following materials utilized on the building interior (everything within the waterproofing membrane):
 - a. Paints and Coatings: Includes all interior paints and coatings applied on-site.
 - b. Adhesives and Sealants: Includes all interior adhesives and sealants applied on-site.
 - c. Flooring: Includes all types of hard and soft surface flooring (carpet, ceramic, vinyl, engineered, solid wood, laminates), wall base, underlayments, and other floor coverings.
 - d. Wall Panels: Includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/ interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
 - e. Ceilings: Includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended ceiling systems (including canopies and clouds), and glazed skylights. Overhead structural elements (exposed, finished, or unfinished) are excluded.
 - f. Insulation: Includes all thermal and acoustic boards, batts, rolls, blankets, sound attenuation fire blankets, foamed-in place, loose-fill, blown, and spray insulation. Insulation for HVAC ducts and plumbing piping are excluded.
 - g. Furniture: Includes all stand-alone furniture items purchased for the project.
 - h. Composite Wood: Includes all particleboard, medium density fiberboard, hardwood veneer plywood, and structural composite wood not included in the flooring, ceiling, wall panels, or furniture material categories.
- 7. EQc Construction Indoor Air Quality Management Plan.
 - a. Product data for minimum MERV 8 temporary filtration media.
 - b. Product data for filtration media used during occupancy.
 - c. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach

employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost and shop labor for Division 3-11, 12 and 32 materials used for Project. Costs exclude site labor, overhead, and profit.
- C. Sustainable Design Action Plans: Provide preliminary submittals within 90 days of date established for commencement of the Work indicating how the following requirements will be met:
 - 1. MRp Construction and Demolition Waste Management Planning.
 - a. Construction and Demolition Waste Management Plan, complying with Section 01 74 19 "Construction Waste Management and Disposal."
 - 2. MRc Building Product Disclosure and Optimization: Environmental Product Declarations, Option 1. Environmental Product Declaration (EPD).
 - a. List of proposed products with Environmental Product Declarations.
 - 3. MRc Building Product Disclosure and Optimization: Sourcing of Raw Materials, Responsible Sourcing of Raw Materials.
 - a. List of proposed products complying with requirements for responsible sourcing of raw materials.
 - 4. MRc Building Product Disclosure and Optimization: Material Ingredients, Option 1. Material Ingredient Reporting.
 - a. List of proposed products complying with requirements for material ingredient reporting.
 - 5. EQc Construction Indoor Air Quality Management Plan.
 - a. Construction Indoor Air Quality Management Plan.
- 1.07 **LEED Progress Reports:** Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans, including relevant photographic documentation.

1.08 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.
- B. WEp/c Indoor Water Use Reduction, Compliance Path 2.
 - Minimum 40% aggregate water consumption reduction for toilets, urinals, lavatory faucets, kitchen faucets, and showerheads when compared to LEED baseline allowances (toilets 1.6 gpf, urinals 1.0 gpf, public lavatory faucet 0.5 gpm, *private lavatory faucet 2.2 gpm at 60 psi, kitchen faucet 2.2 gpm at 60 psi, showerhead 2.5 gpm at 80 psi).
 - a. *Private lavatory faucets are fixtures in residences, dormitories, hotel or motel guest rooms, nursing homes, and patient bathrooms in hospitals, most others are considered public lavatory faucets.
 - b. Toilets, urinals, private lavatory faucets, and showerheads must be WaterSense labeled, equivalent performance is not acceptable.
 - 2. Clothes washers (residential and commercial), residential dishwashers, and ice machines must be ENERGY STAR. Prerinse spray valves (commercial dish washing) must be 1.3 gpm (4.9 lpm) or less.
 - 3. No once-through cooling with potable water for any equipment or appliances that reject heat.
 - 4. Cooling towers and evaporative condensers must have: 1) Makeup water meters, 2) Conductivity controllers and overflow alarms, 3) Drift eliminators that reduce drift to maximum of 0.002% of recirculated water volume for counterflow towers and 0.005% of recirculated water flow for cross-flow towers.
 - 5. After meeting prerequisite requirement for 20% reduction due to efficient fixtures and appliances, alternative water sources (rainwater, greywater, etc.) may contribute to water use reduction calculations.
 - 6. Appliances must meet the requirements:
 - a. Dishwashers Undercounter, ≤1.6gal/rack; Stationary, single tank, door, ≤1.4 gal/rack; Single tank, conveyor, ≤1.0 gal/rack; Multiple tank, conveyor, ≤0.9 gal/rack; Flight machine ≤ 180 gal/hour
 - b. Food Steamer Batch, ≤ 6gal/hour/pan; Cook-to-order ≤ 10gal/hour/pan
 - c. Combination over Countertop or stand, \leq 3.5 gal/hour/pan; Roll-in, \leq 3.5 gal/hour/pan
 - 7. Standards for processes:
 - a. Discharge water temperature tempering Where local requirements limit discharge temperature of fluids into drainage system, use tempering device that runs water only when equipment discharges hot water OR Provide thermal recovery heat exchanger that cools drained discharge water below code-required maximum discharge temperatures while simultaneously preheating inlet makeup water OR If fluid is steam condensate, return it to boiler
 - b. Venturi-type flow-through vacuum generators or aspirators Use no device that generates vacuum by means of water flow through device into drain
- C. MRc Building Product Disclosure and Optimization: Environmental Product Declarations, Option 1. Environmental Product Declaration (EPD) v4.1.
 - 1. At least 20 different products from at least five (5) different manufacturers shall have Environmental Product Declarations that comply with LEED requirements.
 - 2. Product-Specific Declaration: Valued as one (1) whole product.

- 3. Product-Specific Type III EPD Internally Reviewed: Valued as one (1) whole product.
- 4. Industry-Wide (Generic) Type III EPD: Valued as one (1) whole product.
- 5. Product-Specific Type III EPD: Valued as 1.5 products.
- D. MRc Building Product Disclosure and Optimization: Sourcing of Raw Materials, Responsible Sourcing of Raw Materials v4.1.
 - 1. Use products sourced from at least 3 (or 5) different manufacturers that meet at least one of the sourcing and extraction criteria below for at least 20% (or 40%), by cost, of the total value of permanently installed building products in the project.
 - 2. Extended producer responsibility program: Valued at 50% of their cost.
 - 3. Bio-Based Materials tested using ASTM Test Method D6866 and Legally Harvested: Valued at 50% of their cost.
 - 4. Bio-Based Materials meeting the Sustainable Agriculture Network's Sustainable Agriculture Standard: Valued at 100% of their cost.
 - 5. Wood Products FSC Certified: Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products and are valued at 100% of their cost:
 - 1) Rough carpentry.
 - 2) Miscellaneous carpentry.
 - 3) Heavy timber construction.
 - 4) Wood decking.
 - 5) Metal-plate-connected wood trusses.
 - 6) Structural glued-laminated timber.
 - 7) Finish carpentry.
 - 8) Architectural woodwork.
 - 9) Wood paneling.
 - 10) Wood veneer wall covering.
 - 11) Wood flooring.
 - 12) Wood lockers.
 - 13) Wood cabinets.
 - 6. Materials Reuse: Valued at 200% of their cost.
 - 7. Recycled content: Valued at 100% of their cost.
 - 8. Regionally Sourced Products: Valued at 200% of their cost
- E. MRc Building Product Disclosure and Optimization: Material Ingredients, Option 1. Material Ingredient Reporting v4.1.
 - 1. Use at least 20 different permanently installed products from at least 5 different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:
 - a. Manufacturer Inventory.
 - b. Health Product Declarations (HPDs).
 - c. Cradle to Cradle (C2C) certifications.
 - d. Declare Product Labels.
 - e. ANSI/BIFMA e3 Furniture Sustainability Standard.
 - f. Product Lens Certification.
 - g. Facts NSF/ANSI 336: Sustainability Assessment for Commercial Furnishings Fabric Certification.
- F. MRp / MRc PBT Source Reduction-Mercury, prerequisite and credit, v4.1

- 1. Do not specify or install preheat, T-9, T-10, or T-12 fluorescents or mercury vapor highintensity discharge (HID) lamps in the project. Do not specify probe-start metal halide HID lamps in any interior spaces. Specify and install illuminated exit signs that do not contain mercury and use less than 5 watts of electricity. Fluorescent and high-pressure sodium lamps must meet the criteria in Table 1.
- 2. Specify and install fluorescent lamps with both low mercury content (MR Prerequisite PBT Source Reduction—Mercury) and long lamp life, as listed in Table 1.
- 3. Table 1:

Lamp	Maximum content	Lamp life (hrs)
T-8 fluorescent, eight-foot	10 mg mercury	Standard output - 24,000 rated hours on instant start ballasts (3-hour starts) High output – 18,000 rated hours on instant start ballasts or program start ballasts (3-hour starts)
T-8 fluorescent, four-foot	3.5 mg mercury	Both standard and high output - 30,000 rated hours on instant start ballasts, or 36,000 rated hours on program start ballasts (3 hour starts)
T-8 fluorescent, two-foot and three-foot	3.5 mg mercury	24,000 rated hours on instant start ballasts or program start ballasts (3-hour starts)
T-8 fluorescent, U-bent	6 mg mercury	18,000 rated hours on instant start ballasts, or 24,000 rated hours on program start ballasts (3-hour starts)
T-5 fluorescent, linear	2.5 mg mercury	Both standard and high-output - 25,000 rated hours on program start ballasts
T-5 fluorescent, circular	9 mg mercury	Both standard and high-output – 25,000 rated hours on program start ballasts
Compact fluorescent, nonintegral ballast	3.5 mg mercury	12,000 rated hours
Compact florescent, integral ballast, bare bulb	3.5 mg mercury, ENERGY STAR qualified	Bare bulb - 10,000 rated hours Covered models such as globes, reflectors, A-19s – 8,000 hours
High-pressure sodium, up to 400 watts	10 mg mercury	Use noncycling type or replace with LED lamps or induction lamps
High-pressure sodium, above 400 watts	32 mg mercury	Use noncycling type or replace with LED lamps or induction lamps

- G. MRc PBT Source Reduction-Lead, Cadmium, and Copper: Specify substitutes for materials manufactured with lead and cadmium, as follows.
 - 1. Lead
 - a. For water intended for human consumption, specify and use solder and flux to connect plumbing pipe on site that meets the California AB1953 standard, which specifies that solder not contain more than 0.2% lead, and flux not more than a weighted average of 0.25% lead for wetted surfaces. The "lead free" label as defined by the Safe Drinking Water Act (SDWA)) does not provide adequate screening for the purposes of this credit because the SDWA defines "lead free" as solders and flux containing 0.2% lead or less.
 - b. For water intended for human consumption, specify and use pipes, pipe fittings, plumbing fittings, and faucets that meet the California law AB1953 of a weighted average lead content of the wetted surface area of not more than 0.25% lead.
 - c. Specify and use lead-free roofing and flashing.
 - d. Specify and use electrical wire and cable with lead content less than 300 parts per million.
 - e. Specify no use of interior or exterior paints containing lead.
 - f. For renovation projects, ensure the removal and appropriate disposal of disconnected wires with lead stabilizers, consistent with the 2002 National Electric Code requirements.
 - g. Lead used for radiation shielding and copper used for MRI shielding are exempt.
 - 2. Čadmium
 - a. Specify no use of interior or exterior paints containing intentionally added cadmium.
 - 3. Copper
 - a. For copper pipe applications, reduce or eliminate joint-related sources of copper corrosion:
 - b. use mechanically crimped copper joint systems; or
 - c. specify that all solder joints comply with ASTM B828 2002, and specify and use ASTM B813 2010 for flux.
- H. MRc Furniture and Medical Furnishings
 - 1. Use at least 30% (1 point) or 40% (2 points), by cost, of all freestanding furniture and medical furnishings that meet the criteria in one of the following three options.
 - a. Option 1. Minimal Chemical Content
 - 1) All components that constitute at least 5%, by weight, of a furniture or medical furnishing assembly, including textiles, finishes, and dyes, must contain less than 100 parts per million (ppm) of at least four of the five following chemical groups:
 - 2) urea formaldehyde;
 - 3) heavy metals, including mercury, cadmium, lead, and antimony;
 - hexavalent chromium in plated finishes consistent with the European Union Directive on the Restriction of the Use of Certain Hazardous Substances (EU RoHS);
 - 5) stain and nonstick treatments derived from perfluorinated compounds (PFCs), including perfluorooctanoic acid (PFOA); and
 - 6) added antimicrobial treatments.
 - b. Option 2. Testing and Modeling of Chemical Content
 - All components of a furniture or medical furnishing assembly, including textiles, finishes, and dyes, must contain less than 100 parts per million (ppm) of at least two of the five chemicals or materials listed in Option 1. New furniture or medical furnishing assemblies must be in accordance with ANSI/BIFMA Standard Method M7.1–2011. Comply with ANSI/BIFMA e3-

2010 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2, using either the concentration modeling approach or the emissions factor approach. Model the test results using the open plan, private office, or seating scenario in ANSI/BIFMA M7.1, as appropriate. USGBC-approved equivalent testing methodologies and contaminant thresholds are also acceptable. Documentation submitted for furniture must indicate the modeling scenario used to determine compliance. Salvaged and reused furniture more than one year old at the time of use is considered compliant, provided it meets the requirements for any site-applied paints, coatings, adhesives, and sealants.

- c. Option 3: Building Product Disclosure and Optimization
 - 1) Use products that meet at least one of the criteria below. Each product can receive credit for each criterion met. The scope of any environmental product declaration (EPD) must be at least cradle to gate.
 - 2) Life-cycle assessment and environmental product declarations.
 - a) Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope are valued as one whole product for the purposes of credit achievement calculation.
 - b) Product-specific Type III EPD -- Internally Reviewed. Products with an internally critically reviewed LCA in accordance with ISO 14071. Products with product-specific internal EPDs which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope are valued as one whole product for the purposes of credit achievement calculation.
 - c) Industry-wide Type III EPD -- Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Products with industry-wide EPDs, which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope are valued as one whole product for the purposes of credit achievement calculation.
 - 3) Environmental Product Declarations which conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 - a) Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification and external critical review are valued as 1.5 products for the purposes of credit achievement calculation.
 - 4) Extended producer responsibility. Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purposes of credit achievement calculation.
 - 5) Bio-based materials. Bio-based products and materials other than wood must be tested using ASTM Test Method D6866 or equivalent method ISO 16620-2 or be certified to the USDA BioPreferred Voluntary Labeling Initiative that includes verification via ASTM 6866 testing. Exclude hide products, such as leather and other animal skin material.
 - a) Bio-based products that meet the criteria above: value at 50% of cost multiplied by the biobased content of the product for the purposes of credit achievement calculation.
 - b) Bio-based products that meet the Sustainable Agriculture Network's Sustainable Agriculture Standard in addition to the testing

requirements above: value at 100% of cost multiplied by the biobased content of the product for the purposes of credit achievement calculation.

- Wood products. Wood products must be certified by the Forest Stewardship 6) Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.
- 7) Materials reuse. Reuse includes salvaged, refurbished, or reused products. Products meeting materials reuse criteria are valued at 200% of their cost for the purposes of credit achievement calculation.
- Recycled content, Products meeting recycled content criteria are valued at 8) 100% of their cost for the purposes of credit achievement calculation.
 - Recycled content is the sum of postconsumer recycled content plus a) one-half the preconsumer recycled content, based on weight.
 - The recycled fraction of the assembly is then multiplied by the cost of b) assembly to determine the recycled content value.
- Products that meet the above criteria are valued according to source 9) location (extraction, manufacture, and purchase point must be within the distances noted below): For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost.
- LOW-EMITTING MATERIALS v4.1 Ι.
 - EQc Low-Emitting Materials: General Emissions Evaluation. 1.
 - a. Products that require a general emissions evaluation must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.2-2017, using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (TVOC) after 14 days measured as specified in the CDPH Standard Method v1.2 as follows:
 - 0.5ma/m3 or less. 1)
 - 2) between 0.5 and 5.0 mg/m3 or,
 - 0.50 mg/m3 or more. 3)
 - 2. EQc Low-Emitting Materials: Paints and Coatings.
 - For field applications that are inside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

Product Type:	Allowable VOC Content (g/L):	
Bond Breaker	350	
Clear wood finishes - Varnish		275
Clear wood finishes – Sanding Sealer		275
Clear wood finishes - Lacquer		275
Colorant – Architectural Coatings, excluding IM coatings		50
Colorant – Solvent Based IM		600
Colorant - Waterborne IM		50
Concrete – Curing compounds		100
Concrete – Curing compounds for roadways & bridges		350
Concrete surface re	50	
ent Hospital	01 8113 - 12	SUSTAINABLE DESIG

Driveway Sealer	50
Dry-fog coatings	50
Faux finishing coatings - Clear topcoat	100
Faux finishing coatings – Decorative Coatings	350
Faux finishing coatings - Glazes	350
Faux finishing coatings - Japan	350
Faux finishing coatings – Trowel applied coatings	50
Fire-proof coatings	150
Flats	50
Floor coatings	50
Form release compounds	100
Graphic arts (sign) coatings	200
Industrial maintenance coatings	100
Industrial maintenance coatings – High temperature IM	420
coatings	
Industrial maintenance coatings – Non-sacrificial anti-graffiti	100
coatings	
Industrial maintenance coatings – Zinc rich IM primers	100
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Non-flat coatings	50
Pre-treatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Stone consolidant	450
Sacrificial anti-graffiti coatings	50
Shellac- Clear	730
Shellac – Pigmented	550
Specialty primers	100
Stains	100
Stains, interior	250
Swimming pool coatings – repair	340
Swimming pool coatings - other	340
Traffic Coatings	100
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood preservatives	350
Low solids coatings	120

b. For field applications that are inside the weatherproofing system, 75%, by volume or surface area, of paints and coatings shall meet the VOC emissions evaluation AND 100% shall meet the VOC content evaluation."

- 3. EQc Low-Emitting Materials: Adhesives and Sealants
 - a. For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the limits for VOC content when calculated according to

Architectural Applications:	Allowable VOC Content (g/L):
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Specialty Applications:	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Computer diskette manufacturing	350
Contact adhesive	80
Special purpose contact adhesive	250
Tire tread adhesive	100
Adhesive primer for traffic marking tape	150
Structural wood member adhesive	140
Rubber vulcanization adhesive	850
Top and Trim adhesive	250
Substrate Specific Applications:	
Metal to metal substrate specific adhesives	30
Plastic foam substrate specific adhesives	50
Porous material (except wood) substrate specific adhesives	50
Wood substrate specific adhesives	30
Fiberglass substrate specific adhesives	80
Reinforced plastic composite substrate specific adhesive	250
Sealants:	
Architectural sealant – Clear, paintable, and immediately water- resistant sealant	250
Foam Insulation	250
Foam Sealant	250
Grout	65
Marine deck sealant	760
Roadway sealant	250
Non-Staining Plumbing Putty	150
Single-ply roof membrane sealant	450
Other roofing sealants	300
Other sealants	420

South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on October 6, 2017:

Sealant Primers:	
Architectural non-porous sealant primer	250
Architectural porous sealant primer	775
Modified bituminous sealant primer	500
Marine deck sealant primer	760
Other sealant primer	750

- b. For field applications that are inside the weatherproofing system, 75% of adhesives and sealants, by volume or surface area, shall meet the VOC emissions evaluation AND 100% meet the VOC content evaluation.
- 4. EQc Low-Emitting Materials: Flooring.
 - a. At least 90% of all flooring, by cost or surface area, meets the VOC emissions evaluation OR inherently non-emitting sources criteria, OR salvaged and reused materials criteria.
- 5. EQc Low-Emitting Materials: Wall Panels.
 - a. At least 75% of all wall panels, by cost or surface area, meet the VOC emissions evaluation, OR inherently nonemitting sources criteria, OR salvaged and reused materials criteria.
- 6. EQc Low-Emitting Materials: Ceilings.
 - a. At least 90% of all ceilings, by cost or surface area, meet the VOC emissions evaluation, OR inherently nonemitting sources criteria, OR salvaged and reused materials criteria.
- 7. EQc Low-Emitting Materials: Insulation.
 - a. At least 75% of all insulation, meets the VOC emissions evaluation.
- 8. EQc Low-Emitting Materials,: Composite Wood.
 - a. At least 75% of all composite wood, by cost or surface area, meets the Formaldehyde emissions evaluation OR salvaged and reused materials criteria.

PART 3 - EXECUTION

3.01 NONSMOKING BUILDING

A. EQp Environmental Tobacco Smoke Control: Smoking (including tobacco smoke, as well as the smoke produced from the combustion of cannabis and controlled substances and the emissions produced by electronic smoking devices) is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.02 CONSTRUCTION WASTE MANAGEMENT

A. MRc Construction and Demolition Waste Management: Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.03 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT v4.1

A. *Moisture*. Develop and implement a moisture control plan to protect stored on-site and installed absorptive materials from moisture damage. Immediately remove from site and properly dispose of any materials susceptible to microbial growth and replace with new, undamaged materials. Also include strategies for protecting the building from moisture intrusion and preventing occupants' exposure to mold spores.

- B. Particulates. Do not operate permanently installed air-handling equipment during construction unless filtration media with a minimum efficiency reporting value (MERV) of 8, as determined by ASHRAE 52.2–2017, with errata (or media with ISO_{coarse} 90% or higher, as defined by ISO 16890-2016, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media. Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer's recommendations.
- C. VOCs. Schedule construction procedures to minimize exposure of absorbent materials to VOC emissions. Complete painting and sealing before storing or installing "dry" materials, which may accumulate pollutants and release them over time. Store fuels, solvents, and other sources of VOCs separately from absorbent materials.
- D. Outdoor emissions. For renovation projects involving waterproofing, repairing asphalt roofing, sealing parking lots, or other outdoor activities that generate high VOC emissions, develop a plan to manage fumes and avoid infiltration to occupied spaces. Comply with the procedures established by NIOSH, Asphalt Fume Exposures during the Application of Hot Asphalt to Roofs (Publication 2003–112).
- E. *Tobacco.* Prohibit the use of tobacco products inside the building and within 25 feet (7.5 meters) of the building entrance during construction.
- F. Noise and vibration. Develop a plan based on the British Standard (BS 5228) to reduce noise emissions and vibrations from construction equipment and other nonroad engines by specifying low-noise emission design or the lowest decibel level available that meets performance requirements in the British Standard. Construction crews must wear ear protection in areas where sound levels exceed 85 dB for extended periods.
- G. Infection control. For renovations and additions adjacent to occupied facilities or phased occupancy in new construction, follow the FGI 2018 Guidelines for Design and Construction of Hospitals, Guidelines for Design and Construction of Outpatient Facilities, Guidelines for Design and Construction of Residential Health, Care, and Support Facilities and The Joint Commission Standards to establish an integrative infection control team comprising the owner, designer, and contractor to evaluate infection control risk and document the required precautions in a project-specific plan. Use the Guidelines for Environmental Infection Control in Health-Care Facilities, 2003, updated July 2019 to assess risk and to select mitigation procedures for construction activities.

3.04 IAQ ASSESSMENT v4.1

- A. Flush-Out:
 - 1. Install new filtration media prior to start of building flush.
 - 2. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14,000 cu. ft. of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60 deg F and no higher than 80 deg F and a relative humidity no higher than 60%.
 - 3. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3,500 cu. ft. of outdoor air per square foot of floor area to the space while maintaining an internal temperature of at least 60 deg F and no higher than 80 deg F and relative humidity no higher than 60%. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot of outdoor air or the design minimum outdoor air rate, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of three hours prior to occupancy and

continue during occupancy. These conditions must be maintained until a total of 14,000 cu. ft./sq. ft. of outdoor air has been delivered to the space.

- B. Air-Quality Testing: Engage testing agency to perform the following:
 - 1. After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing in occupied spaces for the following contaminants, and as additionally detailed in the USGBC's "LEED Reference Guide for Building Design and Construction."
 - LEED v4.1 EQc Indoor Air Quality Assessment, Option 2, Air Testing Path 1. Particulate Matter and Inorganic Gases: Test for the particulate matter (PM) and inorganic gases listed below, using the allowed testing method, and demonstrate that the contaminants do not exceed the concentration limits listed below.
 - a. Carbon Monoxide (CO): 9 ppm; no more than 2 ppm above outdoor levels as tested per ISO 4224, EPA Compendium Method IP-3, GB/T 18883-2002 for projects in China, or Direct calibrated electrochemical instrument with accuracy of +/- 3% ppm and resolution of 0.1 ppm.
 - PM 10: ISO 14644-1:2015, cleanroom class of 8 or lower, 50 mg/m³, or Healthcare only (20 mg/m³) as tested by Particulate monitoring device with accuracy greater than 5 mg/m³ or 20% of reading and resolution (5 min average data) +/- 5 mg/m³.
 - c. PM 2.5: 12 mg/m³ or 35 mg/m³ (for projects in known EPA nonattainment areas for PM2.5 or local equivalents) as tested by Particulate monitoring device with accuracy greater than 5 mg/m³ or 20% of reading and resolution (5 min average data) +/- 5 mg/m³.
 - d. Ozone: 0.07 ppm as tested by Monitoring devices with accuracy of 5 ppb or 20% of reading and resolution (5 min average data) +/- 5 ppb, ISO 13964, ASTM D5149- 02, or EPA designated methods for Ozone.
 - 3. EQc Indoor Air Quality Assessment, Option 2, Air Testing Path 2. Volatile Organic Compounds: Perform a screening test for Total Volatile Organic Compounds (TVOC) using ISO 16000-6, EPA TO-17, or EPA TO-15 to collect and analyze the air sample. Calculate the TVOC value per EN 16516:2017, CDPH Standard Method v1.2 2017 Section 3.9.4, or alternative calculation method as long as full method description is included in test report. If the TVOC levels exceed 500 mg/m3, investigate for potential issues by comparing the individual VOC levels from the GC/MS results to associated cognizant authority health-based limits. Correct any identified issues and re-test if necessary. Additionally, test the individual volatile organic compounds listed below using an allowed test method, and demonstrate that the contaminants do not exceed the concentration limits listed below.
 - a. Formaldehyde 50-00-0: 20 mg/m³ (16 ppb) as tested by ISO 16000-3, 4; EPA TO-11a; EPA Comp. IP-6; or ASTM D5197-16.
 - b. Acetaldehyde 75-07-0: 140 mg/m³ as tested by ISO 16000-3, 4; EPA TO-11a; EPA Comp. IP-6; or ASTM D5197-16.
 - c. Benzene 71-43-2: 3 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
 - d. Hexane (n-) 110-54-3: 7000 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
 - e. Naphthalene 91-20-3: 9 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
 - f. Phenol 108-95-2: 200 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
 - g. Styrene 100-42-5: 900 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
 - h. Tetrachloroethylene 127-18-4: 35 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.

- i. Toluene 108-88-3: 300 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
- j. Vinyl Acetate 108-05-4: 200 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
- k. Dichlorobenzene (1,4-) 106-46-7: 800 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
- I. Xylenes-total 108-38-3, 95-47-6, and 106-42-3: 700 mg/m³ as tested by ISO 16000-6; EPA IP-1; EPA TO-17; EPA TO-15; ISO 16017-1, 2; or ASTM D6196-15.
- 4. Laboratories performing tests must be accredited under ISO/IEC 17025 for the test methods they use.
- 5. For each sampling point where the maximum concentration limits are exceeded, take corrective action until requirements have been met.
- 6. Air-sample testing shall be conducted as follows:
 - a. Building shall have all interior finishes installed, including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Furnishings are required to be in place for the testing.
 - b. Number of sampling locations varies depending on the size of building and number of ventilation systems. At least one location per ventilation system (preferably worst-case zones), one location per building floor, and one location per space type should be tested. For offices, retail, schools, hospitality, and multifamily residential projects, test areas no larger than 5,000 sq. ft. For large open spaces, one sampling point per 50,000 sq. ft. (4654 sq. m) may be used. Determine whether the project has spaces that are identical. Project teams may sample identical spaces by testing one in seven. If the space fails the test, all seven must be tested. For large buildings with series of identical spaces (more than 21 spaces in a sample group), test a minimum of three spaces in the sample group.
 - c. Air samples shall be collected between 3 and 6 feet above the floor to represent the breathing zone of occupants.

END OF SECTION

SECTION 02 4113 SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SELECTIVE SITE DEMOLITION as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SELECTIVE SITE DEMOLITION shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Demolition and removal of selected site improvements.
- B. Disconnecting, capping or sealing, and abandoning in-place and removing site utilities.
- C. Salvaging items for reuse by Owner.

1.4 RELATED SECTIONS

- A. 31 10 00 Site Clearing
- B. 31 23 00 Excavation and Fill
- C. 31 25 00 Erosion and Sedimentation Controls
- D. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah
- B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- C. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- D. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- E. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

1.6 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any finished surfaces that might be misconstrued as damage caused by demolition operations.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective site demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.

4. Coordination of Owner's continuing occupancy of portions of existing building and use of the site.

1.7 QUALITY ASSURANCE

- A. PRE-DEMOLITION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.
 - 2. Inspect and discuss condition of construction to be demolished.
 - 3. Review structural load limitations of existing structures.
 - 4. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review and finalize protection requirements.
 - 7. Review procedures for dust control.
 - 8. Review procedures for protection of adjacent buildings.
 - 9. Review items to be salvaged and returned to Owner.
 - 10. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.8 CLOSEOUT SUBMITTALS

A. Submit a list of items that have been removed and salvaged.

1.9 REGULATORY REQUIREMENTS

A. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

- A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.
- B. CONSTRUCTION MANAGER shall make application, pay permit fees, and obtain any and all other demolition permits.

1.11 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of CONSTRUCTION MANAGER.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.12 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.

1.13 CONSTRUCTION CONTROL

- 1. Do not commence work until temporary erosion and sedimentation control measures are in place.
- 2. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- 3. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to

construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.15 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.16 FIELD CONDITIONS

- A. Notify ARCHITECT of discrepancies between existing conditions and Drawings before proceeding with SELECTIVE SITE DEMOLITION.
- B. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
 - 1. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 2. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 3. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before building demolition, coordinate with the Owner of any items Owner will remove prior to demolition and any items Owner wants CONSTRUCTION MANAGER to salvage for Owner's reuse.
- D. On-site storage or sale of removed items or materials is not permitted.

1.17 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

1.18 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction.

Provide enough lights, warning signs, and watchmen for the safety of the public.

- Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
- 4. CONSTRÚCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.19 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify Owner and ARCHITECT (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with ARCHITECT concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with governing CITY, STATE, and FEDERAL notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 "Safety Requirements for Demolition Operations" from the American National Standard for Construction and Demolition Operations, and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 31 2300 Excavation and Fill.

PART 3 - EXECUTION

3.1 PRE-DEMOLITION WORK

- A. Contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. Notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility. CONSTRUCTION MANAGER shall also

coordinate the construction activities with the utility companies to ensure compliance with the project schedule.

- C. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to demolition. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.
- E. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- F. Photograph, record on video, or both the existing conditions of the Project site and adjoining property.

3.2 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.3 TEMPORARY EROSION CONTROLS

- A. See 31 25 00 Erosion and Sedimentation Controls.
- B. Comply with the City, State, and Federal requirements for the minimization and control of sediment erosion and site run-off in storm water resulting from construction activities. Install temporary erosions controls prior to SELECTIVE SITE DEMOLITION. Comply with the requirements of the Storm Water Pollution Prevention Plan and the permit(s) issued by the City and State.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Cut off pipe or conduit a minimum of 36 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

- d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
- 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.5 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - a. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - 2. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
 - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 - 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- E. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- F. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.6 DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small

power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

- 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
- 5. Maintain fire watch during and for at least per NFPA 51B hours after flame-cutting operations.
- 6. Maintain adequate ventilation when using cutting torches.
- 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
- 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Pack or crate items after cleaning. Identify contents of containers.
 - 2. Transport items to Owner's storage area designated by Owner.
 - 3. Protect items from damage during transport and storage.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.
- E. Explosives: Use of explosives is not permitted.

3.7 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated below:
 - 1. Coordinate with Owner prior to demolition.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
- E. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 8 feet outside footprint indicated for new construction. Abandon utilities outside this area.
 - 1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 31 23 00 Excavation and Fill.
- F. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.
- G. Pavement: Demolish pavement in sections. Cut pavement full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove pavement between saw cuts. Pavement shall be saw cut in straight lines.

3.8 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to

dimensions indicated.

- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using powerdriven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.9 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.10 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.11 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.12 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
- B. Clean roadways of debris caused by debris transport.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.

1.3 **DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 **PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Owner's Independent testing agency.
 - c. Ready-mix concrete manufacturer responsible for concrete design mixtures.
 - d. Concrete Subcontractor.
 - e. Contractor/subcontractor's quality control supervisor.
 - f. Architect/Structural Engineer representative.
 - g. Owner's representative.
 - h. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips,

semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement in sufficient detail without reference to contract documents. Drawing shall include as a minimum the bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. The Drawings should clearly identify column grid locations, dimensions, and section cuts in sufficient detail to locate bar placement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
 - 2. Contractor shall submit drawings showing construction and expansion joints for review by the Architect and design teams.
- E. Samples:
 - 1. Waterstops
 - 2. Vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. Installer
 - 2. Manufacturer
 - 3. Testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.

- 7. Floor and slab treatments.
- 8. Bonding agents.
- 9. Adhesives.
- 10. Vapor retarders.
- 11. Semirigid joint filler.
- 12. Joint-filler strips.
- 13. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures if required.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301 (ACI 301M).
 - 2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
 - 3. Overlaid Finnish birch plywood.

- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 1064/A 1064M,.
- E. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- F. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as- drawn steel wire into flat sheets.
- G. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II,.
 - 2. Fly Ash: ASTM C 618, Class C or Class F.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 - 4. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

2.6 FIBER REINFORCEMENT

A. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C116/C 116M, Type III, 1 to 2 14 inches (25 to 57 mm long). Minimum addition rate shall be 5.0 lbs/yd3. Use of this produce shall be pre-approved by the SEOR and accepted by the GC. Explicit location for its use shall be identified.

2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Ribbed with center bulb.
 - 2. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Ribbed with center bulb.
 - 2. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
- D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.8 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A
 - 1. Water vapor permeance (ASTM E96) = 0.3 Perms
 - 2. Tensile strength (ASTM D828 or D882) = 45.0 lbf/in.
 - 3. Puncture resistance (ASTM D1709) = 5lb
 - 4. Minimum thickness = 15 mils
 - 5. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips:
 - 1. ASTM D 1751, asphalt-saturated cellulosic fiber
 - 2. ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 15 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings, Tie Beams, Stem Walls, Grade Beams, Interior Concrete Walls: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Minimum Cementitious Materials Content: 550 lb/cu. yd. (326 kg/cu. m).
 - 4. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 5. Air Content: 6 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
- B. Interior Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Minimum Cementitious Materials Content: 550 lb/cu. yd. (326 kg/cu. m).
 - 4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Concrete over steel deck: Normal-weight concrete.

- 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
- 2. Maximum W/C Ratio: 0.45.
- 3. Minimum Cementitious Materials Content: 550 lb/cu. yd. (326 kg/cu. m).
- 4. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
- 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- D. All other concrete: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 4. Air Content: 6 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.

- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations approved by Structural Engineer.

- 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
- 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
- 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
- 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealantsare indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOP INSTALLATION

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated or approved by structural engineer. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.

- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluidapplied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
 - D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel

marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

- 1. Apply a trowel finish to surfaces indicated or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
- 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - c. Specified overall values of flatness, F(F) 25; with minimum local values of flatness, F(F) 17; for elevated concrete over steel deck.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiberbristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 - 2. After broadcasting and tamping, apply float finish.
 - 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.
- H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:
 - 1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer.
 - 2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
 - 3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - Construct concrete bases 4 inches (100 mm) high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 12-inch (305-mm) centers around the full perimeter of concrete base.
 - 5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

- 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
- 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: If curing compounds are used on surfaces (exterior or interior, formed or unformed) that are scheduled or specified to receive surface-adhered treatment (including but not limited to cementitious toppings/overlays, adhesive applied carpet, resilient flooring, terrazzo, thin-set ceramic tile/stone, wood, coatings, paint, waterproofing, membranes, athletic flooring, epoxy overlay/adhesive, hardeners, sealers, water repellents, or other covering system adhered with water-based adhesive), then the following requirements apply:
 - 1) Remove curing compound no later than 7 days after end of curing period by mechanical bead blast process acceptable to Architect.
 - 2) Allow sufficient additional time after curing compound removal to achieve proper concrete moisture and/or water vapor limitation for successful application of subsequent surface treatment as specified in appropriate surface treatment specification Section.
 - b. Do not use curing compounds at concrete surfaces that are to receive the following finishes:
 - 1) Penetrating liquid floor hardener and sealer.
 - 2) Polished concrete.
 - 3) Chemical stain.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENT APPLICATION

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar

before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

- 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. As indicated on contract documents.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete;one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - b. Cast and field cure one set of three standard cylinder specimens for each mix per day.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one of three laboratory-cured specimens at 7 days and one of two specimens at 28 days. Retain the third specimen for low breaks and evaluation if other specimens fail.
 - 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 - 8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests or as directed.
 - 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 - 10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect/Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect/Engineer.

- 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements. If the contractor chooses to request additional specimens to test for early breaks, the cost shall be paid by the contractor requesting the additional tests.
- 12. The contractor shall correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents at no additional cost to the owner.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 72 hours of finishing.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 3000

SECTION 03 30 00.01 CAST-IN-PLACE CONCRETE FOR LANDSCAPING

PART1- GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete footings and foundations.
- B. Control, expansion and contraction joint devices associated with concrete work, including joint sealants.

1.2 RELATED SECTIONS

- A. SECTION 03 35 19 Decorative Concrete Paving
- B. SECTION 03 45 01 Site Structures Precast Concrete

1.3 REFERENCES

- A. American Concrete Institute (ACI):
- 1. 301 Structural Concrete for Buildings.
- 2. 302 Guide for Concrete Floor and Slab Construction.
- 3. 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- 4. 305R Hot Weather Concreting.
- 5. 306R Cold Weather Concreting.
- 6. 308 Standard Practice for Curing Concrete.
- 7. 318 Building Code Requirements for Reinforced Concrete.
 - B. American Society for Testing and Materials (ASTM):
- 1. D 994 Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- 2. D 1190 Concrete Joint Sealer, Hot-Poured Elastic Type.
- 3. D 1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- 4. D 1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- 5. B 221 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- 6. C 33 Concrete Aggregates.
- 7. C 94 Ready-Mixed Concrete.
- 8. C 150 Portland Cement.
- 9. C 260 Air Entraining Admixtures for Concrete.
- 10. C 330 Light Weight Aggregates For Structural Concrete.
- 11. C 494 Chemicals Admixtures for Concrete.
- 12. C 618 Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.4 SUBMITTALS

- A. Product Data: Provide data on joint devices, attachment accessories and admixtures.
- B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.
- 1. Accepted sample becomes the standard of acceptance of the work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Acquire cement and aggregate from same source for all work.
- C. Conform to ACI 305R when concreting during hot weather.
- D. Conform to ACI 306R when concreting during cold weather.

1.6 COORDINATION

- A. Coordinate work with other work proposed on site.
- B. Coordinate the placement of joint devices with erection of concrete form work and placement of form accessories.

PART 2 - PRODUCTS

1.1 CONCRETE MATERIALS

- A. Cement: ASTM C 150, Type I, II or III for general work.
- B. Aggregates: ASTM C 33.
- 1. Odot Type 'A' Aggregate.
 - 2. Coarse Aggregate: General Work: Size No. 57 (1" to No. 4).
 - 3. Fine Aggregate: ASTM C 33; dune, bank-run and manufactured sands not acceptable. C. Water: Clean and not detrimental to concrete.

1.2 ADMIXTURES

- A. Air Entrainment: ASTM C 260.
- B. Chemical: ASTM C 494, Type C Accelerating
- C. Water-Reducing: ASTM C 494, Type A (water reducing) or Type D Water Reducing and Retarding.

1.3 FORM MATERIALS

A. STRIP FORMS:

- 1. Approved type plywood, metal, metal framed plywood, plastic overlaid plywood, wood or other type panel materials of maximum panel size and strength to resist movement during concrete placement, to retain horizontal and vertical alignment until removed, and to minimize number of joints.
 - a. Plywood: PS 1-83; APA B-B plyform Class I; factory sanded faces; factory mill-oiled and edge sealed.
 - b. Plastic Overlaid Plywood: PS 1; APA High Density Overlaid Plyform Class I; factory sealed edges; both faces factory sanded and coated with hard, smooth, semi-opaque surface of thermosetting, resin impregnated material forming durable, continuous bond with plywood.
 - c. Metal-Framed Plywood: Matched, tight fitting type approved prior to use or purchase.
 - d. Steel: Minimum 16 gage sheet well matched, tight fitting, stiffened to support concrete weight without deflection detrimental to tolerances and appearance of finished surfaces.

B. Form Accessories:

1. Form Coating: Commercial formulated type that will not bond with, stain, nor adversely affect concrete surfaces, which will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compounds.

1.4 CONCRETE PROPORTIONING AND DESIGN MIXES

- A. General
- 1. Proportion materials by weight or volume. Use measuring methods that are adjustable, controlled and easily checked.
 - a. Cement: Measure by weight on scale or weight hopper separate and distinct from those used for other materials.
 - b. Coarse and Fine Aggregate: Measure by weight. Include weight of dry material plus total weight of absorbed and surface moisture contained in aggregate.
 - c. Mixing Water: Measure by Weight or volume. Include water contained in aggregate, water introduced in form of admixtures, and water added to batch.
 - d. Admixtures: measure powdered admixtures by weight, and paste or liquid admixtures by weight or volume.
 - B. Normal Weight Portland Cement Concrete
- 1. Min. 28 Day Compressive Strength: 3,500 psi.
- 2. Slump Range (In Inches): 2 to 4.
- 3. Admixture Required: As required and approved.
- 4. Min. Sacks Cement per Cu. Yd.: 5
 - C. Use accelerating admixtures in cold weather only when approved by Landscape Architect. Use of admixtures will not relax cold weather placement requirements.
 - D. Use set retarding admixtures during hot weather only when approved by Landscape Architect.
 - E. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 - EXECUTION

1.1 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304.
- B. Notify Landscape Architect a minimum 24 hours prior to commencement of operations.
- C. Vibrate concrete into seatwall forms.

1.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed in accordance with ACI 301.
- B. Provide free access to Work and cooperate with appointed firm.
- C. Submit proposed mix design to and testing firm for review prior to commencement of Work.
- D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 03 35 19 DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This section includes the complete installation of colored concrete paving and coping as indicated on the Drawings including:
 - 1. Materials: Forming materials, reinforcement, concrete, dryshake color hardener, curing compound, release agent, and sealer.
 - 2. Special imprinting and texturing tools.
 - 3. Concrete placement and finish.
 - 4. Color hardener and release agent placement.
 - 5. Pressure washing to remove excess release agent.
 - 6. Curing compound application.
 - 7. Sealer application.

1.02 RELATED SECTIONS

- A. SECTION 32 91 19 Landscape Grading: Excavation of subsoil and backfill of over excavated or fill areas.
- B. SECTION 03 30 00 Cast-In-Place Concrete for Landscaping

1.03 REFERENCES AND STANDARDS

- A. AMERICAN CONCRETE INSTITUTE (ACI):
 - 1. 301 Structural Concrete for Buildings
 - 2. 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

- 1. A615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- 2. C33 Concrete Aggregates.
- 3. C94 Ready Mix Concrete.
- 4. C143 Slump of Hydraulic Cement Concrete.
- 5. C150 Portland Cement.
- 6. C171 Sheet Materials for Curing Concrete.
- 7. C172 Sampling Fresh Concrete.
- 8. C173 Air Content of Freshly Mixed Concrete by Volumetric Method.
- 9. C231 Air content of Freshly mixed Concrete by the Pressure Method.
- 10. C260 Air-Entraining Admixtures for Concrete.
- 11. C309 Liquid Membrane-Forming Compounds for Curing Concrete.
- 12. C494 Chemical Admixtures for Concrete.
- 13. C509 Elastomeric Cellular Preformed Gasket and Sealing Material.
- 14. D698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- 15. D1556 Test Method for Density of Soil in Place by the Sand-Cone Method.
- 16. D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- 17. D1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- 18. D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- 19. D3017 Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.04 QUALITY ASSURANCE

- A. Criteria: The work shall include all labor, material, equipment and transportation required to install surface colored concrete paving. The Contractor shall have more than 7 years experienced in the construction of shake applied colored and textured concrete paving. The Contractor shall is required to provide a foreman or supervisor who has done at least three similar installations of high quality.
- B. Work shall be performed according to the American Concrete Institutes standards and practices.

- C. Perform work in accordance with ACI 301 requirements of SECTION: Cast-in-Place Concrete.
- D. Obtain cementitious materials from same source throughout.
- E. Pre qualified contractors include the following"1. Bomanite of Oklahoma, Oklahoma City, OK 405.842.6262.

1.05 SUBMITTALS

- A. Submit as guided in the Front end specifications and SECTION: Submittals
- B. Product Data: Provide data on joint filler, bond breaker, joint sealant, admixtures, color hardener, release agent, and seamless texture.
 - 1. Concrete type "1": Colored Concrete Sandscape texture, by Bomanite Corporation, Madera, CA, (559) 673-2411.
 - Concrete type "2": Colored Concrete Reveal by Bomanite Corporation, Madera, CA, (559) 673-2411.
 - 3. Concrete type "3": Colored Concrete Reveal by Bomanite Corporation, Madera, CA, (559) 673-2411.
 - 4. Concrete type "4" Colored Concrete Reveal by Bomanite Corporation, Madera, CA, (559) 673-2411.
 - 5. Decorative paving types, colors, and textures to match existing paving at the adjacent Outpatient Building on site.
- C. Samples:
 - 1. Colored Concrete Paving: Provide two samples of colored concrete for "A", "B", "C". The Owner and Landscape Architect shall determine which panel shall be used as the standard. Two color samples , "A", "B", "C", "D" shall be as follows:
 - a. "1" –Sandscape Color Blend EX-SSR-110-112-14 and EX-SSR-112-13: TBD by Landscape Architect Neutral Earth Tone to Match Building.
 - b. "2" –Color Reveal EX-RV-080211-05: TBD by Landscape Architect Neutral Earth Tone to Match Building.
 - c. "3" –Color Reveal EX-RV-080211-16: TBD by Landscape Architect Neutral Earth Tone to Match Building.
 - d. "4" –Color Reveal EX-RV-080211-18 TBD by Landscape Architect –Neutral Earth Tone to Match Building.
- e. Test Results: Submit test results within five calendar days of receipt.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Placing During Cold Weather: Concrete placement shall be discontinued when the air temperature reaches 40 degrees F. and is falling. Placement may begin when air temperature reaches 35 degrees F. and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees, F., placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85-degree F. Method and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F. for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete: The concrete shall have a minimum compressive strength of 3,500 psi. Portland cement shall conform to ASTM C150, Type I. Aggregates shall conform to ASTM C33. Sand shall comply with ASTM C33. Mixing water shall be fresh, clean and potable. An air-entraining agent complying with ASTM C260 shall be used to achieve entrained air content for the particular concrete mix used in accordance with the published recommendations of the Portland Cement Association and the American Concrete Institute. A normal-set or retarded-set water reducing admixture complying with ASTM C494 may be used. Nothing containing calcium chloride is permitted in the mix. High range water reducing admixture shall comply with C494.
- B. Color Hardener and Release Agent: The color hardener and release agent shall match the approved submittal samples.
- C. Form Materials
 - 1. Form Materials: Conform to ACI 301 as specified in SECTION: Cast-In-Place Concrete.
 - 2. Formwork shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, straight and free from warp, twist, loose knots, splits or other defects. Steel forms shall be channel formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall include be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers.
 - 3. Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.
- D. Reinforcing Steel:
 - 1. ASTM A615; 40 ksi (276 MPa) yield grade; deformed billet steel bars; unfinished.
 - 2. Dowels: ASTM A615; 40 ksi (276 MPa) yield grade, plain smooth steel, unfinished galvanized finish, greased with a metal cap.
- E. Crusher Run: Coarse Screenings: 703.04 Cover for Pipe Underdrains Coarse cover aggregate, screenings, gravel or crushed stone.
- F. Joint Filler Materials Preformed Expansion Joint Filler: Filler shall consist of 3/8-inch thick preformed strips made of cane or other suitable fibers of a cellular nature securely bound together and then uniformly saturated with asphalts. Filler shall conform to ASTM D1751.
- G. Joint Sealers:
 - 1. A two-part polysulfide or two-part urethane self leveling type cold applied compound.
 - 2. Joint sealer shall match color of adjacent concrete.
- H. Bond Breakers
 - 1. Blocking Media Compressible, non-shrinkable, nonreactive with joint sealant and nonabsorption type such as plastic rod or neoprene-grade closed cellular cord, free of oils or bitumens. Blocking media shall have water absorption of not more than 5 percent by weight when tested in accordance with ASTM C509. Blocking media shall be consistent with joint seal manufacturer's installation instructions and be at least 25 percent larger in diameter than width of joints.
 - 2. Separating Tape Pressure sensitive aluminum foil, polyethylene or polyester tape, 3 mil minimum thickness, or masking tape, nonreactive, nonabsorptive, adhesive back tape, width equal to width of joints. Separating tape shall be consistent with joint seal manufacturer's installation instructions.

2.02 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94.

- 1. Mix and deliver concrete in accordance with ASTM C94-94.
- 2. Provide concrete to the following mix design:

Unit Compressive Strength (28 day) ASTM Stone Size Water/cement ratio Slump Range Air Entrained Measurement 3,500 psi #67 0.51 3-6inches 5-7 percent

- B. Refer to paragraph 2.01.B for Color Hardener and Release Agent.
- C. Use accelerating admixtures in cold weather only when approved by the Landscape Architect. Use of admixtures will not relax cold weather placement requirements.
- D. Use set retarding admixtures during hot weather only when approved by Landscape Architect.

2.03 SOURCE QUALITY CONTROL AND TESTS

- A. SECTION: Quality Control.
- B. Submit proposed mix design for sidewalks before commencement of work.
- C. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.
- D. Test samples in accordance with ACI 301.

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Examine installation areas. Report unsatisfactory conditions in writing to Landscape Architect. Do not continue until unsatisfactory conditions have been corrected.
 - B. Starting installation constitutes acceptance of condition or satisfactory for installation of stamped colored concrete by Contractor, who shall correct damage and defects or unsatisfactory work at no additional cost.

3.02 BACKFILLING

- A. Employ a placement method that does not disturb or damage other work.
- B. Maintain optimum moisture content of backfill materials to attain required compaction density.
- C. Make gradual grade changes. Blend the slope into level areas.
- D. Remove surplus aggregate backfill material from the site.
- E. Leave fill material stockpile areas free of excess fill materials.
- F. Subgrade shall be maintained in a smooth, compacted condition. Moisten base to minimize absorption of water from fresh concrete.
- G. Coat surfaces of manholes and valve box frames with oil to prevent bond with concrete pavement.
- H. Compact the subgrade to a 95% compaction density. Receive test results prior to placement of concrete.
- I. Notify the Landscape Architect a minimum 24 hours before commencement of concreting operations.

3.03 AGGREGATE PLACEMENT

- A. Spread aggregate over a prepared substrate to a total compacted thickness as shown on Drawings.
- B. Place aggregate to a compacted depth of 2 or 4 inches as shown in the Contract Documents and roller compact to 95% density.
- C. Level and contour surfaces to elevations and gradients indicated.

- D. Add fine aggregate to coarse aggregate as appropriate to assist compaction.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- G. Provide density test for each 800 square feet of area

3.04 FORMING

- A. Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place. Corners and deep sections shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired.
- B. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.
- C. Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8-inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straight edge. Forms shall have transverse slope as indicated per foot with the low side next to the street. Side forms shall not be removed for 12 hours after finishing has been completed.
- D. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Support reinforcement with plastic chairs so reinforcement will remain in the center of the pavement section. Chairs shall be placed at the sides and in the center of the reinforcement grid. Reinforcement shall be in the center of the concrete paving section.
- B. Interrupt reinforcement at expansion joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.
- D. Provide doweled joints at spacing shown on Drawings, at expansion joints with one end of dowel greased and capped to allow longitudinal movement.

3.06 PLACING CONCRETE

- A. Concrete Work:
 - 1. Place concrete as specified in SECTION: Cast-In-Place Concrete.
 - 2. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
 - 3. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
 - 4. Apply color hardener evenly to the surface of the fresh concrete by the dry-shake method using a minimum of 60 pounds per 100 square feet. It shall be applied in two or more shakes, floated after each shake and troweled only after the final floating.
 - 5. The release agent shall be applied evenly to the troweled surface prior to imprinting
 - 6. While the concrete is still in its plastic stage of set apply imprinting tools to the concrete surface.

3.07 FINISHING

A. Paved Areas:

- 1. Colored Concrete Paving shall be buffed to provide a light nonslip texture.
- 2. Direction of texturing as directed by the Landscape Architect.

- B. Edge Finishing: All slab edges, including those at formed joints shall be finished with an edger having a radius of 1/4-inch.
- C. Unacceptable finishes which do not match the integrity of the approved examples at the median areas and corners or edges that have crumbled and areas with lack sufficient concrete shall be replaced in their entirety to the closest expansion joint.

3.08 JOINTS

- A. Saw Joints: Joint layout is as shown on Drawings. Depth shall be 1-inch.
- B. Expansion Joints: Expansion joint layout is shown on Drawings. Expansion joints shall be formed about all structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness and width indicated on the Drawings.
 - 1. Separate poured in place concrete pavements with 3/8-inch thick joint filler.
 - 2. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
 - 3. Extend joint filler from bottom of pavement to the distance required for bond breaker. Bond break shall be continuous and a minimum of 1/2-inch between top of bond breaker and walk surface.
 - 4. Place 3/8"-inch continuous bead of joint surface sealant to 1/2-inch below walk surface.

3.09 CURING

A. General Requirements: Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected form rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period. Cure concrete by the mat method, impervious sheeting method or membrane curing method according to ACI guidelines.

3.10 **PROTECTION**

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, graffiti and mechanical injury.
- B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

3.11 CLEAN UP

A. Clean all concrete surfaces in the project area from construction debris and stains.

3.12 FINAL ACCEPTANCE

A. Concrete surfaces shall be reviewed by the Landscape Architect to verify compliance with the approved sample and any deficiencies in appearance will be identified. Areas that exhibit excessive cracking, discoloration, form marks, graffiti or tool marks or which are otherwise inconsistent with the overall appearance of the work and not matching the finish of the approved sample shall be removed and replaced.

3.13 TOLERANCES

- A. Refer to SECTION Quality Assurance.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1-inch from required elevations.
- C. Top Surface of General Backfilling: Plus or minus 1-inch from required elevations.
 - 1. Verify compacted Subgrade aggregate base course is acceptable and ready to support paving and imposed loads.
 - 2. Verify gradients and elevations of base are correct. Subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

- D. Course Aggregate Fill:
 - 1. Flatness: Maximum variation of 1/4-inch measured with 10 foot straight edge.
 - 2. Scheduled Compacted Thickness: Within 1/4-inch.
 - 3. Variation From Design Elevation: Within 1/4-inch.
- E. Concrete Paving Tolerances:
 - 1. Maximum Variation of Surface Flatness: 5/16-inch in 10 feet.
 - 2. Maximum Variation from True Position: 1/4-inch.
 - 3. Maximum Variation in Section Thickness: 1/4-inch.

3.14 FIELD QUALITY CONTROL

- A. SECTION: Quality Assurance: Field inspection and testing.
- B. General Requirements: Perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the proper action shall be taken and reports submitted as required and additional tests performed to insure the requirements of this specification is met.
- C. Fill and Backfill Material Testing: Perform one of each of the following tests for each material used. Provide additional tests for each source change.
 - 1. Fill and Backfill Material Testing: Test moisture density relations in accordance with ASTM D698 or ASTM D1557.
 - 2. Density Tests: Test density in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017. When ASTM D2922 and ASTM D3017 density tests are used, verify density test results by performing an ASTM D1556 density test at a location already ASTM D2922 and ASTM D3017 tested as specified herein. Perform an ASTM D1556 density test at the start of the job, and for every ASTM D2922 and ASTM D3017 density test thereafter, test each lift at randomly selected locations every 600 square feet of existing grade in fills for concrete slabs.
 - 3. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Concrete Testing
 - Strength Testing: Provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day or less than once for every 250 cubic yards of concrete. The samples for strength shall be taken in accordance with ASTM C172. Cylinders for acceptance shall be molded in conformance with ASTM C31. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 200 psi.
 - 2. Air Content: Air content shall be determined in accordance with ASTM C173 Tow tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability occurs. If results of the tests are out of tolerance, the air content shall be corrected at the concrete plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerances specified.
 - Slump Test: Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests will be performed when excessive variation in the workability of the concrete is noted.
 - 4. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- E. Thickness Evaluation: The thickness evaluation of the concrete shall be determined before placement by passing a template through the formed section.
- F. Surface Evaluation: The finished surface of each category of the completed work shall be uniform in color, free of blemishes form or tool marks and match the integrity of the sample panels.

- A. Subgrade: To coarse aggregate fill, compacted to 95 percent.
- B. Crusher Run Aggregate: Compacted to 95 percent.
- C. Stamped Colored Concrete Paving: 3,500 psi 28 day concrete, 5-7 inches thick, match color and texture of the approved samples.

END OF SECTION 03 35 19

SECTION 03 45 00

PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast architectural concrete units.
 - 2. Precast architectural insulated concrete units
 - 3. Accessories indicated, specified, or required to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Document Concept: Drawings and Specifications express concept of precast architectural concrete work, however, they may not indicate or specify total work that may be required, nor shall they be construed as engineered.
- B. Delegated Engineering Responsibility: Require manufacturer to employ a delegated engineering professional to provide engineering for each member and component of precast architectural concrete work, including attachment to building structural frame, required to meet concept expressed in Contract Documents that includes, but is not limited to, following:
 - 1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on exterior wall and building structural frame.
 - 2. Preparation of engineering calculations, shop drawings, and other submittals with professional seal affixed according to respective jurisdictional licensing regulations.
- C. Fabricator shall provide a 2022 Revit model to allow for coordination between structural engineer and fabricator.
 - 1. Include correct locations of gravity connections and tie-back connections.
 - 2. Fabricator shall coordinate in BIM 360 coordination via Central Models.
 - 3. Fabricator shall place gravity connections as indicated on the Structural Drawings. If a different location is required, submit a written document to Structural Engineer for review and comments.
 - 4. Fabricator shall develop gravity and horizontal loads due to wind or seismic and submit to Structural Engineer.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each type of product necessary for installation.
 - 1. Include precast architectural concrete unit design mixtures indicating compressive strength and water-absorption tests for each precast concrete mixture.
- B. Shop Drawings:
 - 1. Detail fabrication and installation of architectural precast concrete units.
 - 2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - 4. Indicate details at building corners.
 - 5. Indicate separate face and backup mixture locations and thicknesses.

- 6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
- 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
- 8. Include plans and elevations showing unit locations, dimensions, erection sequences, and bracing plans for special conditions.
- 9. Indicate relationship of architectural precast concrete units to adjacent materials.
- 10. Coordinate and indicate openings and inserts required by other trades.
- 11. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and indicate modified areas on Shop Drawings. Do not adversely affect the appearance, durability, or strength of units.
- C. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
- D. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of one sample panel approximately 16 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
 - 1. Locate panels as directed by Architect.
 - 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 - 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 - 4. Demolish and remove sample panels when directed.
- E. Delegated Engineering Submittal: Include analysis data signed and sealed by the professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Designated at time of bidding as a one of the following:
 - a. PCI-certified plant for Category AC.
 - b. APA-certified plant for production of architectural precast concrete products.
- B. Certified Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category S2 (Complex Structural Systems) for load-bearing members.
- C. Preinstallation Conference: Conduct conference at Project site.
- D. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and, that has a record of successful in-service performance.
- E. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, prevent staining, and prevent cracking, distortion, warping, or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120 applicable to types of architectural precast concrete units indicated.
- B. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Loads: As indicated on the Drawings.
 - 2. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of 1/2 inch.
 - 3. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.
 - 4. Vehicular Impact Loads: Design spandrel beams acting as vehicular barriers for passenger cars to resist a single 6000 lb load applied horizontally in any direction to the spandrel beam, with anchorages or attachments capable of transferring this load to the structure. Design spandrel beams assuming the load to act at a height of 18 or 27 inches above the floor or ramp surface, whichever is more severe, on an area not to exceed 1 sq. ft.

2.2 PRECAST ARCHITECTURAL CONCRETE UNITS

A. Provide unit types as indicated on Drawings, including wall panels and insulated wall panels.

2.3 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
- B. Form-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.4 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A184, fabricated from ASTM A615, Grade 60, deformed bars, assembled with clips.
- C. Supports: Suspend reinforcement from back of mold. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place may only be used if they are not visible in the finished face.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or Type III.
 - 1. For surfaces exposed to view in finished structure, use gray cement, of same type, brand, and mill source.
 - a. Standard gray cement is acceptable for use where not exposed to view.
- B. Supplementary Cementitious Materials: Include one or more of the following based on delegated design concrete mixture:
 - 1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C618, Class N.
 - 3. Silica Fume: ASTM C1240, with optional chemical and physical requirement[, white].
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Coloring Admixture: ASTM C979, synthetic or natural mineral-oxide pigments or colored waterreducing admixtures, temperature stable, and nonfading.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117 and ASTM C1602.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture. Include one or more of the following based on delegated design concrete mixture:
 - 1. Water-Reducing Admixtures: ASTM C494, Type A.
 - 2. Retarding Admixture: ASTM C494, Type B.
 - 3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
 - 4. Water-Reducing and -Accelerating Admixture: ASTM C494, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
 - 6. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.
 - 7. Plasticizing Admixture: ASTM C1017, Type I.
 - 8. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
 - 9. Corrosion-Inhibiting Admixture: ASTM C1582.

2.6 STEEL CONNECTION MATERIALS

- A. Carbon Steel Shapes and Plates: ASTM A36.
- B. Carbon Steel Plate: ASTM A283, Grade C.

- C. Malleable Iron Castings: ASTM A47, Grade 32510 or Grade 35028.
- D. Carbon Steel Castings: ASTM A27, Grade 60-30.
- E. High-Strength, Low-Alloy Structural Steel: ASTM A572.
- F. Carbon Steel Structural Tubing: ASTM A500, Grade B or Grade C.
- G. Wrought Carbon Steel Bars: ASTM A675, Grade 65.
- H. Deformed-Steel Wire or Bar Anchors: ASTM A1064 or ASTM A706.
- I. Carbon Steel Bolts and Studs: ASTM A307, Grade A, or ASTM F1554, Grade 36; carbon steel, hexhead bolts and studs; carbon steel nuts, ASTM A563; and flat, unhardened steel washers, ASTM F844.
- J. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, in accordance with requirements in SSPC-SP 3, and shop-apply SSPC-Paint 23 in accordance with SSPC-PA 1.
- K. Welding Electrodes: Comply with AWS standards.

2.7 INSULATED PANEL MATERIALS

- A. Provide board insulation with regularly spaced holes at connector placement locations.
- B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C578, Type IV, 1.55 lb/cu. ft.; ship-lap edges; thickness as indicated on the Drawings.
- C. Wythe Connectors: One of following manufactured to connect wythes of precast concrete panels.
 - 1. Glass-fiber-reinforced vinylester connectors.
 - 2. Polypropylene pin connectors.
 - 3. Stainless steel pin connectors.
 - 4. Bent galvanized reinforcing bars or galvanized welded-wire trusses.
 - 5. Epoxy-coated carbon-fiber grid.
 - 6. Fiberglass trusses.

2.8 ACCESSORIES

- A. Bearing Pads: Provide one of the following for architectural precast concrete units as recommended by precast fabricator for application:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D2240, minimum tensile strength 2250 psi, ASTM D412.
 - 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer; Type A durometer hardness of 70 to 90, ASTM D2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cottonduck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D2240; in compliance with AASHTO LRFDBDS, Division II, Section 18.10.2; or with MIL-C-882E.
 - 4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.

5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 GROUT MATERIALS

A. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, Grade A for dry pack and Grades B and C for flowable grout, and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content is to be less than 0.06 percent by weight of cement when tested in accordance with ASTM C1218.

2.10 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Use a single design mixture for units with more than one major face or edge exposed.
 - 2. Where only one face of unit is exposed, use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested in accordance with ASTM C1218.
- E. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods in accordance with ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: Six percent by weight or 14 percent by volume, tested in accordance with ASTM C642, except for boiling requirement.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- H. When included in design mixtures, add other admixtures to concrete mixtures in accordance with manufacturer's written instructions.

2.11 FABRICATION OF MOLDS

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished Project.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.12 FABRICATION OF PRECAST ARCHITECTURAL CONCRETE

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- B. Furnish loose hardware items, including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement during concreteplacement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel to maintain at least 3/4 inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
- D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- E. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
 - 1. Place self-consolidating concrete without vibration in accordance with PCI TR-6. Ensure adequate bond between face and backup concrete, if used.
- H. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- I. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- J. Cure concrete, in accordance with PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- K. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs comply with requirements in PCI MNL 117 and Architect's approval.

L. At exterior locations, provide where precast connections are attached to galvanized steel provide galvanized steel connections to meet the intended connection serviceability for exterior connections.

2.13 FABRICATION OF INSULATED PANELS

- A. Cast, screed, and consolidate bottom concrete wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation holes, and consolidate concrete around connectors in accordance with connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.
- E. Maintain temperature below 150 deg F in bottom concrete wythe.

2.14 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.15 FINISHES

- A. Exposed Faces: Free of joint marks, grain, and other obvious defects. Corners, including false joints to be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and sample panels and as indicated on the Drawings.
- B. Concealed Faces: As-cast finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - a. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
 - b. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION OF PRECAST ARCHITECTURAL CONCRETE UNITS

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable requirements in AWS D1.1 and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Welds not specified to be continuous fillet welds use no less than the minimum fillet as specified by AWS.
 - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and repriming damaged painted surfaces.
 - 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
- F. Grouting or Dry Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 - 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch.
 - b. Nonexposed Individual Panel: Plus or minus 1/2 inch.

- 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
- 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 ft.: 1 inch.
- 6. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 - a. Exposed Panel Relative to Adjacent Panel: 1/4 inch
 - b. Nonexposed Panel Relative to Adjacent Panel: 1/2 inch.
 - c. Add 1/8 inch additional tolerance in the maximum jog for panels larger than 20 ft. per 10 ft. of additional height, up to a maximum tolerance of 1/2 inch.
- 7. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
- 8. Maximum Joint Taper: Plus or minus 3/8 inch but not more than 1/4 inch in 10 ft. length.
- 9. Joint Taper in 10 ft.: 1/4 inch.
- 10. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
- 11. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
- 12. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 REPAIR

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 ft.
- C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- D. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, in accordance with precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 03 45 01 SITE STRUCTURES PRECAST CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes the performance criteria, materials, design, production, and erection of architectural precast concrete for wall caps and exterior site walls only. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete work shown on the Contract Drawings.
- B. This Section includes the following:
 - 1. Architectural precast concrete walls, wall caps, planters, stair treads, and site furnishings.
- C. Related Sections include the following:
 - 1. Section 03 30 00.01: Cast-in-Place Concrete for Landscaping.
 - 2. Section 04 20 00: Unit Masonry for Landscaping
 - 3. Section 12 93 00: Site Furnishings

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C-150
 - 2. ASTM C-33
 - 3. ASTM C-260
 - 4. ASTM C-494
 - 5. ASTM C-128
 - 6. ASTM C-31
- B. Precast Concrete Institute (PCI)
- C. American Concrete Institute ACI-318

1.3 DEFINITION

A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Landscape Architect.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Dead Loads: Self weight and weights of attached elements.
 - 2. Live Loads: refer to general structural notes.
 - 3. Wind Loads: refer to general structural notes.
 - 4. Seismic Loads: refer to general structural notes.
 - 5. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 80 °F.

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit shop drawings of all precast concrete items showing detail sections and profile for all precast items. Details shall show all reinforcing and special hardware required for fastening.
- B. Samples:
 - 1. Submit 3 samples, 6" x 6" size for each color.
 - a. Color to be selected from Wausau Tile Site Furnishings color chart.
 - b. Sample to be submitted for color and texture.
 - c. Match existing or architect's sample
 - 2. Submit copy of Quality Assurance and Procedure Program.
- C. Performance Requirements
 - 1. Compressive Strength 5000 psi.
 - 2. Air Content 6-8%
 - 3. Water-Cement Ratio 45:1

1.6 QUALITY ASSURANCE

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete also test and inspect according to PCI TR-6 "Interim Guidelines for the Use of Self-Consolidating Concrete" and ASTM C 1611/C 1611M, ASTM C 1712, ASTM C 1610/1610M, and ASTM C 1621/C 1621M.
- B. Precast manufacturing plant shall be certified, category AT Architectural Trim, by the Precast Concrete Institute (PCI) at the time of bidding.
- C. Manufacturer's Instructions: In addition to specified requirements, comply with precast concrete manufacturer's instructions and recommendations for substrate preparation, material storage, mixing and application, finishing and curing.
- D. Qualifications: Precast Concrete Manufacturer and Trade contractor must have a minimum of 5 years of successful experience on projects of similar magnitude and complexity to that indicated project. Manufacturer and contractor to be prequalified by architect prior to bidding. Fail to prequalify will void bid.
- E. Manufacturer to supply a written Quality Assurance Program and Procedure Manual.
- F. Testing Agency Qualifications: An independent accredited testing agency acceptable to authorities having jurisdiction, qualified according to ASTM C 1077, ASTM E 329 and ASTM E 543 to conduct the testing indicated.
- G. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, PCI Design Handbook - Precast and Prestressed Concrete, applicable to types of architectural precast concrete units indicated.
- H. Quality-Control Standard: For manufacturing procedures and testing requirements, qualitycontrol recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.
- I. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel"; AWS D1.4/D1.4M, "Structural Welding Code Reinforcing Steel" and AWS D1.6/D1.6M Structural Welding Code-Stainless".
- J. Mockups: Mockups to be representative of the finished work including exterior site walls, stair treads, site furnishings and architectural precast concrete complete with anchors, connections, flashings, and joint fillers as accepted on the final Shop Drawings. Build mockups to comply with the following requirements, using materials indicated for the completed work:

- 1. Build mockups in the location and of the size indicated in Contract Documents or, if not indicated, as directed by Architect.
- 2. Notify Architect in advance of dates and times when mockups will be constructed.
- K. Preinstallation Conference: Conduct conference at Project Site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaging and Shipping: Precast concrete to be palletized and shrink wrapped, delivered in original unopened packaging with legible manufacturer identification, including size, piece number, quantities, manufacture date, and inspectors initials.
- B. Storage and Protection: Precast concrete to be stored in secure area in original packaging. Protect from damage by other trades.

1.8 SEQUENCING

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturer or approved equal prior to bidding:
 - 1. Wausau Tile, Inc. PO Box 1520 Wausau, WI 54402-1520 (715)359-3121

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain, or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- B. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete to depth of reveal specified.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) or (ASTM A 706/A 706M], deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M epoxy coated.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 deformed bars, assembled with clips.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from galvanized or chromate wash treated steel wire into flat sheets.
- E. Deformed Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- F. Epoxy Coated-Steel Welded Wire Reinforcement: ASTM A 884/A 884M Class A coated, plain or deformed, flat sheet, Type 1 bendable or 2 non-bendable coating.

G. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or III.
 - 1. For surfaces exposed to view in finished structure, use white, of same type, brand, and mill source throughout the precast concrete production.
 - 2. Standard gray portland cement may be used for non-exposed backup concrete.
- C. Aggregates: All aggregates to meet ASTM C-33 specifications, cleaned and properly graded to size. Aggregates shall be blended to meet individual project requirements.
 - 1. Face-Mixture Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: To match design reference sample.
 - 2. Face-Mixture Fine Aggregates: Selected, natural, or manufactured sand of a material compatible with coarse aggregate to match selected Sample finish.
 - 3. Backup Concrete Aggregates: ASTM C 33 or C 330.
- D. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored waterreducing admixtures, temperature stable, and nonfading. Pigments shall be inorganic, resistant to alkalinity and used per manufacturers recommendations.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

2.6 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1/ D1.1 M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.
- D. Malleable Iron Castings: ASTM A 47/A 47M, Grade 32510 or 35028.
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or C.
- H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496 M or ASTM A 706/A 706M.
- J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or C (ASTM F 568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A 563/A 563M, Grade A); and flat, unhardened steel washers, ASTM F 844.

2.7 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2^{1/2} to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content of grout with less than 0.06 percent chloride ion by weight of cement when tested in accordance with ASTM C 1218/C 1218M.
- B. Nonmetallic, Nonshrink Grout: Premixed, prepackaged non-ferrous aggregate, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating

agents, plasticizing and water-reducing admixtures, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content of grout with less than 0.06 percent chloride ion by weight of cement when tested in accordance with ASTM C 1218/C 1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy-resin: ASTM C 881/C 881M of type, grade, and class to suit requirements.

2.8 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes, and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated in Contract Documents, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: All exposed edges to have minimum 1/8" chamfer to prevent chipping.
 - 3. Finished surfaces to match approved control sample.
 - 4. All precast concrete finished surfaces to be sealed with a sealer approved by manufacturer.

2.9 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on Contract Drawings.
- D. Cast in openings larger than 10 in. (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete- placement and consolidation operations. Completely conceal plastic tipped or corrosion resistant metal or plastic chair support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel and prestressing tendon to maintain at least 3/4 in. (19 mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 11/2 in. (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

- 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation and erection stresses, and specified in-place loads, whichever governs.
- G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- H. Coordinate all step lighting features, connections, and conduit routing prior to fabrication.

2.10 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units of shapes, lines and dimensions indicated, so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. All units to conform to shop drawings, with a 1/8" tolerance in dimensions.

2.11 FINISHES

- A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform and straight. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference samples and as follows:
 - 1. Design Reference Sample:
 - a. All design references provided by Tectura Designs.
 - i. Acid washed A26 (Stair Treads and Seat Wall at base of the Beacon of Hope)
 - ii. Ground and Polish G30(Wall Caps)
 - 2. PCI's Architectural Precast Concrete Color and Texture Selection Guide, of plate numbers indicated.
 - 3. As-Cast Surface Finish: Provide surfaces to match accepted sample or mockup units for acceptable surface air voids, sand streaks, and honeycombs.
 - 4. Textured-Surface Finish: To match accepted sample or mockup units for acceptable surface air voids, sand streaks, and honeycombs, with uniform color and texture.
 - 5. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates to match accepted sample or mockup units.
 - 6. Exposed Aggregate Finish: Use chemical retarding agents applied to molds, and washing and brushing procedures, to expose aggregate and surrounding matrix surfaces after form removal to match accepted sample or mockup units.
 - 7. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces to match accepted sample or mockup units.
 - 8. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces to match accepted sample or mockup units. Protect hardware, connections, and insulation from acid attack.
 - 9. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures to match accepted sample or mockup units.
 - 10. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures to match accepted sample or mockup units.
 - 11. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing to match accepted sample or mockup units.

- B. Finish exposed surfaces of architectural precast concrete units to match face-surface finish.
- C. Finish unexposed surfaces of architectural precast concrete units with as-cast finish.
- D. Finish top and back surfaces of architectural precast concrete units by steel-trowel finish.

2.12 CAULKS AND SEALANTS

- A. Polyurethane or acrylic sealant
- B. Color to be selected by architect from standard color pallet

2.13 SEALER

A. Colorless, pure acrylic water-repellent penetrating sealer. Sealer to maintain natural look of concrete surface with no glaze or gloss, darkening or color change.

PART 3 – EXECUTION

3.1 PREPARATION

A. Furnish anchorage devices for precast concrete units to be embedded in or attached to the foundation before start of such Work. Provide locations, setting diagrams, templates and instructions for the proper installation of each anchorage device.

3.2 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting precast concrete performance.
- B. Proceed with precast concrete installation only after unsatisfactory conditions have been corrected.
- C. Contractor shall notify precast concrete erector that supporting cast-in-place concrete foundation and building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is structurally ready to receive loads from precast concrete units prior to proceeding with installation.

3.3 INSTALLATION

- A. Install loose clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials
- B. Structural steel fabricator to supply and install miscellaneous steel preweld connection hardware in the shop.
- C. Precaster or erector to supply and install miscellaneous steel preweld connection hardware in the field.
- D. Erect architectural precast concrete level, plumb, and square within the specified allowable erection tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Surface weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.

- E. After each unit has been set, all joints shall be raked to a depth of 3/4-inch from the face for pointing. The face of each stone shall then be sponged off to remove any splashed mortar or mortar smears.
- F. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop (Erection) Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
- F. Welding: Comply with applicable AWS D1.1/D1.1M, AWS D1.4/D1.4M and D1.6/D1.6M requirements for welding, welding electrodes, appearance of welds, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage during field welding or cutting operations and provide noncombustible shields as required.
 - 2. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS D 1.1/D 1.1M, D 1.4/D 1.4M or D1.6/D1.6M.
 - 3. Clean weld- affected metal surfaces with chipping hammer followed by brushing or power tool cleaning and then reprime damaged painted surfaces in accordance with paint manufacturer's recommendations.
- G. At bolted connections, use upset threads, thread locking compound or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness at installation. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 - 2. For slip critical connections, one of the following methods shall be used to assure proper bolt pretension:
 - a. Turn-of-Nut in accordance with AISC.
 - b. Calibrated Wrench in accordance with AISC.
 - c. Twist-off Tension Control Bolt meeting ASTM F 1852.
 - d. Direct-Tension Control Bolt meeting ASTM F 1852.
 - 3. For slip critical connections, the method to be used and the inspection procedure to be used shall be approved by the Architect and coordinated with the inspection agency.
- H. Grouting or Dry-Packing Connections and Joints: Indicate joints to be grouted and any critical grouting sequences on Shop (Erection) Drawings. Grout connections where required or indicated on Shop (Erection) Drawings. Retain flowable grout in place until it gains sufficient strength to support itself. Alternatively pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for at least 24 hours after initial set.

3.6 REPAIRS

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Repair damaged units to meet acceptability requirements of PCI MNL 117.
- C. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 ft (6 m).

3.7 POINTING AND CAULKING

A. When ready for pointing, the joints shall be dampened and carefully pointed to a slight concave unless otherwise specified by the Landscape Architect. No pointing shall be done in freezing weather not in locations exposed to hot sun, unless properly protected. Coloring pigments may be added as required. The Landscape Architect shall approve color of mortar and sealant before proceeding with pointing.

B. Head joints and bed joints in precast caps shall be caulked with a joint sealant used in accordance with the Manufacturer's instructions.

3.8 CLEANING

- C. Clean all surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- D. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- E. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, dirt, stains and other markings.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.
- F. All product to be sealed with approved sealer.

END OF SECTION 03 45 01

SECTION 04 20 01 UNIT MASONRY FOR LANDSCAPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

1.2 Provide all labor, materials, equipment, services necessary for and incidental to the installation of all masonry construction as indicated on the Drawings and specified herein.

1.3 RELATED SECTIONS

A. SECTION 03 30 00.01 - Cast-In-Place Concrete for Landscaping

1.4 REFERENCES

- A. American Concrete Institute (ACI): Reference sections as follows:
 - 1. ACI 530 Building Code Requirements for Masonry Structures.
 - 2. ACI 530.1 Specifications for Masonry Structures.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):
 - 1. ASTM C5 Quicklime for Structural Purposes.
 - 2. ASTM C91 Masonry Cement.
 - 3. ASTM C94 Ready-Mixed Concrete.
 - 4. ASTM C144 Aggregate for Masonry Mortar.
 - 5. ASTM C150 Portland Cement.
 - 6. ASTM C199 Test Method for Pier Test for Refractory Mortar.
 - 7. ASTM C207 Hydrated Lime for Masonry Purposes.
 - 8. ASTM C270 Mortar for Unit Masonry.
 - 9. ASTM C387 Packaged, Dry, Combined Materials, for Mortar and Concrete.
 - 10. ASTM C404 Aggregates for Masonry Grout.
 - 11. ASTM C476 Grout for Masonry.
 - 12. ASTM C595 Blended Hydraulic Cement.
 - 13. ASTM C780 Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 14. ASTM C1019 Method of Sampling and Testing Grout.
 - 15. STM C1072 Method for Measurement of Masonry Flexural Bond Strength.
 - 16. ASTM C1142 Ready-Mixed Mortar for Unit Masonry.
 - 17. ASTM E447 Test Methods for Compressive Strength of Masonry Prisms.
 - 18. ASTM E518 Test Method for Flexural Bond Strength of Masonry.
- C. IMIAC (International Masonry Industry All-Weather Council) Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.5 SUBMITTALS

- A. Samples: Submit (3) samples of each type of masonry and each accessory item required. Provide certification of pull out strength of all masonry ties and anchors. Submit certification of compliance with required standards.
- B. Mortar and Grout: Include design mix, indicate whether the Proportion or Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
 - 1. Samples: Submit two samples of mortar, illustrating mortar color and color range.

- C. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports to ASTM C780.
- D. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to ASTM C1019.
- E. Manufacturer's Certificate: Certify that products meets or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI 530 and ACI 530.1.
- B. Maintain one copy of each document on site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver masonry units to job site in undamaged condition. Deliver and handle units to prevent chipping, breaking or other damage.
- B. Storage: Store masonry units off ground and protected from wetting by capillary action, rain or snow, and protected from mud, dust, or other materials and contaminants likely to cause staining or defects.
- C. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) before, during, and forty-eight hours after completion of masonry work.
- C. Coverings: Masonry material shall be kept dry by covering at the end of each day and when work is not in progress with a strong, weather-resistant material extended a minimum of 2-feet down each side and held securely in place.
- D. Protection: Prevent grout or mortar from staining the face of masonry to be left exposed. Remove immediately and grout or mortar in contact with face of masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers for the following shall consist as follows:
 - 1. Facing Brick:
 - a. B-1 to match building brick.
 - 2. Do not exceed variations in color and texture of specified brick.

2.2 MATERIALS

- A. Portland Cement: ASTM C150, Type I gray color.
- B. Lime: Hydrated lime, ASTM C207, Type S.
- C. Sand : ASTM C144.
- D. Aggregate: ASTM C404.
- E. Water: Mixing water must be clean and free of harmful amounts of acids, alkalis, organic materials, or other substances that would adversely affect the quality or appearance of the mortar or the masonry units.

- F. Reinforcement: Steel reinforcing shall conform to the following ASTM Specifications:
 - 1. Billet steel deformed bars, ASTM A615; 40 ksi (276 Mpa) yield grade; unfinished.
- G. Anchors and Ties
 - 1. All anchors and ties shall be coated or corrosion-resistant metal meeting or exceeding the following ASTM Specifications:
 - a. Zinc coating of wire, ASTM A116, Class 3.
 - 2. Joint reinforcement: Prefabricated welded joint reinforcement, longitudinal cross tie wire minimum 9-gauge spaced 16-inches on center; ladder or truss-type design.
- H. Cleaning agents:
 - 1. Use cleaning agents as recommended by the brick and mortar manufacturer.

2.3 MIXES

- A. Materials:
 - 1. Portland Cement: ASTM C150, Type I; nonstaining type. Masonry cement is unacceptable.
 - 2. Masonry Sand: ASTM C144, natural sand only. Manufactured sand is unacceptable.
 - 3. Gradation: Comply with referenced standard for 3/8" joints, except grade with 100% passing No. 16 sieve for joints 1/4" or less.
 - 4. Color: Natural.
 - 5. Hydrated Lime: ASTM C207, Type "S". Type "NA" (air entraining) is unacceptable.
 - 6. Quicklime: ASTM C5. Slake quicklime and age lime putty as recommended by manufacturer.
 - 7. Water: Clean, fresh, potable.
- B. Mortar Proportions, Including Mixing:
 - 1. General:
 - a. Thoroughly mechanically mix in quantity needed for immediate use.
 - a. Do not use antifreeze compounds.
 - b. Do not permit mortar to stand more than 1 hour without remixing.
 - c. Discard mortar that has begun to set, or is not used within 2-1/2 hours after initial mixing. Retemper mortar which has stiffened due to evaporation to restore its workability.
 - 2. Portland Cement Lime Mortar
 - a. Proportion following by volume, according to requirements of ASTM C270-92a (masonry cement mortar not acceptable).
 - b. Type "M".
- C. Grout Mixes: Grout for reinforced masonry shall meet the minimum requirements for Type XX, ASTM C476.
 - 1. Mix grout according to ASTM C94.
- D. Admixtures:
 - 1. No air-entraining admixtures or materials containing air entraining admixtures shall be used. Air content of mortar and grout shall be limited to 12%.
 - 2. No antifreeze compounds or other substances shall be added to mortar or grout. No calcium chloride shall be included in mortar or grout in which metal reinforcing or accessories will be embedded.
 - 3. Mortar colors shall consist of inorganic compounds not to exceed 15% of the weight of the cement except that carbon block shall not exceed 3% of the weight of the cement. If mortar colors are used in reinforced masonry, prism tests shall determine the ultimate compressive strength of the masonry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Observation: Observe surfaces that are to support masonry work to assure completion to proper lines and grades free of all dirt and other deleterious material. Do not begin work until surfaces have been properly prepared to the Landscape Architects approval.

3.2 INSTALLING MASONRY

- A. Preparation:
 - 1. Verify that initial absorption rate of clay brick is less than 0.024 oz./sq. inch per minute. Brick with absorption rates greater than this amount shall be wetted with clean water 24 hours before placement until the unit is nearly saturated, and shall be surface dry when laid. During freezing, weather units that require wetting shall be sprinkled with warm or hot water just before laying.

B. Installation:

- 1. Do not install cracked, broken or chipped masonry units exceeding ASTM allowances. Use masonry saw to cut and fit exposed units. Lay brick plumb, true to line, and with level courses accurately spaced within allowable tolerances.
- 2. Unless otherwise shown on the drawings, install masonry work using one-half running bond and soldier course. Stop horizontal runs at the end of workday by racking back in each course; toothing will not be permitted.
- 3. Adjust units to final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove, clean joints and units of mortar, and relay with fresh mortar. Adjust shelf angles to keep work level and at proper elevation.
- 4. When joining fresh masonry to set or partially set masonry. Remove loose unit and mortar, and clean and lightly wet exposed surfaces of set masonry before laying fresh masonry.
- 5. Place all accessories and reinforcement in the masonry as the job progresses. Place horizontal joint reinforcement in first bed joint and each successive third joint o concrete masonry walls to prevent cracking.
- 6. Cooperate with other trades to assure proper location of anchors, inserts, penetrations, etc.

C. Joints:

- 1. Provide a nominal joint thickness of 3/8-inch for concrete unit masonry, 3/8-inch for brick masonry. Do not furrow bed joints for solid masonry units.
- 2. Provide face-shell bedding for concrete unit masonry except at grouted cells and base course, where full mortar bedding is required. Construct uniform joints.
- 3. Provide full head and bed joints, shoved tight to prevent penetration of moisture. Provide weatherproof, concave, tooled joints in exposed surfaces when mortar is thumbprint hard, using round jointing tool.
- 4. Strike joints flush in surfaces to be covered with other material or surface-applied finish other than paint. Concave tool exterior joints below grade. Remove mortar protruding into cells or cavities of multi-wythe walls or to block weep holes. Fill with mortar all horizontal joints between top of masonry partitions and underside of concrete beams.
- 5.
- 6. Keep movement joints clean of all mortar and debris. For tuckpointing, rake mortar joints to a depth of 1/2 to 3/4-inch, saturate with clean water, fill solidly with pointing mortar and tool to match existing joints.
- D. Weep Holes: 1. P
 - Provide weep holes in head joints in first course immediately above all flashing. Leave head joint free and clean of mortar or install weep hole tube in head joint.

- 2. Space weep holes 24-inches on center maximum for brick masonry, and 32-inches on center maximum for concrete unit masonry. Keep weep holes and area above flashing free of mortar droppings.
- 3. For backfill material behind retaining walls, and for loose fill insulation in walls, screen cavity side of weep hole against clogging before fill material is placed.
- E. Masonry Bonding:
 - 1. Bond facing and backing of multi-wythe walls as shown on the Drawings with masonry headers extended a minimum of 3-inches into backing. If a single header does not extend through a wall, overlap headers from opposite sides of wall at least 3-inches. Provide minimum number of wall headers equal to 4% of wall surface, spaced maximum distance of 24-inches on center either vertically or horizontally.
- F. Metal-tie Bonding:
 - Provide metal ties for bonding of multi-wythe walls. Stagger ties in alternate courses, and provide minimum of one tie for each 4.5-square foot of wall surface. Maximum distance between adjacent ties not to exceed 18-inches vertically or 36-inches horizontally. Embed ties in horizontal joints of facing and backing. Provide additional ties within 12-inches of openings, spaced maximum 36-inches around the perimeter.
 - 2. Instead of metal ties, a continuous prefabricated metal joint reinforcement as specified, spaced no more than 16-inches on center vertically may be used.
 - 3. Anchor nonbearing partitions abutting or intersecting other walls or partitions with cavity wall ties at vertical spacing not to exceed 4-feet.
- G. Anchoring Brick Veneer:
 - 1. Attach brick veneer to backing with metal veneer ties spaced maximum 16-inches on center vertically and horizontally with a minimum of one tie for each 2 square feet of wall area. Embed ties at least 2-inches in horizontal joint of facing. Provide additional ties within 12-inches of openings, spaced maximum 36-inches around the perimeter.
- H. Expansion and Contraction:
 - 1. Provide vertical movement joints at intervals of not more than 20-feet on centers, and at all offsets, return, openings, and intersections with dissimilar materials. Provide continuous bond break at steel columns and members. Provide pressure-relieving joints by placing a continuous 1/8-inch neoprene pad below shelf angles.

3.3 REINFORCED MASONRY

- A. Masonry Strength: Provide a minimum ultimate compressive strength of 8,000 psi.
- B. Reinforcement: 1. Ho
 - Hold vertical reinforcement firmly in place by means of frames or other suitable devices. Place horizontal reinforcement as masonry work progress. Provide minimum clear distance between longitudinal bars equal to nominal diameter of the bar. Provide minimum clear distance between bars in columns equal to 1-1/2-times bar diameter. Minimum thickness of mortar or grout between masonry and reinforcement shall be 1/4-inch, except than 1/4-inch bars may be laid in 1/2-inch horizontal mortar joints, and 6-gauge or smaller wires may be laid in 3/8-inch mortar joints. Collar joints containing both horizontal and vertical reinforcement shall have a minimum width 1/2-inch larger than the sum of the diameters of the horizontal and vertical reinforcement.
- C. Low-lift Grouting:
 - 1. For grout spaces less than 2-inches width, place grout at maximum 24-inches intervals in lifts of 6 to 8 inches as the wall is built. Assure that grout core is clean of mortar, mortar droppings, and debris. Agitate grout during and after placement to assure complete filling and coverage of reinforcement. If work is to be stopped for 1-hour or more, hold grout 1-1/2-inch below top of masonry. Continue

grouting to top of finished wall.

- D. High-lift Grouting:
 - 1. For grout spaces 2-inches or more in width, grout may be placed in lifts not to exceed 4-feet. For running bond, provide one metal tie for each 3-square feet of wall with a maximum spacing of 16-inches vertically and 24 or 32-inches horizontally for brick and concrete block, respectively.
 - 2. For a stack bond, provide one metal tie for each 2 square feet of wall with a maximum spacing 12-inches vertically and 24-inches horizontally for brick, or 16-inches vertically and horizontally for a concrete block.
 - 3. Keep grout core clean. Provide cleanout holes in bottom course as required for inspection and cleaning. Replace cleanout plugs only after area to be grouted has been accepted. Do not place grout until the entire wall has been in place a minimum of 3 days. Place horizontal grout barriers at convenient intervals. If work is to be stopped for 1 hour or more, hold grout 1-1/2-inch below top of masonry. Continue grouting to top of finished wall.
- E. Forms and Shoring:
 - 1. Provide substantial and tight forms to prevent leakage of mortar or grout. Brace or shore forms to maintain position and shape. Do not remove forms or shoring until masonry has hardened sufficiently to carry its own weight and any other temporary loads that may be placed on it during construction (10 days for girders and beams, 7 days for masonry slabs).

3.4 POINTING AND CLEANING

1.

1.

- A. Pointing:
 - At final completion of masonry work, cut out any defective joints or holes in exposed masonry and repoint with mortar, tooling to match adjacent joints.

B. Cleaning:

- Dry brush masonry surface after mortar has set at end of each workday and after final pointing. Clean exposed, unglazed masonry with stiff brush and clean water. Cleaning agents may be used only with written approval of Landscape Architect. Cleaning agent must be tested on sample wall area of 20 square feet. Protect adjacent materials from damage due to cleaning operations. Remove efflorescence in accordance with the Brick Manufacturer's recommendations.
- 2. Leave work area and surrounding surfaces clean and free of mortar spots, droppings, and broken masonry.

3.5 FIELD QUALITY CONTROL

A. Mortar and Grout: Mix mortar and grout according to the proportion requirements of ASTM C270, and ASTM C476 as applicable. Control batching procedure to ensure proper proportions by measuring materials by volume. Mortar consistency shall be controlled. Re tempering will be permitted only within the first 2-1/2 hours of the initial mix. Any mortar or grout that has partially set shall be discarded.

3.6

END OF SECTION 04 20 01

SECTION 07 84 23

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes penetration firestopping systems for openings and penetrations through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each product and system indicated.
 - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include firestopping design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestopping system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification of qualified testing and inspecting agency's tested system to suit a particular firestopping condition, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- D. Qualification Data:
 - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed firestopping systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- C. Source Limitations: Obtain penetration firestopping systems, for each kind of penetration and construction condition required, from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide firestopping systems that comply with the following requirements and those specified in "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency performing testing and follow-up inspection services for firestopping systems acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping systems: Provide materials that are identical to those tested per ASTM E 814 or UL 1479. Provide rated firestopping system products that bear classification marking of qualified testing and inspecting agency.
 - 3. FM Global: Provide classification markings on penetration firestopping corresponding to designations listed by the following:
 - a. FM Global in its "Building Materials Approval Guide."

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 **PROJECT CONDITIONS**

- A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.
- B. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- C. Ventilate firestopping systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping systems.
- C. Notify Owner's inspecting agency at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up firestopping system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.
 - 1. FM Global: Manufacturer to provide firestopping products in compliance with FM Global requirements as indicated in "Quality Assurance" Article.
- B. Compatibility: Provide firestopping systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping systems, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.
- C. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials and approved by the qualified testing and inspection agency for firestopping systems indicated.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
- B. F-Rated Systems: Provide penetration firestopping systems with F-ratings determined per ASTM E 814 or UL 1479, equaling or exceeding fire-resistance rating of constructions penetrated.
- C. T-Rated Systems: For the following conditions, provide penetration firestopping systems with Tratings, as well as F-ratings, determined per ASTM E 814 or UL 1479, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - 1. Penetrations located outside wall cavities.
 - 2. Penetrations located outside fire-resistive shaft enclosures.
 - 3. Penetrations located in construction containing fire-protection-rated openings.
- D. For penetration firestopping systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

2.3 PENETRATION FIRESTOP SYSTEMS

- A. Description: Classified in Underwriters Laboratories (UL) Fire Resistance Directory, "Section XHEZ Penetration Firestop Systems", and/or "Section XHHW Fill Void or Cavity Materials" for specific project conditions.
- B. Application Considerations:

- 1. Firestops exposed to view and/or are scheduled to receive finishes shall be paintable or capable of receiving finish materials.
- 2. Firestops exposed to traffic, moisture, and physical damage shall be products that do not deteriorate when exposed to these conditions.
- 3. Firestops for water piping penetrations, of any type, shall be moisture-resistant products.
- 4. Firestops for floor penetrations with annular spaces exceeding 4 in (100 mm) or more in width and exposed to possible loading and traffic shall be products capable of supporting the floor loads involved either by installing floor plates or by other means.
- 5. Firestops for penetrations involving insulated piping shall be products that do not require removal of insulation.
- 6. Firestops for cable trays and future penetrations shall be reusable pillows or bags.
- C. Provide firestops within fire resistive walls and partitions containing flush mounted devices such as outlet boxes, electrical cabinets and mechanical cabinets mounted back to back and spaced less than 24 inches on center in accordance with UL Fire Resistance Directory "Wall Opening Protective Materials", Category CLIV.
- D. For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
 - 1. Remove foreign materials from surfaces of openings, joints and penetrating items that could interfere with adhesion of firestopping.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.4 INSTALLATION OF PENETRATION FIRESTOPS

- A. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- B. Install fill materials for penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 in (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning Penetration Firestopping Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Tested System or Engineered Judgement Number.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.6 FIELD QUALITY CONTROL

- A. Where required, inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174 "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Inspections shall include the following verifications:
 - a. Verify that proper specified firestopping system products and materials are used.
 - b. Verify installer's credentials and certification.
 - c. Verify that each firestopping system is installed in accordance with product manufacturer's latest published requirements.
 - d. Verify that firestopping system materials and installation comply with appropriate rating authorities' requirements.
 - e. Verify that firestopping system is installed in specified and/or indicated locations in rated assemblies.
 - 2. Do not proceed to enclose firestopping system installations with other construction until reports of examinations are issued.
 - 3. Where deficiencies are found, repair or replace firestopping system materials and products to bring deficient installation into compliance with specified requirements.

3.7 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which opening and joints occur.
- B. Protect firestopping system components during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 12 93 00 SITE FURNISHINGS

PART1- GENERAL

1.1 SUMMARY

A. This section includes the production and installation of site furnishings that include benches, planters, litter receptacles, chairs, tables, and fixed stainless steel bollards.

1.2 RELATED SECTIONS

A. SECTION 03 35 19 Decorative Concrete Paving

1.3 REFERENCES

- A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):
- B. ALUMINUM ASSOCIATION (AA).
- C. AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAAG) for Accessible Public Rights-of-Way, Section R302 Detectable Warning Surfaces
- D. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATIONS (AAMA) 605.2 -Voluntary specification for high Performance Organic Coatings on Architectural Aluminum Extrusions and Panels.
- E. ASTM Testing Standards:
 - 1. ASTM B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 2. ASTM D 522 Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - 3. ASTM D 523 Standard Test Method for Specular Gloss.
 - 4. ASTM D 2247 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - 5. ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test.
 - 6. ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test.
 - 7. ASTM G 155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
- F. ISO Testing Standards:
 - 1. ISO 1520 Paints and Varnishes Cupping Test.
 - 2. ISO 2815 Paints and Varnishes Buchholz Indentation Test.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings since 1969.
- B. Provide 5 similar reference projects with direct contact information.
- C. Product Support: Products are supported with complete engineering drawings.
- D. Base Worth: An installed base of products worth in excess of four hundred million dollars.
- E. Assets: Excess of twenty million dollars in assets.
- F. Insurance: Liability insurance coverage of two million dollars

- G. Manufacturing Lead Time: Manufacturing lead time will be determined at time of order.
- H. Facility Operator: Welders and machine operators are certified for all AWS & ASTM standards that apply.

1.5 SUBMITTALS

- A. General: Comply with requirements of SECTION SUBMITTALS.
- B. Literature: Technical data and installation instructions.
- C. Samples:
 - 1. Chairs, tables, benches, litter receptacles: Samples of color and finish.
- D. Maintenance and clean up: Instructions for maintenance and clean up.
- E. Shop (Erection) Drawings for custom benches.
 - 1. Detail fabrication and installation of architectural wooded benches and there connection to the precast concrete units.
 - 2. Indicate locations, plan views, elevations, dimensions, shapes, and cross-sections of each bench unit.
 - 3. Indicate aesthetic intent including joints, drips, chamfers, rustications or reveals, and extent and location of each surface finish.
 - 4. Indicate details at planter and wall corners.
 - 5. Indicate welded connections by AWS standard symbols and show size, length, and type of each weld.
 - 6. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 7. Indicate plan views and elevations showing unit location and dimensions, erection sequences, and bracing plan for special conditions.
 - 8. Indicate relationship of wooden bench attachments to architectural precast concrete and other adjacent materials.
 - 9. Indicate locations and details of joint widths.
 - 10. Coordinate and indicate openings and inserts required by other trades.
 - 11. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Architect and submit design Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
 - 12. Mockup Mockup a full scale copy of furnishings and submit photographs of all joints, welds, seams and finishes prior to fabrication.
 - 13. Shop Drawings must be submitted prior to mockup and or fabrication.
 - 14. Qualification Data: For Installer, Fabricator, Testing agency, and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 DELIVERY AND STORAGE

A. Site furnishings shall be delivered to the project site in a timely manner in their original unopened containers bearing labels clearly identifying the manufacturer's name. Storage of materials shall be subject to approval and shall afford easy access for inspection.

1.7 JOB CONDITIONS

- A. Existing Conditions: Examine work in place that this work is dependent. Defects that may influence satisfactory completion and performance of this work shall be corrected by the requirements of the applicable section of work before commencement of the work. Commencement shall be construed as work in place being acceptable for satisfying the requirements of this section.
- B. Protection: Protect site furnishings and adjacent work against damage during construction of the project.
- PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. LANDSCAPE FORMS-1-800-430-6209
- B. ATKORE CALPIPE -1-877-277-8518
- C. PLANTERS UNLIMITED-1-888320-0626
- D. APPROVED EQUAL

2.2 SITE FURNISHINGS

- A. Bench–Plan/Schedule Reference:
 - 1. Manufacturer: LANDSCAPE FORMS
 - 2. Melville Bench with Back Arm Option: Arms
 - 3. Color: Powdercoat Metal, Color: Stone with Jarrah Wood
- B. Table and Chairs Plan/Schedule Reference:
 - 1. Manufacturer: LANDSCAPE FORMS
 - 2. Chipman Style Round Table and Armless Chairs
 - 3. Size: 45 Inch Round
 - 4. Height: Dining Table, 29.25 inch
 - 5. Umbrella Hole: No umbrella hole
 - 6. Mounting option: Surface Mount
 - 7. Finish/Color: Powercoat Metal (Metallic) Color: Stone
- C. Litter Receptacle Plan/Schedule Reference:
 - 1. Manufacturer: LANDSCAPE FORMS
 - 2. Poe Litter Receptacle with Side Opening
 - 3. Diameter: 29"
 - 4. Height: 44"
 - 5. Finish/Color: Powdercoat Metal (Metallic) Color: Stone
 - 6. Surface Mounted

D. Bicycle Rack – Plan/Schedule Reference:

- 1. Manufacturer: LANDSCAPE FORMS
- 2. Ride Bicycle Rack
- 3. Size: 4" x 28" x 26"
- 4. Finish/Color: Powdercoat Metal (Metallic) Color: Stone
- 5. Surface Mounted
- E. Illuminated Fixed Bollard Plan/Schedule Reference:
 - 1. Manufacturer: ATKORE CALPIPE
 - 2. Stainless Steel LED Globe Style 23
 - 3. Size: 3' H x 8" W
 - 4. Finish/Color: Stainless Steel
 - 5. Embedded Concrete Footing

- F. Fixed Bollard Plan/Schedule Reference:
 - 1. Manufacturer: ATKORE CALPIPE
 - 2. Stainless Steel Fixed Security Bollard SSF080
 - 3. Size: 3' H x 8" W
 - 4. Finish/Color: Stainless Steel
 - 5. Embedded Concrete Footing
- G. Planters-Plan/Schedule Reference:
 - 1. Manufacturer: PLANTERS UNLIMITED
 - 2. Modern Round Planter
 - 3. Size: 24" DIA.
 - 4. Material: Fiberglass
 - 5. Finish/Color: Matte finish, Color Chaps Brown
 - 6. Surface Mounted
- H. Planters-Plan/Schedule Reference:
 - 1. Manufacturer: PLANTERS UNLIMITED
 - 2. Modern Square Planter
 - 3. Size: 72" L x 36" W x 36" H. DIA.
 - 4. Material: Fiberglass
 - 5. Finish/Color: Matte finish, Color Chaps Brown
 - 6. Surface Mounted
- I. Planters-Plan/Schedule Reference:
 - 1. Manufacturer: PLANTERS UNLIMITED
 - 2. Modern Round Planter
 - 3. Size: 84" L x 30W x 30" H
 - 4. Material: Fiberglass
 - 5. Finish/Color: Matte finish, Color Chaps Brown
- 6. Surface Mounted

2.3 RECYCLED CONTENT

- A. Product:
- 1. Recycled Material Content: Minimum 65 percent.
- 2. Post-Consumer Material Content: Minimum 50 percent.
- 3. Pre-Consumer Material Content: Minimum 15 percent.
- 4. Recyclable: 100 percent.

2.4 FINISHES

- A. Table, Chairs,
 - 1. Finish on Metal: Landscape Forms, Inc. "Pangard II".
 - a. Primer: Rust inhibitor.
 - b. Topcoat: Thermosetting TGIC polyester powder coat. UV, chip, and flake resistant.
 - c. 3Test Results: "Pangard II".
 - d. Gloss Consistency, Gardner 60 Degrees, ASTM D 523: Plus or minus 5 percent from standard.
 - e. UV Resistance, Color and Gloss, ASTM G 155, Cycle 7: Delta E less than 2 at 2.0 mils and less than 20 percent loss.
 - f. Cross-Hatch Adhesion, ASTM D 3359, Method B: 100 percent pass.
 - g. Flexibility Test, Mandrel, ASTM D 522: 3 mm at 2 mils.
 - h. Erichsen Cupping, ISO 1520: 8 mm.
 - i. Impression Hardness, Buchholz, ISO 2815: 95.
 - j. Impact Test, ASTM D 2794: 60 inch-pounds at 2.5 mils.
 - k. Pencil Hardness, ASTM D 3363: 2H minimum.
 - I. Corrosion Resistance, 1,500-Hour Test, ASTM B 117: Max undercutting 1 mm.

m. Humidity Resistance, 1,500-Hour Test, ASTM D 2247: Max blisters 1 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installation areas. Field verify the location of all site furnishings in the field and receive Landscape Architect's approval prior to construction. Report unsatisfactory conditions in writing to Landscape Architect. Do not proceed until unsatisfactory conditions have been corrected.
- B. Starting installation constitutes acceptance of condition or satisfactory for installation of site furnishings by Contractor, who shall correct damage and defects or unsatisfactory work at no additional cost.

3.2 INSTALLATION

- A. General:
 - 1. Install components plumb and level, accurately in location, alignment, and elevation, measured from established lines and levels and free from rack, distortion or defects detrimental to installed appearance and performance.
 - Contractor shall be responsible for providing all necessary connections, supports, brackets, hardware, and anchors, whether shown or not shown on the drawings, as required for a full and complete installation and execution of the Bollard scope of work.
 Fit exposed connections accurately together to form tight hairline joints.
- B. Chair and Tables: Install as manufacturer's instructions and approved final shop drawings.
- C. Benches: Install as manufacturer's instructions and approved final shop drawings.
- D. Litter Receptacles: Install as manufacturer's instructions and approved shop drawings.
- E. Bike Rack: Install as per manufacturer's instructions and approved shop drawings.
- F. Bollard Cover: Contractor shall be responsible for providing all necessary connections, supports, brackets, hardware, and anchors, whether shown or not shown on the drawings, as required for a full and complete installation and execution of the Bollard scope of work.

3.3 **PROTECTION**

- A. Protect all site furnishings from construction activities with temporary protective coverings approved by the units manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alteration and refinish entire unit or provide new units.

3.4 CLEAN-UP

A. Clean-up site furnishings as required and in accordance with manufacturer's recommendation.

END OF SECTION 12 93 00

SECTION 142100 ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric traction elevators, conveying equipment, components, and accessories.
 - 2. Related materials necessary to complete installation.

1.2 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each product indicated, specified, or required.
 - 1. Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
 - 2. Include car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- D. Samples for Initial Selection: For finishes involving color selection.
- E. Samples for Verification: For car finishes, hoistway door and frame, and signal equipment finishes; 3 inch square Samples of sheet materials; and 4 inch lengths of running trim members.
- F. Operation and Maintenance Data: For inclusion in operations and maintenance manual required by Division 01.
 - 1. Include manufacturer's or Installer's standard operation and maintenance manual, according to ASME A17.1/CSA B44.
 - 2. Include manufacturer's instructions for operation and maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 3. Include precautions against cleaning products and methods which may be detrimental to finishes.
 - 4. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

- G. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.
- H. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- I. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
- 1.4 QUALITY ASSURANCE
 - A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
 - 1. Manufacturer: Kone.
 - 2. Product: Trauma.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. Kone.
 - 2. Otis Elevator Co.
 - 3. Schindler Elevator Corp.
 - 4. TKE Elevator.

- C. Source Limitations: Obtain electric traction elevators from single manufacturer.
 - 1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, to be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with codes, regulations and standards indicated on the Drawings.

2.3 ELECTRIC TRACTION ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components to be used, as included in standard elevator systems and as required for complete system.
- B. Patient Transfer Elevators Description:
 - 1. Elevator Numbers: PT1 and PT2.
 - 2. Machine Type: Gearless traction.
 - 3. Rated Load: 10,000 pounds.
 - 4. Rated Speed: 500 feet per minute.
 - 5. Travel: 126 feet.
 - 6. Stops and Openings:
 - a. Helipad Level: Front.
 - b. Roof: None.
 - c. Level 6: Front.
 - d. Level 5: Front.
 - e. Level 4: Rear.
 - f. Level 3: Rear.
 - g. Level 2: Front and Rear.
 - h. Level 1:
 - 1) Elevator T1: Front and Rear.
 - 2) Elevator T2: Rear.
 - 7. Operation System: Group automatic operation.
 - 8. Auxiliary Operations:
 - a. Standby power operation.
 - b. Automatic operation of lights and ventilation fans.
 - c. Priority service at all floors.
 - d. Independent service for all cars in group.
 - 9. Dual Car-Control Stations: Provide two car-control stations in each elevator.
 - 10. Car Enclosures:
 - a. Inside Width: 96 inches from side wall to side wall.
 - b. Inside Depth: 132 inches from back wall to front wall (return panels).
 - c. Inside Height: Not less than 96 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, ASTM A480, No. 4 finish.
 - e. Door Faces: Satin stainless steel, ASTM A480, No. 4 finish.

- f. Car Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
- g. Finishes: As specified on Drawing Sheet A4.23.
- h. Reveals: Black.
- i. Plastic-laminate doors are about as expensive as stainless-steel doors but are not as durable.
- j. Door Sills: Aluminum.
- 11. Hoistway Entrances:
 - a. Width: 60 inches.
 - b. Height: 84 inches.
 - c. Type: As indicated on the Drawings.
 - d. Door Faces and Frames: Satin stainless steel, ASTM A480, No. 4 finish.
 - e. Sills: Aluminum.
- 12. Hall Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
- 13. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, ASTM A480, No. 4 finish.
 - b. Provide hooks for protective pads in one car with a complete set of full-height protective pads.

2.4 TRACTION SYSTEMS

- A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
 - 1. Provide nonregenerative system.
- B. Fluid for Hydraulic Buffers: Fire-resistant fluid.
- C. Inserts: Furnish required anchorage devices for installing guide rails, machinery, and other components of elevator work.
- D. Machine Beams: Provide steel framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 055000 "Metal Fabrications" for materials and fabrication.
- E. Car Frame and Platform: Bolted- or welded-steel units.
- F. Guides: Roller guides at top and bottom of car and counterweight frames.
- 2.5 OPERATION SYSTEMS
 - A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
 - B. Auxiliary Operations:
 - Group Standby Power Operation: On activation of standby power, cars are returned to a designated floor and parked with doors open. One car is returned at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60

seconds, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at fire-command station. Manual operation causes automatic operation to cease.

- 2. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.
- 3. Priority Service: Service is initiated by a card reader at designated floors. One elevator is removed from group operation and directed to the floor where service was initiated. On arriving at the floor, elevator opens its doors and parks. Car is placed in operation by selecting a floor and pressing door close button or by operating keyswitch to put car in independent service. After responding to floor selected or being removed from independent service, car is returned to group operation. If car is not placed in operation within a preset time after being called, it is returned to group operation.
- 4. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are reenergized before car doors open.
- C. Security features are not to not affect emergency firefighters' service.
 - 1. Card-Reader Operation: System uses card readers at car-control stations and hall push-button stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space for card reader in car.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessorcontrolled, infrared light beams projecting across car entrance. Interruption of one or more light beams causes doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer sounds and doors begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. Provide enameled or powder-coated steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor: Exterior, C-C Plugged grade plywood, not less than 7/8 inch nominal thickness.
 - 2. Finishes: As indicated on Drawing Sheet A4.23.
 - 3. Sight Guards: Provide sight guards on car doors.
 - 4. Sills: Extruded aluminum, with grooved surface, 1/4 inch thick.
 - 5. Light Fixture Efficiency: Not less than 35 lumens per watt.
 - 6. Ventilation Fan Efficiency: Not less than 3.0 cubic feet per minute per watt.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile to accommodate hoistway wall construction.
 - 1. Where gypsum board wall construction is indicated, frames to be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies to comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Fire-Protection Rating: As required for 2 hour rated shaft walls.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 - 1. Finishes: As indicated on Drawing Sheet A4.23.
 - 2. Sight Guards: Provide sight guards on doors matching door edges.
 - 3. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
 - 4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107.

2.9 SIGNAL EQUIPMENT

- A. General: Hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled buttons and lighted elements illuminated with LEDs.
- B. Swing-Return Car-Control Stations: Provide car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.
 - 1. Mark buttons and switches for function. Use both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.

- 2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
- 3. Provide telephone jack in each unit for firefighters' two-way telephone communication service.
- G. Hall Lanterns: Manufacturer's standard wall-mounted units for mounting above entrance frames. Provide single arrow at terminal landings.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - 1. At manufacturer's option, audible signals may be placed on cars.
- I. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.
- J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.
- K. Emergency Car Lighting: An emergency power unit employing a sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
- L. Cab Wiring: All wiring on the elevator cab shall use factory wired harnesses with Wago Cage Clamp plugs and receptacles, and shall terminate behind the car operating panel.
- M. Exhaust fan mounted on the car top.
- N. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.
- 2.10 FINISH MATERIALS
 - A. Cold-Rolled Steel Sheet: ASTM A1008, commercial steel, Type B, exposed, matte finish.
 - B. Hot-Rolled Steel Sheet: ASTM A1011, commercial steel, Type B, pickled.
 - C. Stainless Steel Sheet: ASTM A240, Type 304.
 - D. Stainless Steel Bars: ASTM A276, Type 304.
 - E. Stainless Steel Tubing: ASTM A554, Grade MT 304.
 - F. Aluminum Extrusions: ASTM B221, Alloy 6063.
 - G. Plastic Laminate: High-pressure type complying with ISO 4586-3, Type HGS for flat applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION OF ELECTRIC TRACTION ELEVATORS

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance.
 - 3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

3.4 PROTECTION

A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for each elevator used for construction purposes:

- 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
- 2. Provide strippable protective film on entrance and car doors and frames.
- 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
- 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
- 5. Do not load elevators beyond their rated weight capacity.
- 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
- 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies to be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance during normal working hours.
 - 2. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevators.
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 142123 MACHINE-ROOM-LESS ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Machine-room-less electric traction passenger and service elevators, conveying equipment, components, and accessories.
 - 2. Related materials necessary to complete installation.

1.2 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical product literature for each product indicated, specified, or required.
 - 1. Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
 - 2. Include car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- D. Samples for Initial Selection: For finishes involving color selection.
- E. Samples for Verification: For car finishes, hoistway door and frame, and signal equipment finishes; 3 inch square Samples of sheet materials; and 4 inch lengths of running trim members.
- F. Operation and Maintenance Data: For inclusion in operations and maintenance manual required by Division 01.
 - 1. Include manufacturer's or Installer's standard operation and maintenance manual, according to ASME A17.1/CSA B44.
 - 2. Include manufacturer's instructions for operation and maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 3. Include precautions against cleaning products and methods which may be detrimental to finishes.

- 4. Include name, address, and telephone number of manufacturer's nearest authorized service representative.
- G. Manufacturer's Special Warranty: Sample of unexecuted warranty stating obligations, remedies, limitations, and exclusions.
- H. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- I. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
 - 1. Manufacturer: Kone.
 - 2. System: Monospace 500.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Division 01 Section "Substitution Procedures."
 - 1. Kone.
 - 2. Otis Elevator Co.

- 3. Schindler Elevator Corp.
- 4. TKE Elevator.
- C. Source Limitations: Obtain electric traction elevators from single manufacturer.
 - 1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, to be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with codes, regulations and standards indicated on the Drawings.

2.3 MACHINE-ROOM-LESS ELECTRIC TRACTION ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Public Elevators Description:
 - 1. Elevator Numbers: P1, P2, and P3.
 - 2. Rated Load: 5,200 pounds.
 - 3. Rated Speed: 350 feet per minute.
 - 4. Travel: 82 feet.
 - 5. Stops and Openings:
 - a. Level 6: Front.
 - b. Level 5: Front.
 - c. Level 4: Front.
 - d. Level 3: Front.
 - e. Level 2: Front.
 - f. Level 1: Front
 - 6. Operation System: Group automatic operation.
 - 7. Auxiliary Operations:
 - a. Standby power operation.
 - b. Automatic operation of lights and ventilation fans.
 - c. Independent service for all cars in group.
 - 8. Car-Control Stations: One; equip with required keyswitches if any.
 - 9. Car Enclosures:
 - a. Inside Width: 70 inches from side wall to side wall.
 - b. Inside Depth: 117 inches from back wall to front wall (return panels).
 - c. Inside Height: Not less than 96 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, ASTM A480, No. 4 finish.
 - e. Door Faces: Satin stainless steel, ASTM A480, No. 4 finish.
 - f. Car Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
 - g. Finishes: As specified on Drawing Sheet A4.23.
 - h. Reveals: Black.
 - i. Door Sills: Aluminum.

- 10. Hoistway Entrances:
 - a. Width: 48 inches.
 - b. Height: 84 inches.
 - c. Type: As indicated on the Drawings.
 - d. Door Faces and Frames: Satin stainless steel, ASTM A480, No. 4 finish.
 - e. Sills: Aluminum.
- 11. Hall Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
- 12. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
- C. Staff Elevators Description:
 - 1. Elevator Numbers: S1 and S2
 - 2. Rated Load: 5,200 pounds.
 - 3. Rated Speed: 350 feet per minute.
 - 4. Travel: 82 feet.
 - 5. Stops and Openings:
 - a. Level 6: Front.
 - b. Level 5: Front.
 - c. Level 4: Rear.
 - d. Level 3: Front and Rear.
 - e. Level 2: Rear.
 - f. Level 1: Rear.
 - 6. Operation System: Group automatic operation.
 - 7. Auxiliary Operations:
 - a. Standby power operation.
 - b. Automatic operation of lights and ventilation fans.
 - c. Independent service.
 - 8. Car-Control Stations: One at each opening; equip only one with required keyswitches if any.
 - 9. Car Enclosures:
 - a. Inside Width: 70 inches from side wall to side wall.
 - b. Inside Depth: 125 inches from back wall to front wall (return panels).
 - c. Inside Height: Not less than 96 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, ASTM A480, No. 4 finish.
 - e. Door Faces: Satin stainless steel, ASTM A480, No. 4 finish.
 - g. Car Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
 - h. Finishes: As specified on Drawing Sheet A4.23.
 - i. Reveals: Black.
 - k. Door Sills: Aluminum.
 - 10. Hoistway Entrances:
 - a. Width: 48 inches.
 - b. Height: 84 inches.
 - c. Type: As indicated on the Drawings.

- e. Door Faces and Frames: Satin stainless steel, ASTM A480, No. 4 finish
- g. Sills: Aluminum.
- 11. Hall Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
- 12. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.
- D. Loading Dock Elevators Description:
 - 1. Elevator Number: LD1.
 - 2. Rated Load: 5,200 pounds.
 - 3. Rated Speed: 350 feet per minute.
 - 4. Travel: 50 feet.
 - 5. Stops and Openings:
 - a. Level 4: Front.
 - b. Level 3: Front.
 - c. Level 2: Front.
 - d. Level 1: Front.
 - 6. Auxiliary Operations:
 - a. Standby power operation.
 - c. Automatic operation of lights and ventilation fans.
 - e. Independent service for all cars in group.
 - 7. Car-Control Stations: Equip only one with required keyswitches if any.
 - 8. Car Enclosures:
 - a. Inside Width: 70 inches from side wall to side wall.
 - b. Inside Depth: 117 inches from back wall to front wall (return panels).
 - c. Inside Height: Not less than 96 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, ASTM A480, No. 4 finish.
 - e. Door Faces: Satin stainless steel, ASTM A480, No. 4 finish.
 - g. Car Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
 - h. Finishes: As specified on Drawing Sheet A4.23.
 - i. Reveals: Black.
 - k. Door Sills: Aluminum.
 - 9. Hoistway Entrances:
 - a. Width: 48 inches.
 - b. Height: 84 inches.
 - c. Type: As indicated on the Drawings.
 - e. Door Faces and Frames: Satin stainless steel, ASTM A480, No. 4 finish.
 - h. Door Sills: Aluminum.
 - 10. Hall Fixtures: Satin stainless steel, ASTM A480, No. 4 finish.
 - 11. Additional Requirements:

- a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
- b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

2.4 TRACTION SYSTEMS

- A. Elevator Machines: Permanent magnet, variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
 - 1. Provide nonregenerative system.
- B. Fluid for Hydraulic Buffers: Fire-resistant fluid.
- C. Inserts: Furnish required anchorage devices for installing guide rails, machinery, and other components of elevator work.
- D. Car Frame and Platform: Bolted- or welded-steel units.
- E. Guides: Roller guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Auxiliary Operations:
 - 1. Group Standby Power Operation: On activation of standby power, cars are returned to a designated floor and parked with doors open. One car is returned at a time, with priority given to loaded cars. If a car cannot be returned after two attempts, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within 60 seconds, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at fire-command station. Manual operation causes automatic operation to cease.
 - 2. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.
 - 3. Basic operation systems for a single car (single automatic and selective-collective operation) and groups of two or more cars (group automatic operation) are defined in ASME 17.1/CSA B44 and do not require further specification. For groups of three or more cars, systems with demand-based dispatching may provide better response time than standard group automatic systems at little additional cost. However, because of the slow speed of hydraulic elevators, systems with demand-based dispatching may not provide significant improvement. Insert requirements here for more sophisticated systems if needed.
 - 4. Retain "Auxiliary Operations" Paragraph below to define operations retained in "Elevators" Article.
 - 5. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after 5 minutes and are reenergized before car doors open.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessorcontrolled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. General: Enameled- or powder-coated-steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor: Exterior, C-C Plugged grade plywood, not less than 7/8 inch nominal thickness.
 - 2. Finishes: As indicated on Drawing Sheet A4.23.
 - 3. Sight Guards: Provide sight guards on car doors.
 - 4. Sills: Extruded aluminum, with grooved surface, 1/4 inch thick.
 - 5. Light Fixture Efficiency: Not less than 35 lumens per watt.
 - 6. Ventilation Fan Efficiency: Not less than 3.0 cubic feet per minute per watt.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 - 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Fire-Protection Rating: As required for 2 hour rated shaft walls.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 - 1. Finishes: As indicated on Drawing Sheet A4.23..
 - 2. Sight Guards: Provide sight guards on doors matching door edges.
 - 3. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
 - 4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107.

2.9 SIGNAL EQUIPMENT

A. General: Hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled; vandal-resistant buttons and lighted elements illuminated with LEDs.

- B. Swing-Return Car-Control Stations: Car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.
 - 1. Mark buttons and switches for function using both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: One hall push-button station at each landing.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
 - 3. Provide telephone jack in each unit for firefighters' two-way telephone communication service.
- G. Hall Lanterns: Manufacturer's standard wall-mounted units for mounting above entrance frames. Provide single arrow at terminal landings.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - 1. At manufacturer's option, audible signals may be placed on cars.
- I. Standby-Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.
- J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby-power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.
- K. Emergency Car Lighting: An emergency power unit employing a sealed rechargeable battery and totally static circuits shall be provided to illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
- L. Cab Wiring: All wiring on the elevator cab shall use factory wired harnesses with Wago Cage Clamp plugs and receptacles, and shall terminate behind the car operating panel.

- M. Exhaust fan mounted on the car top.
- N. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.
- 2.10 FINISH MATERIALS
 - A. Cold-Rolled Steel Sheet: ASTM A1008, commercial steel, Type B, exposed, matte finish.
 - B. Hot-Rolled Steel Sheet: ASTM A1011, commercial steel, Type B, pickled.
 - C. Stainless-Steel Sheet: ASTM A240, Type 304.
 - D. Stainless-Steel Bars: ASTM A276, Type 304.
 - E. Stainless-Steel Tubing: ASTM A554, Grade MT 304.
 - F. Aluminum Extrusions: ASTM B221, Alloy 6063.
 - G. Plastic Laminate: High-pressure type complying with ISO 4586-3, Type HGS for flat applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 - 1. Examine surfaces and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
 - 3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Lubricate operating parts of systems as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension

at each landing.

- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance.
 - 3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator per building. Comply with the following requirements for each elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide strippable protective film on entrance and car doors and frames.
 - 3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
 - 4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 5. Do not load elevators beyond their rated weight capacity.
 - 6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - 7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies to be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance during normal working hours.
 - 2. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevators.
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 260000

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 RELATED DOCUMENTS

- A. Requirements under Division 1 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 1, this section and division take precedence. Become thoroughly familiar with all their contents as to requirements that affect this division, section or both. The work required under this section includes material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate each system's functioning as implied by the design and the equipment specified.
- B. The specifications and drawings for the project are complementary, and portions of the work described in one, shall be provided as if described in both. In the event of discrepancies, notify the engineer and request clarification prior to proceeding with the work involved.
- C. Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of work, indicating the intended general arrangement of the equipment and other materials without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all contract documents. Correct errors that could have been avoided by proper checking and inspection, at no additional cost to the owner.
- D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the contract is based.

1.3 DEFINITIONS

- A. Whenever used in these specifications or drawings, the following terms shall have the indicated meanings:
 - 1. Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
 - 2. Install: "to perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
 - 3. Provide: "to furnish and install complete, and ready for the intended use."
 - 4. Furnished by owner (or owner-furnished) or furnished by others: "an item furnished by the owner or under other divisions or contracts, and installed under the requirements of this division, complete, and ready for the intended use, including all items and services

incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division.

- 5. Engineer: where referenced in this division, "engineer" is the engineer of record and the design professional for the work under this division, and is a consultant to, and an authorized representative of, the architect, as defined in the general and/or supplementary conditions. When used in this division, it means increased involvement by, and obligations to, the engineer, in addition to involvement by, and obligations to, the "architect".
- 6. AHJ: the local code and/or inspection agency (authority) having jurisdiction over the work.
- 7. NRTL: nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, certified, or all three, by an NRTL, and acceptable to the AHJ over this project.
- 1.4 PRE-BID SITE VISIT
 - A. Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

1.5 MATERIAL AND WORKMANSHIP

- A. Provide all material and equipment new and in first class condition. Provide markings or a nameplate for all material and equipment identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. In general, provide the following quality grade(s) for all materials and equipment:
- B. Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the architect and engineer. Workmanship shall be the finest possible by experienced mechanics of the proper trade.
- C. The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal or excessive noise from equipment, devices or other system components will not be acceptable.
- D. Remove from the premises waste material present as a result of work. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.
- E. Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction.

1.6 MANUFACTURERS

- A. In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers listed are not in accordance with any ranking or preference.
- C. Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

1.7 COORDINATION

- A. Coordinate all work with other divisions and trades so that the various components of the systems will be installed at the proper time, fit the available space, and will allow proper service access to those items requiring maintenance. Refer to all other division's drawings, and to relevant equipment submittals and shop drawings to determine the extent of clear spaces. Components which are installed without regard to the above shall be relocated at no additional cost to the owner.
- B. Unless otherwise indicated, the general contractor will provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the general contractor with information where chases and openings are required. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing system components in the manner anticipated in the design. Keep informed as to the work of other trades engaged in the construction of the project, and execute work in a manner as to not interfere with or delay the work of other trades.
- C. Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor will be held responsible for errors that could have been avoided by proper checking and inspection
- D. Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the construction documents are not necessarily intended to designate the required trim.

1.8 ORDINANCES, CODES, AND STANDARDS

- A. Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ including any amendments and standards as set forth by the National Fire Protection Association (NFPA), Underwriters Laboratories (UL), Occupational Safety and Health Administration (OSHA), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), American National Standards Institute (ANSI), American Society of Testing Materials (ASTM) and other national standards and codes where applicable. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services.
- B. Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence.
- C. Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the engineer's attention for final resolution. Contractor will be held responsible for any violation of the law.
- D. Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for and furnish certificates of inspection to owner. Contractor will be held responsible for violations of the law.

1.9 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Store and protect from damage equipment and materials delivered to job site, in accordance with manufacturers' recommendations. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment and material that has been damaged by construction activities will be rejected, and contractor shall furnish new equipment and material as required at no additional cost to the owner.
- B. Keep premises broom clean from foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.
- C. Plug or cap open ends of conduits while stored and installed during construction when not in use to prevent the entrance of debris into the systems.

1.10 SUBSTITUTIONS

- A. Include in the base bid the products specifically named in these specifications or on the drawings. Submit, in the form of alternates, with bid, products of any other manufacturers for similar use, provided the differences in cost, if any, are included for each proposed alternate.
- B. No substitutions will be considered with receipt of Bids, unless the Architect and Engineer have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids, and have approved the substitution request. Include, with each such request, the name of the material or equipment for which substitution is being requested, and a complete description of the proposed substitution, including drawings, cut sheets, performance and test data, and all other information necessary for an evaluation. Include also a statement setting forth changes in other materials, equipment or other work that would be required to incorporate the substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The proposer of any substitutions shall compensate the Engineer at a rate of \$150.00 per hour for time spent evaluating proposed substitutions and or the subsequent revisions to the design required to utilize the substitution.
- C. The Architect's or Engineer's decision to approve or disapprove a substitution in a Bid is final.
- D. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal.
- E. No substitutions will be considered after receipt of Bids and before award of the Contract.
- F. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.11 SUBMITTALS

- A. Assemble and submit to the architect, for engineer's review, manufacturers' product literature for material and equipment to be furnished, installed, or both, under this division, including shop drawings, manufacturers' product data and performance sheets, samples, and other submittals required by this division. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Provide the number of submittals required by division 1; however, at a minimum, submit two (2) sets. Before submitting, verify that all materials and equipment submitted are mutually compatible and suitable for the intended use, fit the available spaces, and allow ample and code-required room for access and maintenance. Submittals shall contain the following information. Submittals not so identified will be returned to the contractor without action:
 - 1. The project name.
 - 2. The applicable specification section and paragraph.
 - 3. The submittal date.
 - 4. The contractor's stamp, which shall certify that the stamped drawings have been checked by the contractor, comply with the drawings and specifications, and have been coordinated with other trades.
- B. Submittals and shop drawings shall not contain HP Engineering's firm name or logo, nor shall it contain the HP Engineering's engineers' seal and signature. They shall not be copies of HP Engineering's work product.
- C. Transmit submittals as early as required to support the project schedule. Allow for two weeks engineer review time, plus mailing time, plus a duplication of this time for re-submittals, if required. The engineer's submittal reviews will not relieve the contractor from responsibility for errors in dimensions, details, size of members, or quantities; or for omitting components or fittings; or for not coordinating items with actual building conditions.
- D. Refer to division 1 for acceptance of electronic submittals for this project. For electronic submittals,

contractor shall submit the documents in accordance with the procedures specified in division 1. Contractor shall notify the architect and engineer that the shop drawings have been posted. If electronic submittal procedures are not defined in division 1, contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, contractor shall copy the architect and engineer's designated representatives. Contractor shall allow the engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

1.12 ELECTRONIC DRAWING FILES

A. In preparation of shop drawings or record drawings, contractor may, as an option, obtain electronic drawing files in Revit, AutoCAD, or DXF format from the engineer for a fee of \$300 for a drawing set up to 10 sheets plus \$25 per sheet in excess of 10 sheets. Contact the architect for written authorization; and, contact the engineer to obtain the necessary release agreement form and to indicate the desired shipping method and drawing format. In addition to payment, architect's written authorization and engineer's release agreement form must be received before electronic drawing files will be sent.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Submit to the architect, for engineer's review, copies each of operations and maintenance instruction manuals, appropriately bound into manual form including approved copies of the following, revised if necessary to show system and equipment as actually installed. Paper clips, staples, rubber bands, and mailing envelopes are not considered approved binders. Provide the number of submittals required by Division 1; however, at a minimum, submit two (2) sets, and include, at a minimum, the following information:
- 1. Cover sheet that lists the project name, date, owner, architect, consulting engineer, general contractor, subcontractor, and an index of contents.
- 2. Manufacturers' catalogs and product data sheets
- 3. Wiring diagrams
- 4. Operation and Maintenance instructions
- 5. Parts lists
- 6. Approved shop drawings
- 7. Test reports as defined in NETA ATS for the systems and equipment provided or furnished or installed under this contract.
- 8. Names, addresses, telephone numbers, and e-mail addresses of local contacts for warranty services and spare parts.
- B. Submit manuals prior to requesting the final punch list and before any requests for substantial completion. Final approval of this division's systems installed under this contract will be withheld until this equipment brochure is received and deemed complete by the architect and engineer.
- C. Provide "as-built" drawings (see Division 1 and general conditions).

1.14 TRAINING

A. At a time mutually agreed upon between the owner and contractor, provide the services of a factory trained and authorized representative to train owner's designated personnel on the operation and maintenance of the equipment provided for this project.

- B. Provide training to include but not be limited to an overview of the system and/or equipment as it relates to the facility as a whole; operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention; and review of data included in the operation and maintenance manuals.
- C. Submit a certification letter to the architect stating that the owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The contractor and the owner's representative shall sign the certification letter indicating agreement that the training has been provided.
- D. Schedule training with owner with at least 7 days advance notice.

1.15 WARRANTIES

- A. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of substantial completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds this duration. Warranties shall include labor and material. Remedy all defects, occurring within the warranty period(s), as stated in the general conditions and Division 1 without any additional costs to the owner.
- B. Perform any required remedial work promptly, upon written notice from the engineer or owner.
- C. At the time of substantial completion, deliver to the owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the required period, each warranty instrument being addressed to the owner and stating the commencement date and term.

1.16 MISCELLANEOUS REMODELING WORK

A. Provide all demolition of existing electrical systems and new electrical system modifications required because of building remodeling, as noted on the drawings, or necessary for proper operation and new construction. Remove all abandoned cables and wiring above accessible ceilings and ventilation shafts.

PART 2 - ELECTRICAL WORK

2.1 BUILDING OPERATION

A. Comply with the schedule of operations as outlined in the architectural portions of this specification. Building shall be in continuous operation. Accomplish work that requires interruption of building operation at a time when the building is not in operation, and only with written approval of building owner and/or tenant. Coordinate interruption of building operation with the owner and/or tenant a minimum of 7 days in advance of work.

2.2 EXCAVATION AND BACKFILLING

- A. Perform excavation and backfill required for installation of underground work under this contract. Trenches shall be of sufficient width. Crib or brace trenches to prevent cave-in or settlement. Do not excavate trenches close to columns and walls of building without prior consultation with the architect. Use pumping equipment if required to keep trenches free of water. Backfill trenches in maximum 6" layers of well-tamped dry earth in a manner to prevent future settlement.
- B. Excavation as herein specified shall be classified as common excavation. Common excavation shall comprise the satisfactory removal and disposition of material of whatever substances and of every description encountered, including rock, if any, within the limits of the work as specified and shown on the drawings. Excavation shall be performed to the lines and grades indicated on the drawings. Excavated materials which are considered unsuitable for backfill, and surplus of excavated material which is not required for backfill, shall be disposed of by the contractor at his own expense and responsibility, and to the satisfaction of the architect.

2.3 COINCIDENTAL DAMAGE

A. Repair all streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of this work. Repair materials shall match existing construction. All backfilling and repairing shall meet all requirements of the owner, city and others having jurisdiction. Repair work shall be thoroughly first class. Conform to all requirements of Division 2 of these specifications.

2.4 CUTTING AND PATCHING

A. Following the requirements in Division 1, cut walls, floors, ceilings, and other portions of the facility as required to perform work under this division. Obtain permission of the architect, owner, or both, before doing any cutting. Cut all holes as small as possible. Patch walls, floors, and other portions of the facility as required by work under this division. All patching shall be thoroughly first class and shall match the original material and construction, including fire ratings if applicable in a manner satisfactory to the architect.

2.5 ROUGH-IN

A. Coordinate without delay all roughing-in with other divisions. Conceal all piping and rough-in except in unfinished areas and where otherwise indicated in the construction documents.

2.6 SUPPORT SYSTEMS

A. Steel slotted support systems (slotted channel): comply with MFMA-3, factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch; Cooper B-Line, Erico International Corporation, Hilti, Inc., Power-Strut, Thomas & Betts Corporation, Unistrut.

B. Finishes:

- 1. Metallic coatings: hot-dip galvanized after fabrication and applied according to MFMA-3.
- 2. Nonmetallic coatings: manufacturer's standard PVC, polyurethane or polyester coating applied according to MFMA-3.
- 3. Painted coatings: manufacturer's standard painted coating applied according to MFMA-3
- C. Aluminum slotted support systems (slotted channel): comply with MFMA-3, type 6063-T6, per ASTM B221; factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch; Cooper B-Line, Erico International Corporation, Hilti, Inc., Power-Strut, Thomas & Betts Corporation, Unistrut.
- D. Field Fabrication:
- 1. Where field cutting of standard lengths of channel are required, make cuts straight and perpendicular to manufactured surfaces.
- 2. For field-cut or damaged surfaces of coated channels, dress cut ends, damaged surfaces, or both, with an abrasive material (e.g., file, grinding stone, or similar) and cleanser to remove oils, rust, sharp edges and shards.
- 3. For channel with a factory-applied coating, re-finish cut edges with a coating compatible with the factory finish and as recommended by the manufacturer (e.g., manufacturer's touch-up paint or zinc-rich cold-galvanizing compound, as applicable).

2.7 PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 7 section "through-penetration firestop systems."

B. Roofs:

1. Coordinate all roof penetrations with engineer, owner, and as applicable, the roofing contractor providing a

roof warranty.

- 2. Keep all raceway penetrations within mechanical equipment curbs wherever possible. Coordinate with all other applicable Division's work.
- Flash and counterflash all openings through roof, and/or provide pre-fabricated molded seals compatible with the roof construction installed, or as required by the engineer, owner, or roofing contractor. All roof penetrations shall be leak-tight at the termination of the work and shall not void any new or existing roof warranties.
- C. Walls and Floors
- 1. Sleeves for raceways and cables
- Steel pipe sleeves: ASTM A 53/A 53M, type E, grade B, schedule 40, galvanized steel, plain ends and drip rings.
- 3. Cast-iron pipe sleeves: cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- 4. Sleeves for rectangular openings: galvanized sheet steel with minimum 0.138 inch thickness and of width and length to suit application.

2.8 FIRE-STOPPING THROUGH PENETRATIONS

- A. Fire-resistant through penetration sealants: two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, raceways, and cable tray penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by underwriters' laboratories, inc., or other NRTL acceptable to AHJ.
- B. Acceptable manufacturers:
- 1. Hilti, Inc.
- 2. 3m Corp.
- 3. Rectorseal.
- 4. Specify Technology Inc.
- 5. United States Gypsum Company.
- C. Submittals
- 1. Submit product data, manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Division 1.
- 2. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment shall include both project name and contractor's name who will install firestop system as described in drawings.
- 3. Submit material safety data sheets provided with product delivered to job-site.

2.9 CONCRETE BASES

- A. Provide concrete bases (e.g., housekeeping pads) for equipment where indicated on the drawings and as specified herein. Concrete bases shall have chamfered edges. Size of base shall be a minimum of 2 inches greater than the footprint of the equipment that it is supporting.
- B. Construct equipment bases of a minimum 28-day, 4000-psi concrete conforming to American Concrete

Institute standard building code for reinforced concrete (ACI 318-99) and the latest applicable recommendations of the ACI standard practice manual. Concrete shall be composed of cement conforming to ASTM C 150 type I, aggregate conforming to ASTM C33, and potable water. Exposed exterior concrete shall contain 5 to 7 percent air entrainment.

- C. Unless otherwise specified or shown on the structural drawings, reinforce equipment bases with no. 4 reinforcing bars conforming to ASTM A 615 or 6x6 w2.9 x w2.9 welded wire mesh conforming to ASTM A185. Place reinforcing bars 24 inches on center with a minimum of two bars each direction.
- D. Provide galvanized anchor bolts for equipment placed on concrete bases or on concrete slabs. Anchor bolts size, number and placement shall be as recommended by the manufacturer of the equipment.
- E. Concrete equipment bases shall have a minimum height of 4 inches and shall be poured-in-place.

2.10 ACCESS DOORS

- A. Provide access doors in ceilings and walls, where indicated or required for access or maintenance to concealed equipment installed under this section. Provide concealed hinges, screwdriver-type lock, and anchor straps.
- B. Manufactured by Milcor, Zurn, Titus, or equal. Obtain architect's approval of type, size, location and color before ordering.

2.11 EQUIPMENT FURNISHED BY OTHERS

- A. Provide necessary equipment and accessories that are not provided by the equipment supplier or owner to complete installation of equipment furnished by others, in locations as indicated on the drawings, specified herein, or both. Equipment and accessories not provided by the equipment supplier may include such items as flexible cords and plugs, as required for proper operation of the complete system, in accordance with the manufacturers' instructions.
- B. Be responsible for correct rough-in dimensions, and verify them with engineer, owner's representative, equipment supplier, or all three, prior to rough-in and service installations.

2.12 CLEANING

A. In addition to the requirements of Division 1, remove from the premises dirt and refuse resulting from the performance of the electrical work, as required, to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from the work. Clean all material and equipment installed under this division. Remove dirt, dust, plaster, stains and foreign matter from all surfaces. Touch up and restore all damaged finishes to their original condition.

2.13 ADJUSTING, ALIGNING AND TESTING

- A. Adjust, align, and test all electrical equipment on this project provided under this division and all electrical equipment furnished by others for installation or wiring under this division, for proper operation.
- B. Test all systems and equipment according to the requirements in NETA ATS (latest edition) and all additional requirements specified in following sections.
- C. Maintain the following on the project premises at all times: a true RMS reading voltmeter, a true RMS reading ammeter, and a megohmmeter insulation resistance tester. Provide test data readings as requested or as required by the engineer.

2.14 EQUIPMENT IDENTIFICATION

A. Provide equipment identification nameplates:

- 1. On all panelboards, switches, starters, dimmers, switches in distribution panelboards and switchboards and where indicated on the drawings.
- B. Nameplates:
- 1. Engraved, contrasting color, three-layer, laminated plastic indicating the name of the equipment, load, or circuit as designated on the drawings and in the specifications:
 - A) Field-applied permanent epoxy adhesive, compatible with the equipment finish.
 - B) Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied.
- 2. Color: black background with white letters for normal power; red background with white letters for emergency power. Letter height: ½ inch minimum.

2.15 SYSTEM START UP

- A. Prior to starting up the electrical systems:
- 1. Check all components and devices.
- 2. Lubricate items accordingly.
- 3. Tighten screws and bolts for connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486a and UL 486b.
- 4. Adjust taps on each transformer for rated secondary voltage when the transformer is at minimum load.
- 5. Check and record building's service entrance voltage, grounding conditions, grounding resistance, and proper phasing.
- 6. Replace all burned-out lamps and lamps used for temporary construction lighting in permanent light fixtures.

7. Balance all single-phase loads at each panelboard, redistributing branch circuit connections until balance is achieved. Do not type up final panelboard directories until all re-balancing and redistribution of circuits are complete. Turn on all loads in an attempt to maximize the load on the panel and take ampere readings on each of the phases before redistributing circuits and balancing the panel.

8. After all systems have been inspected and adjusted, confirm all operating features required by the drawings and specifications and make final adjustments as necessary.

PART 3 - EXISTING EQUIPMENT REUSE AND REMOVAL

- A. Remove all existing wiring, light fixtures, exposed conduits and other electrical installations not reused prior to substantial completion of the work.
- B. Existing raceways may be reused if their points of terminations are suitable; if they are clean inside with no evidence of rust or burrs; if free from cracks, flattened sections or sharp bends; and, if suitably located to avoid conflicts with other trades or installations. Carefully "fish" all existing conduits reused under this contract to remove all debris and obstructions, and swab until all moisture is removed.
- C. Cut, patch, and repair where required for new electrical installations, and patch and repair all surface damage resulting from this work. Cut flush with the floor and plug at both ends, raceways stubbed above the floor and not used at substantial completion of the work.
- D. Relocate all existing electrical systems required to be in operation at substantial completion of the contract, if required, as a result of work included under this contract, even if not specifically indicated in the drawings or specifications.

PART 4 - ALTERNATES

CN - Replacement Hospital HP Engineering A. Provide all work contemplated under the different alternates to include labor, materials, equipment and services necessary for and incidental to the completion of work under each particular alternate. Furnish separate bids for each alternate applicable to contractor's proposal, stating the amount to be added or deducted from the base bid in case the alternate is accepted. Comply with applicable sections of the base specifications for work required by the alternate unless otherwise specified. Refer to the architectural portion of the specification.

END OF SECTION

SECTION 26 0519

-LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Metal-clad cable, Type MC, rated 600 V or less.
 - 3. Armored cable, Type AC, rated 600 V or less.
 - 4. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

1.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B496 for stranded conductors.
- D. Conductor Insulation:
 - 1. Type NM: Comply with UL 83 and UL 719.
 - 2. Type RHH and Type RHW-2: Comply with UL 44.
 - 3. Type USE-2 and Type SE: Comply with UL 854.
 - 4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
 - 5. Type THHN and Type THWN-2: Comply with UL 83.
 - 6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 7. Type UF: Comply with UL 83 and UL 493.
 - 8. Type XHHW-2: Comply with UL 44.
- E. Shield:
 - 1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

1.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. RoHS compliant.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits:
 - 1. Single circuit and multi-circuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

- E. Ground Conductor: Bare.
- F. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.
- G. Armor: Aluminum, interlocked.
- H. Jacket: PVC applied over armor.

1.3 ARMORED CABLE, TYPE AC

- A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Comply with UL 4.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits:
 - 1. Single circuit and multicircuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Ground Conductor: Bare.
- F. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.
- G. Armor: Aluminum, interlocked.

1.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. MC cable shall not be used for home runs unless approved prior to bid in writing by the EOR. Contractor shall notify the EOR in writing their intent to use MC cable for any application in the building prior to bidding.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits in Cable Tray: Type THHN/THWN-2, single conductors in raceway.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wiremesh, strain relief device at terminations to suit application.
- J. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 26 0536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Comply with requirements in Section 28 3111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.
- C. All conductor insulation shall be continuously colored to match phase types according to NFPA standards.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fireresistance rating of assembly. Reference Division 7.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding critical equipment.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.

- c. Inspect compression-applied connectors for correct cable match and indentation.
- d. Inspect for correct identification.
- e. Inspect cable jacket and condition.
- f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
- g. Continuity test on each conductor and cable.
- h. Uniform resistance of parallel conductors.
- 3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency and testing agency's field supervisor.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- H. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- I. Straps: Solid copper, copper lugs. Rated for 600 A.
- J. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- L. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with zinc-plated bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 30 inches below grade.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for connections.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

- 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Installbonding jumper to bond across flexible duct connections to achieve continuity.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

- Substations and Pad-Mounted Equipment: 5 ohms. Manhole Grounds: 10 ohms. 5.
- 6.
- Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance. F.

END OF SECTION

SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Sustainable Design Submittals:

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Metal Conduit:
 - 1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. GRC: Comply with ANSI C80.1 and UL 6.
 - 3. ARC: Comply with ANSI C80.5 and UL 6A.
 - 4. IMC: Comply with ANSI C80.6 and UL 1242.
 - 5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch, minimum.
 - 6. EMT: Comply with ANSI C80.3 and UL 797.
 - 7. FMC: Comply with UL 1; zinc-coated steel.
 - 8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings:
 - 1. Comply with NEMA FB 1 and UL 514B.
 - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
 - 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 5. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 - 6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Nonmetallic Conduit:
 - 1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Fiberglass:
 - a. Comply with NEMA TC 14.
 - b. Comply with UL 2515 for aboveground raceways.
 - c. Comply with UL 2420 for belowground raceways.
 - 3. ENT: Comply with NEMA TC 13 and UL 1653.
 - 4. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
 - 5. LFNC: Comply with UL 1660.
 - 6. Rigid HDPE: Comply with UL 651A.
 - 7. RTRC: Comply with UL 2515A and NEMA TC 14.
- B. Nonmetallic Fittings:
 - 1. Fittings, General: Listed and labeled for type of conduit, location, and use.

- 2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 - a. Fittings for LFNC: Comply with UL 514B.
- 3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oilresistant gaskets.
- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Prime coated, ready for field painting.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- Ε. Metal Floor Boxes:
 - Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a 1. gualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by 1 a qualified testing agency, and marked for intended location and application.
- Η. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron Ι. with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- Gangable boxes are allowed. L.
- Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with M. flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - Nonmetallic Enclosures: Fiberglass. 2.
 - 3. Interior Panels: Steel: all sides finished with manufacturer's standard enamel.
- N. Cabinets:
 - 1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - Hinged door in front cover with flush latch and concealed hinge. 2.
 - Key latch to match panelboards. 3.
 - Metal barriers to separate wiring of different systems and voltage. 4.
 - Accessory feet where required for freestanding equipment. 5.
 - Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing 6. agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- Α. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified 2. testing agency, and marked for intended location and application.
- Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, Β. bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two. Standard: Comply with SCTE 77. 1.

- 2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
- 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
- 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- 5. Cover Legend: Molded lettering, "ELECTRIC.".
- 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- 7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pullingin irons installed before concrete is poured.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of reinforced concrete.
 - 1. Standard: Comply with SCTE 77.
 - 2. Color of Frame and Cover: Gray.
 - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 6. Cover Legend: Molded lettering, "ELECTRIC.".
 - 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pullingin irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground: EMT.
 - 3. Underground Conduit: RNC, Type EPC-80-PVC,.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.

- d. Gymnasiums.
- 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
- 6. Damp or Wet Locations: GRC.
- 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways Embedded in Slabs:

- 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
- 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
- 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- 5. Change from ENT to GRC before rising above floor.
- L. Stub-Ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1- 1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- U. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

- 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
- 2. Where an underground service raceway enters a building or structure.
- 3. Conduit extending from interior to exterior of building.
- 4. Conduit extending into pressurized duct and equipment.
- 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
- 6. Where otherwise required by NFPA 70.
- X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Y. Expansion-Joint Fittings:
 - Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- DD. Locate boxes so that cover or plate will not span different building finishes.
- EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

- GG. Set metal floor boxes level and flush with finished floor surface.
- HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 2000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
 - 2. Install backfill as specified in Section 31 2000 "Earth Moving."
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 2000 "Earth Moving."
 - 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
 - 5. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade. Consult with civil engineer for frost line depth at site location.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 0544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Section 07 8413 "Penetration Firestopping" for penetration firestopping installed in fire-resistancerated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 9200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals

- 1. This project is pursuing LEED Healthcare v4: Silver Certification
- 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Bands and tubes.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
 - 8. Paint for identification.
 - 9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- C. Comply with ANSI Z535.4 for safety signs and labels.
- D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be continuous colored insulation.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral: White.
 - 6. Color for Equipment Grounds: Green.
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- E. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
- F. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemicalresistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressuresensitive adhesive.
 - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 - 2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:

- a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
- b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
- c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
- 3. Tag: Type II:
 - a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Thickness: 12 mils.
 - d. Weight: 36.1 lb/1000 sq. ft..
 - e. Tensile according to ASTM D882: 400 lbf and 11,500 psi.
- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with selflocking cable tie fastener.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

2.7 SIGNS

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal Size: 7 by 10 inches.
- B. Metal-Backed Butyrate Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal Size: 10 by 14 inches.
- C. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.

- 3. Temperature Range: Minus 40 to plus 185 deg F.
- 4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, selfextinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

- 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- M. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:

- 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- 2. Limit use of underground-line warning tape to direct-buried cables.
- 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Metal Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using plenum-rated cable ties.
- Y. Nonmetallic Preprinted Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using plenum-rated cable ties.
- Z. Write-on Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using plenum-rated cable ties.
- AA. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1- 1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- BB. Metal-Backed Butyrate Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- CC. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- DD. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 15 A and 100 V to Ground: Identify with self-adhesive raceway labels.

- 1. Locate identification at changes in direction, at penetrations of walls and floors, at 10-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- 2. Label shall include circuit number and panel of origin.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

 "POWER."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self- adhesive labels with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- K. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- N. Arc Flash Warning Labeling: Self-adhesive labels.
- O. Operating Instruction Signs: Self-adhesive labels.
- P. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- Q. Equipment Identification Labels:

- 1. Indoor Equipment: Self-adhesive label.
- 2. Outdoor Equipment: Laminated acrylic or melamine sign.
- 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Enclosed controllers.
 - g. Variable-speed controllers.
 - h. Contactors.
 - i. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION

SECTION 26 2213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - This project is pursuing LEED Healthcare v4: Silver Certification
 Refer to this section for additional, required LEED submittals not included in this specification
 - Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- 4. Certification: Indicate that equipment meets Project seismic requirements.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
 - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event.

2.3 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

- B. Comply with NFPA 70.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70 and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- C. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 - 1. One leg per phase.
 - 2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
 - 3. Grounded to enclosure.
- D. Coils: Continuous winding except for taps.
 - 1. Coil Material: Copper.
 - 2. Internal Coil Connections: Brazed or pressure type.
 - 3. Terminal Connections: Bolted.
- E. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- F. Enclosure
 - 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 - 4. Finish: Comply with NEMA 250.
 - a. Finish Color: Gray weather-resistant enamel.
- G. Enclosure: Totally enclosed, nonventilated.
 - 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
 - 2. Wiring Compartment: Sized for conduit entry and wiring installation.
 - 3. Finish: Comply with NEMA 250.
 - a. Finish Color: Gray weather-resistant enamel.
- H. Taps for Transformers 3 kVA and Smaller: None.

- I. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and two 5 percent taps below rated voltage.
- J. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- K. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- L. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of [150] [115] [80] deg C rise above 40 deg C ambient temperature.
- M. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- N. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding the indicated insulation class in a 40 deg C maximum ambient and a 24-hour average ambient of 30 deg C.
 - 2. Indicate value of K-factor on transformer nameplate.
 - 3. Unit shall comply with requirements of DOE 2016 efficiency levels when tested according to NEMA TP 2 with a K-factor equal to one.
- O. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
- P. Neutral: Rated 200 percent of full load current for K-factor-rated transformers.
- Q. Wall Brackets: Manufacturer's standard brackets.
- R. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:
 - 1. 9.00 kVA and Less: 40 dBA.
 - 2. 9.01 to 30.00 kVA: 45 dBA.
 - 3. 30.01 to 50.00 kVA: 45 dBA for K-factors of 1, 4, and 9; 48 dBA for K-factors of 13 and 20.
 - 4. 50.01 to 150.00 kVA: 50 dBA for K-factors of 1, 4, and 9; 53 dBA for K-factors of 13 and 20.
 - 5. 150.01 to 300.00 kVA: 55 dBA for K-factors of 1, 4, and 9; 58 dBA for K-factors of 13 and 20.
 - 6. 300.01 to 500.00 kVA: 60 dBA for K-factors of 1, 4, and 9; 63 dBA for K-factors of 13 and 20.
 - 7. 500.01 to 700.00 kVA: 62 dBA for K-factors of 1, 4, and 9; 65 dBA for K-factors of 13 and 20.
 - 8. 700.01 to 1000.00kVA: 64 dBA for K-factors of 1, 4, and 9; 67 dBA for K-factors of 13 and 20.

2.5 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 26 0553 "Identification for Electrical Systems."
- B. Nameplates: Self-adhesive label for each distribution transformer. Self-adhesive labels are specified in Section 26 0553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
 - 1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
 - 2. Ratio tests at rated voltage connections and at all tap connections.
 - 3. Phase relation and polarity tests at rated voltage connections.
 - 4. No load losses, and excitation current and rated voltage at rated voltage connections.
 - 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
 - 6. Applied and induced tensile tests.
 - 7. Regulation and efficiency at rated load and voltage.
 - 8. Insulation-Resistance Tests:
 - a. High-voltage to ground.
 - b. Low-voltage to ground.
 - c. High-voltage to low-voltage.
 - 9. Temperature tests.
- B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
 - 2. Brace wall-mounted transformers as specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

- C. Construct concrete bases according to Section 03 3000 "Cast-in-Place Concrete" and anchor floor- mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 26 0529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base according to manufacturer's written instructions.
- E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and.
- E. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.

- c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than onehalf percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
- d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- F. Large (Larger Than 167-kVA Single Phase or 500-kVA Three Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform power-factor or dissipation-factor tests on all windings.
 - d. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than onehalf percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - e. Perform an excitation-current test on each phase.
 - f. Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
 - g. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- G. Remove and replace units that do not pass tests or inspections and retest as specified above.
- H. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
 - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- I. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 -

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.4 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

- 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF format.
- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF format.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.9 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole.
 - 3. 600V ac.
 - 4. 1200 A and smaller.
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
 - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:

- 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
- 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
- 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
- 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
- 6. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Three Pole, Single Throw, 600V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Type HD, Heavy Duty, Three Pole, Double Throw, 600V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 6. Service-Rated Switches: Labeled for use as service equipment.

2.5 RECEPTACLE SWITCHES

- A. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch:600V ac, amperage rating as specified; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- B. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: Switch:600V ac, amperage rating as specified; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- D. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).
- E. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.

6. Service-Rated Switches: Labeled for use as service equipment.

2.6 SHUNT TRIP SWITCHES

- A. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.
- B. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch Switch:600V ac, amperage rating as specified; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate [**specified**] [**indicated**] fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: Switch:600V ac, amperage rating as specified; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from source of control power with enough capacity to operate shunt trip, pilot, indicating and control devices.
- E. Accessories:
 - 1. Oiltight key switch for key-to-test function.
 - 2. Oiltight red ON pilot light.
 - 3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - 4. Form C alarm contacts that change state when switch is tripped.
 - 5. Three-pole, double-throw, fire-safety and alarm relay; 24 V dc coil voltage.
 - 6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.
 - 7. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 8. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
 - 9. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 10. Lugs: [Mechanical] [Compression] type, suitable for number, size, and conductor material.
 - 11. Service-Rated Switches: Labeled for use as service equipment.

2.7 MOLDED-CASE CIRCUIT BREAKERS

- A. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- B. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- C. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be [100 percent rated][series rated][100 percent rated or series rated as indicated on the Drawings]. [Circuit breaker/circuit breaker] [Fuse/circuit breaker] combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution Series Rated System. _____Amps Available. Identical Replacement Component Required."
- D. MCCBs shall be equipped with a device for locking in the isolated position.

- E. Lugs shall be suitable for 167 deg F (75 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
- F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following fieldadjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I-squared t response.
- J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- K. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- L. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- M. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- N. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Communication Capability: Integreal communication module with functions and features compatible with power monitoring and control system, specified in Section 26 0913 "Electrical Power Monitoring and Control."
 - 6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 9. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
 - 10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 11. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 12. Electrical Operator: Provide remote control for on, off, and reset operations.

2.8 MOLDED-CASE SWITCHES

- A. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- B. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- C. Features and Accessories:
 - 1. Standard frame sizes and number of poles.
 - 2. Lugs:
 - a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - b. Lugs shall be suitable for 167 deg F (75 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
 - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
 - 7. Alarm Switch: One NO contact that operates only when switch has tripped.
 - 8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
 - 9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
 - 10. Electrical Operator: Provide remote control for on, off, and reset operations.

2.9 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1.
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

3.3 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.4 IDENTIFICATION

- A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - Verify tightness of accessible bolted electrical connections by calibrated torquewrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
 - 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phaseto-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."
- F. Tests and Inspections for Molded Case Circuit Breakers:
 - 1. Visual and Mechanical Inspection:
 - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify that the unit is clean.
 - e. Operate the circuit breaker to ensure smooth operation.
 - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torquewrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.
 - 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
 - e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

- Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
- Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
- 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
- f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
- g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
- h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
- i. Verify operation of charging mechanism. Investigate units that do not function as designed.
- 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- 4. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- H. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 0573.16 Coordination Studies.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 01 8113 Sustainable Design Requirements: Action and informational submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. USB receptacles.
 - 3. GFCI receptacles, 125 V, 20 A.
 - 4. SPD receptacles, 125 V, 20 A.
 - 5. Hospital-grade receptacles, 125 V, 20 A.
 - 6. Twist-locking receptacles.
 - 7. Pendant cord-connector devices.
 - 8. Cord and plug sets.
 - 9. Toggle switches, 120/277 V, 20 A.
 - 10. Decorator-style devices, 20 A.
 - 11. Occupancy sensors.
 - 12. Digital timer light switches.
 - 13. Wall-box dimmers.
 - 14. Wall plates.
 - 15. Floor service fittings.
 - 16. Poke-through assemblies.
 - 17. Service poles.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packinglabel warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Ivory.
 - 2. Wiring Devices Connected to Essential Electrical System: Red.

- 3. SPD Devices: Blue.
- 4. Isolated-Ground Receptacles: Orange.
- H. Wall Plate Color: For plastic covers, match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
- B. Isolated-Ground Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
- C. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
- D. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.
- E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.3 STANDARD-GRADE RECEPTACLES, 125 V, 15 A

- A. Duplex Receptacles, 125 V, 15 A:
 - 1. Description: Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.

- B. Isolated-Ground Duplex Receptacles, 125 V, 15 A :
 - 1. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
- C. Tamper-Resistant Duplex Receptacles, 125 V, 15 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498 and FS W-C-596.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
- D. Weather-Resistant Duplex Receptacle, 125 V, 15 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.
- E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 15 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.4 USB RECEPTACLES

- A. USB Charging Receptacles :
 - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickelplated, brass mounting strap.
 - 2. USB Receptacles: Dual and quad, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
 - 3. Standards: Comply with UL 1310 and USB 3.0 devices.
- B. Tamper-Resistant Duplex and USB Charging Receptacles:
 - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickelplated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
 - 2. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
 - 3. USB Receptacles: Dual USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
 - 4. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.
 - 5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

- 2.5 GFCI RECEPTACLES, 125 V, 20 A
 - A. Duplex GFCI Receptacles, 125 V, 20 A:
 - 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Type: [Feed] [Non-feed] through.
 - 4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
 - B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:
 - 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Type: [Feed] [Non-feed] through.
 - 4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
 - 5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
 - C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Type: Non-feed through.
 - 4. Standards: Comply with UL 498 and UL 943 Class A.
 - 5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.6 SPD RECEPTACLES, 125 V, 20 A

- A. Duplex SPD Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light.
 - SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400
 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE
 C62.41.2 and IEEE C62.45.
 - 3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
 - 4. Configuration: NEMA WD 6, Configuration 5-20R.
 - 5. Standards: Comply with NEMA WD 1, UL 498, UL 1449, and FS W-C-596.
- B. Isolated-Ground Duplex SPD Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light.
 - 2. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - 3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
 - 4. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
 - 5. Configuration: NEMA WD 6, Configuration 5-20R.

6. Standards: Comply with UL 498, UL 1449, and FS W-C-596.

2.7 HOSPITAL-GRADE RECEPTACLES, 125 V, 20 A

- A. Hospital-Grade, Single Receptacles, 125 V, 20 A:
 - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickelplated, brass mounting strap. Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- B. Hospital-Grade, Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickelplated, brass mounting strap. Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- C. Hospital-Grade, Isolated-Ground, Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- D. Hospital-Grade, Tamper-Resistant, Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with NEMA WD 1, UL 498 Supplement sd, and FS W-C-596.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- E. Hospital-Grade, Tamper-Resistant, Duplex (125 V, 20 A) and USB Charging Receptacles:
 - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickelplated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
 - 2. Line Voltage Receptacles: Two pole, three wire, and self-grounding, NEMA Configuration 5-20R.
 - 3. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
 - 4. Standards: Comply with NEMA WD 1, UL 498 Supplement sd, UL 1310, and FS W-C-596.
 - 5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- F. Hospital-Grade, Duplex GFCI Receptacles, 125 V, 20 A:
 - 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Single-piece, rivetless, nickel-plated, all-brass grounding system.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Type: Non-feed through.
 - 4. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.
 - 5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

- G. Hospital-Grade, Tamper-Resistant, Duplex GFCI Receptacles, 125 V, 20 A:
 - 1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Single-piece, rivetless, nickel-plated, all-brass grounding system.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Type: Non-feed through.
 - 4. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.
 - 5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- H. Hospital-Grade, Duplex SPD Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light. With single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
 - SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400
 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE
 C62.41.2 and IEEE C62.45.
 - 3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
 - 4. Configuration: NEMA WD 6, Configuration 5-20R.
 - 5. Standards: Comply with UL 498 supplement sd, UL 1449, and FS W-C-596.
 - 6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- I. Hospital-Grade, Isolated-Ground, Duplex SPD Receptacles, 125 V, 20 A:
 - 1. Description: With single-piece, rivetless, nickel-plated, all-brass grounding system. Nickelplated, brass mounting strap. Two pole, three wire, and self-grounding.
 - SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400
 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE
 C62.41.2 and IEEE C62.45.
 - 3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
 - 4. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
 - 5. Configuration: NEMA WD 6, Configuration 5-20R.
 - 6. Standards: Comply with NEMA WD 1, UL 498 supplement sd, UL 1449, and FS W-C-596.
 - 7. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

2.8 TWIST-LOCKING RECEPTACLES

- A. Twist-Lock, Single Receptacles, 120 V, 20 A:
 - 1. Configuration: NEMA WD 6, Configuration L5-20R.
 - 2. Standards: Comply with UL 498.
- B. Twist-Lock, Single Receptacles, 250 V, 20 A:
 - 1. Configuration: NEMA WD 6, Configuration L6-20R.
 - 2. Standards: Comply with UL 498.
- C. Twist-Lock, Single Receptacles, 277 V, 20 A:
 - 1. Configuration: NEMA WD 6, Configuration L7-20R.
 - 2. Standards: Comply with UL 498.
- D. Twist-Lock, Isolated-Ground, Single Receptacles, 125 V, 20 A:

- 1. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- 2. Configuration: NEMA WD 6, Configuration L5-20R.
- 3. Standards: Comply with UL 498.

2.9 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.
- B. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.
- C. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
- D. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.
- E. Standards: Comply with FS W-C-596.

2.10 CORD AND PLUG SETS

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with greeninsulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.
- 2.11 TOGGLE SWITCHES, 120/277 V, 15 A
 - A. Single-Pole Switches, 120/277 V, 15 A:
 1. Standards: Comply with UL 20 and FS W-S-896.
 - B. Two-Pole Switches, 120/277 V, 15 A:
 - 1. Comply with UL 20 and FS W-S-896.
 - 2. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 3. Standards: Comply with UL 20 and FS W-S-896.
 - C. Three-Way Switches, 120/277 V, 15 A:1. Comply with UL 20 and FS W-S-896.
 - D. Four-Way Switches, 120/277 V, 15 A:
 1. Standards: Comply with UL 20 and FS W-S-896.
 - E. Pilot-Light, Single-Pole Switches: 120/277 V, 15 A:
 - 1. Description: Illuminated when switch is on.

- 2. Standards: Comply with UL 20 and FS W-S-896.
- F. Lighted Single-Pole Switches, 120/277 V, 15 A:
 - 1. Description: Handle illuminated when switch is off.
 - 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- G. Key-Operated, Single-Pole Switches, 120/277 V, 15 A:
 - 1. Description: Factory-supplied key in lieu of switch handle.
 - 2. Standards: Comply with UL 20 and FS W-S-896.
- H. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 15 A:
 - 1. Description: For use with mechanically held lighting contactors.
 - 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- I. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 15 A:
 - 1. Description: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- 2.12 TOGGLE SWITCHES, 120/277 V, 20 A
 - A. Single-Pole Switches, 120/277 V, 20 A:
 1. Standards: Comply with UL 20 and FS W-S-896.
 - B. Antimicrobial, Single-Pole Switches, 120/277 V, 20 A:
 - 1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Standards: Comply with UL 20 and FS W-S-896.
 - C. Two-Pole Switches, 120/277 V, 20 A:
 - 1. Comply with UL 20 and FS W-S-896.
 - D. Antimicrobial, Double-Pole Switches, 120/277 V, 20 A:
 - 1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Standards: Comply with UL 20 and FS W-S-896.
 - E. Three-Way Switches, 120/277 V, 20 A:
 - 1. Comply with UL 20 and FS W-S-896.
 - F. Antimicrobial, Three-Way Switches, 120/277 V, 20 A:
 - 1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Standards: Comply with UL 20 and FS W-S-896.
 - G. Four-Way Switches, 120/277 V, 20 A:
 - 1. Standards: Comply with UL 20 and FS W-S-896.
 - H. Pilot-Light, Single-Pole Switches: 120/277 V, 20 A:
 - 1. Description: Illuminated when switch is on.
 - 2. Standards: Comply with UL 20 and FS W-S-896.
 - I. Lighted Single-Pole Switches, 120/277 V, 20 A:

- 1. Description: Handle illuminated when switch is off.
- 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- J. Key-Operated, Single-Pole Switches, 120/277 V, 20 A:
 - 1. Description: Factory-supplied key in lieu of switch handle.
 - 2. Standards: Comply with UL 20 and FS W-S-896.
- K. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
 - 1. Description: For use with mechanically held lighting contactors.
 - 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- L. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
 - 1. Description: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.13 DECORATOR-STYLE DEVICES, 15 A

- A. Decorator Duplex Receptacles, 125 V, 15 A:
 - 1. Description: Two pole, three wire, and self-grounding. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498.
- B. Decorator, Tamper-Resistant, Duplex Receptacles, 125 V, 15 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
- C. Decorator, Tamper- and Weather-Resistant, Duplex Receptacles, 125 V, 15 A :
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-15R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.
- D. Decorator Single-Pole Switches, 120/277 V, 15 A:
 - 1. Comply with UL 20.
- E. Decorator Single-Pole Lighted Switches, 120/277 V, 15 A:
 - 1. Description: Square face illuminated when circuit is switched off.
 - 2. Standards: Comply with UL 20.
- F. Decorator, Antimicrobial, Single-Pole Switches, 120/277 V, 15 A:
 - 1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Standards: Comply with UL 20 and FS W-S-896.

2.14 DECORATOR-STYLE DEVICES, 20 A

- A. Decorator Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498.
- B. Decorator Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
- C. Decorator, Tamper- and Weather-Resistant, Duplex Receptacles, 125 V, 20 A:
 - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 - 2. Configuration: NEMA WD 6, Configuration 5-20R.
 - 3. Standards: Comply with UL 498.
 - 4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.
- D. Decorator Single-Pole Switches, 120/277 V, 20 A:
 - 1. Comply with UL 20.
- E. Decorator Single-Pole Lighted Switches, 120/277 V, 20 A:
 - 1. Description: Square face illuminated when circuit is switched off.
 - 2. Standards: Comply with UL 20.
- F. Decorator, Antimicrobial, Single-Pole Switches, 120/277 V, 20 A:
 - 1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Standards: Comply with UL 20 and FS W-S-896.

2.15 OCCUPANCY SENSORS

- A. Wall Switch Sensor Light Switch, Dual Technology:
 - 1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
 - 2. Standards: Comply with UL 20.
 - 3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 - 4. Adjustable time delay of 20 minutes.
 - 5. Able to be locked to Automatic-On mode. Where vacancy sensors are indicated, able to be locked to Manual On mode.
 - 6. Connections: Provisions for connection to BAS.
- B. Wall Sensor Light Switch, Passive Infrared:
 - 1. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
 - 2. Standards: Comply with UL 20.
 - 3. Connections: Provisions for connection to BAS.

- 4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
- 5. Integral relay for connection to BAS.
- 6. Adjustable time delay of 20 minutes.
- 7. Able to be locked to Automatic-On mode. Where vacancy sensors are indicated, able to be locked to Manual On mode.
- C. Wall Sensor Light Switch, Ultrasonic:
 - 1. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using ultrasonic technology.
 - 2. Standards: Comply with UL 20.
 - 3. Connections: Provisions for connection to BAS.
 - 4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 - 5. Integral relay for connection to BAS.
 - 6. Adjustable time delay of 20 minutes.
 - 7. Able to be locked to Automatic-On mode. Where vacancy sensors are indicated, able to be locked to Manual On mode.

2.16 TIMER LIGHT SWITCH

- A. Digital Timer Light Switch:
 - 1. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10-minute increments.
 - 2. Standards: Comply with UL 20.
 - 3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 - 4. Integral relay for connection to BAS.

2.17 DIMMERS

- A. Wall-Box Dimmers:
 - 1. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
 - 2. Control: Continuously adjustable slider; with single-pole or three-way switching.
 - 3. Standards: Comply with UL 1472.
 - 4. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. Onoff switch positions shall bypass dimmer module.
 - a. 600 W; dimmers shall require no derating when ganged with other devices.
 - 5. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
 - 6. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.18 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch thick satin finish, except Type 302 stainless steel 0.04-inch is required in all patient care areas.
 - 3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weatherresistant, thermoplactic with lockable cover.
- D. Antimicrobial Cover Plates:
 - 1. Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Tarnish resistant.

2.19 FLOOR SERVICE FITTINGS

- A. Flush-Type Floor Service Fittings:
 - 1. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
 - 2. Compartments: Barrier separates power from voice and data communication cabling.
 - 3. Service Plate and Cover: Round, solid brass with satin finish.
 - 4. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
 - 5. Data Communication Outlet: Blank cover with bushed cable opening.
- B. Flap-Type Service Fittings:
 - 1. Description: Type: Modular, flap-type, dual-service units suitable for wiring method used, with flaps flush with finished floor.
 - 2. Compartments: Barrier separates power from voice and data communication cabling.
 - 3. Flaps: Round, solid brass with satin finish.
 - 4. Service Plate: Same finish as flaps.
 - 5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
 - 6. Data Communication Outlet: Blank cover with bushed cable opening.
- C. Above-Floor Service Fittings:
 - 1. Description: Type: Modular, above-floor, dual-service units suitable for wiring method used.
 - 2. Compartments: Barrier separates power from voice and data communication cabling.
 - 3. Service Plate: Round, solid brass with satin finish.
 - 4. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
 - 5. Data Communication Outlet: Blank cover with bushed cable opening.

2.20 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

- B. Standards: Comply with scrub water exclusion requirements in UL 514.
- C. Service-Outlet Assembly: Pedestal type with services indicated.
- D. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.
- E. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
- F. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.
- G. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables.

2.21 SERVICE POLES

- A. Dual-Channel Service Poles:
 - 1. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 - 2. Poles: Nominal 2.5-inch square cross-section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
 - 3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
 - 4. Material: Aluminum.
 - 5. Finishes: Manufacturer's standard painted finish and trim combination.
 - 6. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, balanced twisted pair data communication cables.
 - 7. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
 - 8. Data Communication Outlets: Blank insert with bushed cable opening.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.

- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
 - 2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan-speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 26 0553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
- C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
 - 1. In healthcare facilities, prepare reports that comply with NFPA 99.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- E. Test straight-blade hospital-grade outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.
- F. Wiring device will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

END OF SECTION

SECTION 26 5613

LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 01 8113 Sustainable Design Requirements: Action and informational Submittals
 - 1. This Project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section

1.2 SUMMARY

- A. Section Includes:
 - 1. Poles and accessories for support of luminaires.

1.3 DEFINITIONS

- A. EPA: Equivalent projected area.
- B. Luminaire: Complete luminaire.
- C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.
- D. Standard: See "Pole."

1.4 ACTION SUBMITTALS

- A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.
 - 1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
 - 2. Include finishes for lighting poles and luminaire-supporting devices.
 - 3. Anchor bolts.
 - 4. Manufactured pole foundations.

1.5 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that

load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

- B. Qualification Data: For Installer.
- C. Seismic Qualification Data: from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Material Test Reports:
 - 1. For each foundation component, by a qualified testing agency.
 - 2. For each pole, by a qualified testing agency.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranty: Manufacturer's standard warranty.
- H. Soil test reports

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for foundation testing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B660.
- B. Store poles on decay-resistant skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

- C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below finished grade.
- D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- E. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of poles that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - 2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design pole foundation and pole power system.
- B. Seismic Performance: Foundation and pole shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.0.
- C. Structural Characteristics: Comply with AASHTO LTS-6-M.
- D. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
- E. Live Load: Single load of 500 lbf distributed according to AASHTO LTS-6-M.
- F. Ice Load: Load of 3 lbf/sq. ft,, applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.
- G. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
 - 1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.

- a. Wind Importance Factor: 1.0.
- b. Minimum Design Life: 50 years.
- H. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.
- I. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.2 STEEL POLES

- A. Source Limitations: Obtain poles from single manufacturer or producer.
- B. Poles: Comply with ASTM A500/A500M, Grade B carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.
 - 1. Shape: Square, straight.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Steel Mast Arms: A specified on drawings.
- D. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with galvanized-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.
- E. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- F. Fasteners: Galvanized steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
 - 1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- G. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.
- H. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- I. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported load multiplied by a 5.0 safety factor.
- J. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- K. Galvanized Finish: After fabrication, hot-dip galvanize according to ASTM A123/A123M.

- L. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high gloss, high-build polyurethane enamel.
 - a. Color: As indicated on drawings.
- M. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Powder Coat: Comply with AAMA 2604.
 - Electrostatic-applied powder coating; single application and cured to a minimum 2.5 mils dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
 - b. Color: As indicated on drawings.

2.3 POLE ACCESSORIES

- A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.
- B. Decorative accessories, supplied by decorative pole manufacturer, include the following:
 - 1. Banner Arms: Per owners requirements.

2.4 MOUNTING HARDWARE

- A. Anchor Bolts: Manufactured to ASTM F1554, Grade 55, with a minimum yield strength of 55,000 psi.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A153, Class C].
 - 2. Threading: Uniform National Coarse, Class 2A.
- B. Nuts: ASTM A563, Grade A, Heavy-Hex.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A153, Class C.
 - 2. Two nuts provided per anchor bolt [, shipped with nuts pre-assembled to the anchor bolts].
- C. Washers: ASTM F436, Type 1.

- 1. Galvanizing: Hot dip galvanized according to ASTM A153, Class C.
- 2. Two washer(s) provided per anchor bolt.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.
- C. Examine roughing-in for foundation and conduit to verify actual locations of installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

- A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A36/A36M and hot-dip galvanized according to ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 03 3000 "Cast-in-Place Concrete."
- B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A36/A36M and hot-dip galvanized according to ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 03 3000 "Cast-in-Place Concrete."
- C. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A36/A36M and hot-dip galvanized according to ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.
 - 1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.
- D. Direct-Buried Foundations: Install to depth indicated on Drawings. Add backfill as shown on Drawings. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

E. Anchor Bolts: Install plumb using manufacturer-supplied steel template, uniformly spaced.

3.3 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.
 - 1. Fire Hydrants and Water Piping: 60 inches.
 - 2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet.
 - 3. Trees: 15 feet from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03 3000 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 3. Install base covers unless otherwise indicated.
 - 4. Use a short piece of 1/2 -inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.
- F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.
- B. Steel Conduits: Comply with requirements in Section 26 0533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.5 GROUNDING

- A. Ground Metal Poles and Support Structures: Comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.

- 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundation.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Inspect poles for nicks, mars, dents, scratches, and other damage.
 - 2. System function tests.

END OF SECTION

SECTION 26 5619

LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 01 8113 Sustainable Design Requirements: Action and informational submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.
- B. Related Requirements:
 - 1. Section 26 0923"Lighting Control Devices" for automatic control of lighting, including time switches, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section 26 0933"Central Dimming Controls" for architectural dimming systems specified in Section 26 5100.
 - 3. Section 26 0943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
 - 4. Section 26 5613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaire.
 - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
 - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 - 6. Wiring diagrams for power, control, and signal wiring.
 - 7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Product Schedule: For luminaires and lamps.
- C. Delegated-Design Submittal: For luminaire supports.
 - 1. Include design calculations for luminaire supports and seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing laboratory providing photometric data for luminaires.
- B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: For each type of the following:
 - 1. Luminaire.
- D. Source quality-control reports.
- E. Sample warranty.
- 1.6 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

- 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
- 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Diffusers and Lenses: One for every 100] of each type and rating installed. Furnish at least one of each type.
 - 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location where indicated on the drawings.
- E. Lamp base complying with ANSI C81.61.
- F. Bulb shape complying with ANSI C79.1.
- G. CRI and CCT as indicated on the drawings.
- H. L70 lamp life of 50,000 hours.
- I. Lamps dimmable as indicated on the drawings.
- J. Internal driver, except where otherwise indicated on the drawings.
- K. Nominal Operating Voltage: As indicated on the drawings.
- L. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

- M. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- N. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

- A. Area and Site:
 - 1. Luminaire Shape: As indicated on the drawings.
 - 2. Mounting As indicated on the drawings.
 - 3. Luminaire-Mounting Height: As indicated on the drawings..
 - 4. Distribution: As indicated on the drawings...
 - 5. Diffusers and Globes: As indicated on the drawings.
 - 6. Housings: As indicated on the drawings.
- B. Bollard:
 - 1. Shape: As indicated on the drawings.
 - 2. Height Above Finished Grade: As indicated on the drawings..
 - 3. Overall Height: As indicated on the drawings.
 - 4. Diameter: As indicated on the drawings...
 - 5. Mounting: As indicated on the drawings.
 - 6. Distribution: As indicated on the drawings.
 - 1. Diffusers and Globes: As indicated on the drawings.
 - 2. Housings: As indicated on the drawings.
- C. Canopy:
 - 1. Shape: As indicated on the drawings.
 - 2. Dimensions: As indicated on the drawings..
 - 3. Diffusers and Globes: As indicated on the drawings.
 - 4. Housings: As indicated on the drawings.

2.4 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Diffusers and Globes:
 - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- G. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 - 2. Provide filter/breather for enclosed luminaires.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage and coating.
 - c. CCT and CRI for all luminaires.

2.5 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 - Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color: As indicated on the drawings.

- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As indicated on the drawings.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:

- 1. Sized and rated for luminaire weight.
- 2. Able to maintain luminaire position after cleaning and relamping.
- 3. Support luminaires without causing deflection of finished surface.
- 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming.
- K. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 0533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 BOLLARD LUMINAIRE INSTALLATION:

- A. Align units for optimum directional alignment of light distribution.
 - 1. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

- A. Aim as indicated on Drawings.
- B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.6 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 26 0533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.10 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Metal wireways and auxiliary gutters.
 - 3. Metallic surface pathways.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Polymer-concrete handholes and boxes for exterior underground cabling.
 - 6. Fiberglass handholes and boxes for exterior underground cabling.

1.4 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid conduit.
- C. IMC: Intermediate metal conduit.
- D. PVC: Polyvinyl chloride conduit.
- E. RTRC: Reinforced thermosetting resin conduit.

1.5 ACTION SUBMITTALS

- A. Product data for the following:
 - 1. Conduit and fittings.
 - 2. Boxes, enclosures, and cabinets.
 - 3. Underground handholes and boxes.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. Underground ducts, piping, and structures in location of underground enclosures and handholes.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-E.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated [GRC] [IMC].
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: Set screw or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-E.
- C. RNC: [Type EPC-40-PVC] [Type EPC-80-PVC] <Insert type>, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Continuous HDPE: Comply with UL 651A.
- F. RTRC: Comply with UL 2515A and NEMA TC 14.
- G. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- C. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-E.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman; nVent.

- 2. MonoSystems, Inc.
- 3. Quazite; Hubbell Incorporated, Power Systems.
- 4. Wiremold; Legrand North America, LLC.
- C. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-E.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 - 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
 - 5. Gangable boxes are [allowed] [prohibited].
- D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.
 - 1. Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4, with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures:
 - a. Material: Plastic.
 - b. Finished inside with radio-frequency-resistant paint.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
 - 1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.

- 3. Key latch to match panelboards.
- 4. Metal barriers to separate wiring of different systems and voltage.
- 5. Accessory feet where required for freestanding equipment.
- 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 POLYMER-CONCRETE HANDHOLES

- A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Oldcastle Infrastructure Inc.; CRH Americas.
 - 2. Quazite; Hubbell Incorporated, Power Systems.
 - 3. Martin Enterprises
- C. General Requirements for Polymer Concrete Handholes:
 - 1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 3. Comply with TIA-569-E and SCTE 77.
- D. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 2. Cover Legend: Molded lettering, "COMMUNICATIONS".
- F. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- G. Handholes 24 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 FIBERGLASS HANDHOLES AND BOXES

- A. Description: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete or fiberglass.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Oldcastle Infrastructure Inc.; CRH Americas.
 - 2. Quazite; Hubbell Incorporated, Power Systems.
 - 3. Martin Enterprises.
- C. General Requirements for Fiberglass Handholes and Boxes:

- 1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- 3. Comply with TIA-569-E and SCTE 77.
- D. Color of Frame and Cover: Gray or Green.
- E. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
- F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
- G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- H. Cover Legend: Molded lettering, "COMMUNICATIONS".
- I. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- J. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: RNC, Type EPC-40-PVC.
 - 2. Concealed Conduit, Aboveground: GRC.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
- B. Pathway Fittings: Compatible with pathways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing

conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

- C. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- D. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. ANSI/BICSI N1-2019.
 - 3. TIA-569-E.
 - 4. NECA 101
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
- F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Install conduit in the most direct path possible. Strive to keep conduit parallel and perpendicular as depicted.
- H. The conduit system shall be continuous. (i.e. conduit, pull boxes, etc.) between the point of origin and the destination. Daisy chaining of conduit is not allowed under any variance or circumstance.
- I. Conduit system shall contain no bends greater than 90 degrees and no more than 180 degrees total bends in the aggregate.
- J. If a bend greater than 90 degrees is required contractor shall install an appropriate sized pull box within 3 feet of the bend.
- K. Flexible conduit shall never be used for routes over 30 feet.
- L. All conduit bends shall be smooth and continuous. Conduit bend radius shall be at least 10 times the internal diameter of the conduit.
- M. "LB"s shall not be used.

- N. A pull box shall not be used as a corner. All conduits shall enter and exit opposite sides of handholes and pull boxes.
- O. All conduits shall be reamed, swabbed and dried prior to any cable installation.
- P. Cap or plug all conduit after drying to prevent water and debris entering conduit.
- Q. Install plastic or nylon pull cord/s within all installed conduit, leaving 10' of slack at each handhole or pull box.
- R. Metallic conduit shall be bonded to a ground on one or both ends in accordance with local and national codes.
- S. Complete pathway installation before starting conductor installation.
- T. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- U. Conduit shall stub above slab/grade minimum 6".
- V. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- W. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- X. Support conduit within 12 inches of enclosures to which attached.
- Y. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 - 3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from nonmetallic conduit and fittings to GRC and fittings before rising above floor.
- Z. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- AA. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- BB. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- CC. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

- DD. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- EE. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- FF. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- GG. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- HH. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- II. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- JJ. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified.
 - 2. Install backfill as specified.
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified.
 - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a

minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

- 6. Warning tape with trace wire: Bury warning planks approximately 12 inches above directburied conduits, but a minimum of 6 inches below grade. Align tape along centerline of conduit.
- 7. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, 24" depth of frost line below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

SECTION 31 1000 SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SITE CLEARING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SITE CLEARING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Clearing and Grubbing
- B. Soil Stripping and Stockpiling

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 31 25 00 Erosion and Sedimentation Controls
- C. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahleguah
 - 2. Oklahoma Department of Environmental Quality (ODEQ)
- B. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
- C. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- E. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- F. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- G. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction
- H. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.6 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become CONSTRUCTION MANAGER's property and shall be removed from Project site.

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 PRECONSTRUCTION CONFERENCE

A. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.

1.9 REGULATORY REQUIREMENTS

A. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.15 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

1.16 UTILITY INTERRUPTIONS

A. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.

1.17 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with governing CITY, STATE, and FEDERAL notification regulations before beginning SITE CLEARING. Comply with hauling and disposal regulations of authorities having jurisdiction.

2.2 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312300 "Excavation and Fill."
- B. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PRE-SITE CLEARING WORK

- A. Contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. Notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility. CONSTRUCTION MANAGER shall also coordinate the construction activities with the utility companies to ensure compliance with the project schedule.
- C. All existing structures, improvement and utilities designated to remain shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the OWNER of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible

unless noted on the plan.

- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to demolition. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.
- E. Verify that utilities have been disconnected and capped before starting SITE CLEARING operations.
- F. Protect and maintain benchmarks and survey control points from disturbance during construction.
- G. Locate and clearly identify trees, shrubs, and other vegetation to remain.
- H. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 CONSTRUCTION CONTROL

- A. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- B. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

3.3 TEMPORARY EROSION CONTROLS

- A. See 31 25 00 Erosion and Sedimentation Controls.
- B. Comply with the City, State, and Federal requirements for the minimization and control of sediment erosion and site run-off in storm water resulting from construction activities. Install temporary erosions controls prior to SITE CLEARING. Comply with the requirements of the Storm Water Pollution Prevention Plan and the permit(s) issued by the City and State.

3.4 CLEARING AND GRUBBING

- A. The limits of the area(s) to be cleared and grubbed shall be marked by stakes, flags, tree markings, or other suitable methods.
- B. Protect trees or groups of trees, designated to remain, from damage by all construction operations by erecting suitable barriers, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees designated to remain.
- C. Except as otherwise directed, cut, grub, remove and dispose of all trees, stumps, brush, shrubs, roots and any other objectionable material within the limits defined on the Plans.
- D. All trees, stumps, brush, shrubs, roots and other objectionable material shall be cut, grubbed, removed and disposed of from areas to be occupied by buildings, structures, roads, pipelines and any other areas to be stripped. Trees and brush shall be removed to a depth at least three (5) feet below the existing grade.
- E. In addition, heavy growths of weeds or other plants shall be stripped from the surface in order to provide clear access to the work site and to prevent their inclusion in stockpiled soil which is to be reused later. Trees, stumps, surface plants and all debris removed from the site shall be disposed of off-site by the CONSTRUCTION MANAGER at his own expense.
- F. Areas outside the limits of clearing shall be protected from damage and no equipment or materials shall be stored in these areas.
- G. No stumps, trees, limbs, or brush shall be buried in any fills or embankments.

3.5 SOIL STRIPPING AND STOCKPILING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches.

- 2. Do not stockpile topsoil within protection zones.
- 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
- 4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut a straight line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 BACKFILL

A. Backfill any voids resulting from structures, vegetation, and objects removed according to 31 2300 Excavation and Fill.

3.8 DISPOSAL OF MATERIALS

- A. All tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material shall be removed from the site and disposed of in a permitted disposal site.
- B. Burning of cleared and grubbed materials will not be permitted.
- C. Suitable excavated materials may be stockpiled to be used for backfilling. Excess excavated materials and unsuitable backfill materials shall be disposed offsite by the CONSTRUCTION MANAGER according to City, State, and Federal regulations.

END OF SECTION

SECTION 31 2200 GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for GRADING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for GRADING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

A. Grading

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 31 25 00 Erosion and Sedimentation Controls
- C. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 DELIVERY, STORAGE, AND HANDLING 1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements,

improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.15 PROJECT CONDITIONS

- A. Traffic
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any

interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.

- C. SUBSURFACE CONDITIONS
 - A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

E. HAZARDOUS CONDITIONS

 If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Subgrade Planer
 - 1. An approved subgrade planer shall be provided, mounted on visible rollers riding on the forms, having adjustable cutting blades which shall trim the subgrade to exact sections shown on the plans. Planer frames shall be heavy enough to remain on the forms at all times and shall be of such strength and rigidity that, under a test made by changing the support from the wheels to the center for the type pavements as set out under "Subgrade Planer," they shall not develop a deflection of more than 1/8 inch. Tractive power equipment used on the subgrade to pull the planer shall not be such as to produce ruts or indentations in the subgrade.
- B. Subgrade Template
 - 1. The template for checking the contour of the subgrade shall be provided and operated by the CONSTRUCTION MANAGER. The template shall rest upon the side forms and shall be of such strength and rigidity that, under a test made by changing the support to the center, it shall not develop a deflection of more than 1/8 inch. It shall be provided with accurately adjustable rods projecting downward to the subgrade at 1-foot intervals, and these rods shall be adjusted to the required cross-section when the template is resting on the side forms.
- C. Compacting Equipment
 - 1. Compacting equipment shall be designed to produce the pavement density and surface smoothness herein specified and shall be maintained in first-class operating condition.

PART 3 - EXECUTION

3.1 SUBGRADE

A. After the excavation and embankment has been substantially completed, the subgrade shall be brought to the proper alignment, cross section and elevation, so that after rolling and subsequent finishing operations, it shall conform to the correct alignment, cross section and elevation. Rolling and sprinkling shall be performed when and to the extent directed and the roadbed shall be completed to or above the

plane of the typical section shown on the plans and the lines and grades established the by the OWNER.

- B. After completion of the compaction and immediately before the application of base or pavement, the subgrade planer shall be operated from approved forms in a manner to finish the subgrade to the required section. The subgrade shall then be tested with the approved template, operated and maintained by the CONSTRUCTION MANAGER. All irregularities which develop in excess of 1/2 inch in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material; reshaping; and recompacting by sprinkling and rolling.
- C. The subgrade shall be maintained in a smooth, compacted condition, in conformity with the required section and established grade, until the base or pavement is placed, and shall be kept wetted down sufficiently in advance of placing any base or pavement to insure its being in a firm and moist condition for at least 2 inches below surface of the prepared subgrade. Only such subgrade as is necessary for the satisfactory prosecution of the work shall be completed ahead of the placement of base or pavement. Hauling or operating of unnecessary equipment on the completed subgrade shall be kept to a minimum. Complete drainage of the subgrade shall always be provided.
- D. Finishing of the subgrade by hand shall be permitted on sections where the pavement width is not uniform, at intersections and elsewhere where the operation of the subgrade planer would not be practical. Subgrade finished by hand shall conform to the requirements above specified.
- E. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- F. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- G. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION

SECTION 31 2300 EXCAVATION AND FILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for EXCAVATION AND FILL as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for EXCAVATION AND FILL shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Subgrade Preparation
- B. Excavation
 - 1. Trenching
- C. Dewatering
- D. Fill
 - 1. Backfill
 - 2. Compaction

1.4 RELATED SECTIONS

- A. 31 10 00 Site Clearing
- B. 31 22 00 Grading
- C. 31 25 00 Erosion and Sedimentation Controls
- D. 32 11 00 Base Courses
- E. 33 10 00 Water Utilities
- F. 33 30 00 Sanitary Sewerage Utilities
- A. 33 40 00 Storm Drainage Utilities
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ AUTHORITY HAVING JURISDICTION
 - 1. City of Tahlequah
 - 2. Oklahoma Department of Environmental Quality (ODEQ)
 - 3. Environmental Protection Agency (EPA).
- B. Backfill Soil material or controlled low-strength material used to fill an excavation.
- C. Initial Backfill Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- D. Final Backfill Backfill placed over initial backfill to fill a trench.
- E. Borrow Borrow shall consist of required excavation, removal, and proper utilization of materials obtained from designated or approved sources for use as fill or backfill.
- F. Excavation Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- G. Authorized Additional Excavation Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- H. Unauthorized Excavation Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- I. Embankment The placement and compaction of all suitable materials obtained from excavation or

borrow to raise existing grades.

- J. Structures Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subgrade Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities Underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- M. Rock Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or ripping.
 - 1. For classifying rock excavation in bulk or mass excavations, use a late model, well-maintained tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design sized for use with, and propelled by, a crawler-type tractor with a minimum net flywheel power rating of 370 hp (276 kW), operating in low gear.
 - For classifying rock excavation in footing, trench, and pit excavations, use a late model, wellmaintained, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tipradius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179s

1.6 ACTION SUBMITTALS

- A. For each type of the following:
 - 1. Material Test Reports: For each borrow material proposed for fill and backfill as follows:
 - a. Source of borrow material
 - b. Classification according to ASTM D-2487
 - c. Laboratory Compaction curve according to ASTM D-698
 - d. Liquid Limit (LL)
 - e. Plastic Limit (PÍ)
 - f. Gradation
- B. Geotextiles
- C. Controlled Low-Strength Material, including design mixture
- D. Warning tapes

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. See Execution.

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference

benchmark elevation.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.15 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be

reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. UTILITY INTERRUPTIONS

 Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

 CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.16 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Excavating and grading equipment shall be approved types and designs and shall be maintained in first class condition. Equipment used for disposing of excavated materials outside of the limits of the work shall be such as will avoid scattering or wasting material along the line of haul.

2.2 MATERIALS

- A. Provide borrow materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils -
 - 1. On-Site Soils and Imported Fill
 - a. Soil Classification Groups GC, SC, SW or GW according to ASTM D 2487. This soil type is required beneath building footprint (below foundation elements), extending outside perimeter walls a horizontal distance equal to the height of fill embankment. Also acceptable for all other areas/elevations not requiring LVC material.
 - 2. Low Volume Change (LVC) Engineered Fill
 - a. Soil Classification Groups CL, GC, or SC according to ASTM D 2487, or a combination of these groups. This soil type is required beneath slabs for a depth of 2-ft, CL materials should be placed above foundation elements only. May be used below foundations if classifying as a GC or SC only. Acceptable for all other areas/elevations outside the building footprint as well. Topsoil strippings or material containing organics shall not be used as LVC material.
 - b. CL soils containing less than 30 percent gravels may be difficult to establish proper compaction and it may be necessary to limit these materials to non-pavement and non-building areas.
 - 3. On-Site Natural Soils –

- a. Soil Classification Groups CH according to ASTM D 2487. This soil type shall not be placed within the upper 2-ft beneath foundations, floor slabs and pavements.
- 4. Additional requirements for satisfactory soils
 - a. Controlled, compacted fill shall consist of approved materials that are free of organic matter and debris and contain maximum rock size of 12 inches, or the lift thickness, whichever is less. Frozen material shall not be used and fill shall not be placed on a frozen subgrade. A sample of each material type shall be submitted to the Geotechnical Engineer for evaluation prior to its use.
 - b. Low plasticity cohesive soil or granular soil having a liquid limit of less than 50%, contain at least 15% fines retained on the No. 200 sieve, and preapproved by the Geotechnical Engineer.
 - c. Satisfactory soils shall be free of rock or gravel larger than 12 inches in any dimension or the lift thickness, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups not defined as Satisfactory Soils above, according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within the required optimum moisture content at the time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.3 GEOTEXTILES

- A. Geotextiles for Erosion Control
 - 1. Pervious fabric under riprap for slope protection and gabion separation shall meet the requirements of AASHTO M 288, "Permanent Erosion Control Geotextile Requirements." The fabric shall be a non-woven, needle-punched material constructed of long chain synthetic polymers composed of at least 85 percent polyester, polyolefins or polyamides.
 - 2. The fabric shall meet the following test requirements:
 - a. Weight: 6 oz. sg/yd, ASTM D 2646
 - b. Thickness: 70 mils, ASTM D 1777
 - c. Grab Strength: 180 lbs, ASTM D1682
 - d. Puncture Strength: 75 lbs, ASTM D 751
 - 1) Tension testing machine with ring clamp, steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
 - e. Burst Strength: 290 psi, ASTM D 751, diaphragm test method
 - f. Trapezoidal Tear Strength, 50 lbs (either principal direction), ASTM D 1117
 - g. Ultraviolet Degradation at 150 hours: 70% retained strength, ASTM D 4355
 - h. E.O.S.: 50-100, USACE Method
- B. Geotextiles for Subsurface Drainage Purposes
 - 1. Geotextiles for pipe underdrain and drainage systems shall meet the requirements of AASHTO M

288, "Subsurface Drainage Geotextile Requirements." Geotextile shall be according to AASHTO M 288, Table 2, with from 15 to 50 percent of in-situ soil passing the No. 200 sieve.

- C. Geotextiles for Subgrade Reinforcement
 - 1. Geotextiles for subgrade reinforcement under pavement structures shall meet the requirements of AASHTO M 288, "Stabilization Geotextile Property Requirements."
- D. Geotextiles for Bases
 - 1. Geotextiles used for separation under base courses shall be a non-woven fabric for base course separation in accordance with AASHTO M 288, "Separation Geotextile Property Requirements" with a Class 2 Degree of Survivability.

2.4 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material (CLSM) shall be a self-compacting low strength material with a flowable consistency.
- B. CLSM shall be produced from the following materials:
 - 1. Portland Cement: ASTM C 150, Type I.
 - 2. Fly Ash: ASTM C 618, Class C or F.
 - 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
 - 4. Foaming Agent: ASTM C 869.
 - 5. Water: ASTM C 94.
 - 6. Air-Entraining Admixture: ASTM C 260.
- C. CLSM shall meet the following requirements:
 - 1. Spread diameter of 8 inches or greater according to ASTM D 6103.
 - 2. Minimum strength of 300 psi according to ASTM D 4832 at 28 days after placement.
 - 3. Unit weight of 115 to 145 lb/cu.ft measured at the point of placement according to ASTM D 6023.

2.5 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXPLOSIVES

A. Do not use explosives.

3.3 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Geotechnical Engineer.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is

earth excavation.

- 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- 3. If mass rock is encountered, the rock excavation shall be classified and cross sectioned by Geotechnical Engineer. The amount of rock excavation shall be calculated and a cost proposal for the excavation shall be submitted to the Architect for the review of Owner, Architect, and Civil Engineer.
- B. Construction Methods
 - All excavation shall be in accordance with the lines, grades and typical sections as shown on the plans or as established by the OWNER. Unless otherwise shown on the plans or established by the OWNER, the excavation shall be made to the subgrade. Where excavation to grades established in the field by the OWNER would terminate in unstable soil, the CONSTRUCTION MANAGER shall remove the unstable soil and backfill to the required grade.
 - 2. Where excavation to grade established in the field by the OWNER terminates in loose or solid rock, the CONSTRUCTION MANAGER shall extend the depth of excavation 6 inches and backfill with select material compacted as required.
 - 3. The CONSTRUCTION MANAGER shall conduct his operation in such a manner that adequate measurements may be taken before any backfill, as required above, is placed.
- C. Provisions for Drainage
 - 1. If it is necessary in the execution of the work to interrupt the natural drainage of the surface or the flow of artificial drains, the CONSTRUCTION MANAGER shall provide temporary drainage facilities that shall prevent damage to public or private interest and shall restore the original drains as soon as the work shall permit.
 - 2. The CONSTRUCTION MANAGER shall be held liable for all damages which may result from neglecting to provide for either natural or artificial drainage which his work may have interrupted.
- D. Excess Excavation
 - Excavation in excess of that needed for construction shall be disposed of by the CONSTRUCTION MANAGER. In general, suitable excess excavation shall be used in construction of streets, drives, parking lots, widening of embankments, flattening of slopes, etc., but, if it becomes necessary to waste any material, it shall be disposed of in such a manner as to present a neat appearance and to not obstruct proper drainage or cause injury to any street improvements or abutting property. If necessary to haul off excess or unsuitable material, the CONSTRUCTION MANAGER should ask approval of the OWNER as to disposition site and method.
- E. The on-site soils typically classify as Type B in accordance with OSHA regulations. Temporary excavations in soils classifying as Type B with a total height of less than 20 ft. shall be cut no steeper than 1H:1V in accordance with OSHA guidelines. Confirmation of soil classification during construction, as well as construction safety (including shoring, if required), shall be the responsibility of the CONSTRUCTION MANAGER.
- F. Overburden soils on the site consist of very dense clayey gravels with chert cobbles and boulders with isolated areas consisting of clays with a reduced chert content. The overburden soils are anticipated to be rippable with dozers, but with difficulty. In addition, areas resistant to ripping consisting of large chert boulders, requiring other removal methods (pneumatic breakers or blasting, if allowed) should be anticipated. The Earthwork Contractor shall review the attached boring logs when assessing excavation difficulty at this site. Mass grading at this site is anticipated to occur at a slower rate as compared to sites where overburden soils are primarily fine grained (silts and clays).
- G. If relatively chert free fat clay zones are encountered at footing bottom and finish subgrade elevation, they shall be undercut 2 ft., or to gravelly clays/clayey gravels, whichever is shallower, and replaced with LVC

fill material.

3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. The length of trench excavated approximately to grade shall not exceed one hundred-fifty feet (150-ft) and no trench excavation whatsoever shall be made farther than three hundred feet (300-ft) in advance of completed backfill.
- B. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, joining, and embedment. Stipulated minimum trench widths are not minimum average widths but are minimum widths that shall be required. Stipulated maximum trench widths shall not be exceeded. Trench width shall be the width of the trench excavation measured from bank to bank at the top of the pipe. For rigid pipes, when the maximum trench width is exceeded, the CONSTRUCTION MANAGER shall be required to provide a higher strength pipe or higher bedding classification, singly or in combination as directed by the ARCHITECT, at the CONSTRUCTION MANAGER's expense. Any additional foundation material and/or embedment material required due to over excavation, beyond the maximum trench width shall be at the CONSTRUCTION MANAGER's expense.
- C. Where trenches are excavated in soil of such nature as to require sheeting and shoring to assure proper installation, and safety of the workmen and any adjacent structures or other objects, the CONSTRUCTION MANAGER shall provide the necessary sheeting and shoring. Where possible, shields designed to be portable and moved along as work progresses may be used. The contract pay widths shown in the above shall apply to all trenches with or without sheeting or shoring.
- D. Excavation shall be made in open-cut from the surface of the ground and shall be made no larger than necessary to permit proper construction of the work in accordance with the plans and specifications. The entire foundation area in the bottom of all excavations shall be firm, stable and of uniform density as nearly as practical, and unless necessary, materials shall not be disturbed below grade. Where trenches are excavated in soft, unsuitable materials, trench bottom may be stabilized by over-excavating unsuitable materials and replaced with engineered fill.
- E. Where depth of trenching and other excavations are greater than twenty feet (20'), and when not provided for in the plans, an engineer shall be retained by the CONSTRUCTION MANAGER to design bank protection as per OSHA rules and regulations. The bank protection design, signed and sealed by a Professional Engineer registered in the State of Oklahoma, shall be submitted to the ARCHITECT.
- F. The sides of all excavations shall be sufficiently sheeted, shored and braced so as to prevent slides, caveins, settlement or movement of the banks. In wet, saturated or flowing ground where it is necessary to install tight sheeting or cofferdams, wood or steel sheet piling of approved design and type shall be used. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressures exerted and maintain the walls of the excavation properly in place and protect all persons or property from injury or damage. When excavations are made adjacent to existing buildings or other structures, or in paved streets or alleys, particular care shall be taken to adequately sheet, shore, and brace the sides of the excavation to prevent any undermining of or settlement beneath the structures or the pavement. Underpinning of adjacent structures, when necessary, shall be done in an approved manner. The foundation material that is undermined shall be replaced and compacted in accordance with the requirements of this section. Sheeting, shoring, and bracing shall not be left in place unless otherwise shown on the plans or authorized by the ARCHITECT. The removal of sheeting, shoring and bracing shall

be done in such a manner as not to endanger or damage either the new structure or any existing structure or property, either private or public, and so as to avoid cave-ins or sliding of the banks. If for any reason the CONSTRUCTION MANAGER, with the approval of the ARCHITECT, leaves in place any sheeting, shoring or bracing, no payment will be allowed for such material left in place unless it is classified as a contract pay item. All holes or voids left by the removal of sheeting, shoring or bracing shall be satisfactorily filled and compacted in accordance with the requirements of this section.

3.7 SUBGRADE PREPARATION AND INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's materials, testing, and inspections Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- D. Once the subgrade has passed proof-rolling, the exposed subgrade shall be scarified to a minimum depth of 8 inches, moisture conditioned, and compacted to the requirements within Compaction of Backfills and Fills.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 FILL

- A. Prior to the placing of any fill, all clearing and grubbing and site preparation shall have been completed. Stump holes or other small excavations within the limits of the embankment shall have been backfilled before commencing the embankment construction. The surface of the ground, including plowed or loosened ground or small ditches or washes, shall be restored to approximately its original slope.
- B. Embankments shall be constructed to the established grade and to the shape of the typical section shown on the, plans, and each section shall conform to the detailed sections of slopes. After completion of the embankment, it shall be continuously maintained to its finished section and grade until the project is accepted.
- C. Earth embankments shall be constructed in successive horizontal layers, for the full width of specified depth or cross sections; and in such lengths as are suitable for the sprinkling and compaction methods to be used. Each layer of earth embankment shall be uniform as to material, density, and moisture content before beginning compaction. Layers of embankment shall be brought up uniformly on each side of the structure, and special care shall be taken to prevent any wedging action against the structure. For such distances along embankments adjacent to structures where it is impracticable to obtain compaction by rolling, the embankment material shall be placed in layers not exceeding 12 inches in depth of loose material wetted uniformly to the moisture content directed; and shall then be compacted by methods approved by the OWNER, maintaining the required moisture content by additional sprinkling, if necessary, supplemented by such hand work as is necessary to secure a uniform and thoroughly compacted fill, until each layer has been uniformly compacted to the satisfaction of OWNER.
- D. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

- A. Backfill is that portion of the total trench backfill down to but not including the pipe embedment material. The backfill shall be only material approved by the ARCHITECT consisting of loose earth, free of clods, stones, organic matter, debris or other objectionable materials.
- B. All backfilling shall be done in such a manner as not to disturb or injure the pipe or structures over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be opened and repaired and then re-backfilled as herein specified.

- C. The top surface or slopes of all backfill shall be neatly graded off where select topsoil, sod or other material is removed and piled separately; such material shall be carefully replaced in a manner satisfactory to the ARCHITECT. The top twelve inches (12-inches) of backfill material shall be of as good quality as the original topsoil that was removed.
- D. A clay trench plug shall be constructed at the edge of the building and extend at least 5 feet out from the face. The clay shall have a minimum plasticity index (PI) of 15 and be placed in controlled lifts not exceeding 9 inches in loose thickness. Each lift of clay backfill shall be compacted to at least 95 percent of the material's maximum standard Proctor dry density, ASTM 698, at a minimum moisture content that is above its optimum value.
- E. Place backfill on subgrades free of mud, frost, snow, or ice.
- F. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- G. Backfill voids with satisfactory soil while removing shoring and bracing.
- H. Utility trench backfill material shall be placed in layers not exceeding 6 inches in depth of loose material.
- I. Place and compact initial backfill, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
- J. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- K. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content for CL, SC, GW, and SW soil types; and to within 0 to 4 percent above optimum moisture content for CH soil types.
- B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content requirements and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact backfills and fills to not less than the following percentages of maximum dry unit weight according to ASTM D-698:
 - 1. Building Area Below Foundation Bearing Elevation
 - a. Six (6) passes (3 each direction) minimum using a self-propelled vibratory compactor with a minimum drum diameter of 48-inches, or 100% Standard Proctor Density (ASTM D698), whichever is applicable.
 - 2. Building Area Above Foundation Bearing Elevation & Below Floor Slabs
 - a. Three (3) passes of the compactor referenced above, or 95% Standard Proctor Density (ASTM D698), whichever is applicable;
 - 3. Pavements, Sidewalks & Exterior Slabs
 - a. Same as Building Area above foundations.
 - 4. Non-Structural Areas
 - a. 90% Standard Proctor Density (ASTM D698).
 - 5. Utility Trenches
 - a. Compact each layer according to the location of the utility, and no less than 95 percent Standard Proctor Density (ASTM D698).

3.13 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 - 5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent of maximum dry unit weight according to ASTM D-698.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D-698.

3.14 PROTECTION

- A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
- C. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

3.16 DEWATERING

- A. PERFORMANCE
 - 1. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 5. Remove dewatering system when no longer required for construction.
- B. PREPARATION
 - 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 2. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 3. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
 - 4. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

- 5. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- 6. Provide temporary grading to facilitate dewatering and control of surface water.
- 7. Monitor dewatering systems continuously.
- 8. Promptly repair damages to adjacent facilities caused by dewatering.
- 9. Protect and maintain temporary erosion and sedimentation controls during dewatering operations.
- C. INSTALLATION
 - 1. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 2. Space well points or wells at intervals required to provide sufficient dewatering.
 - 3. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
 - 4. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
 - 5. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 6. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 - 7. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 8. Maintain piezometric water level a minimum of 60 inches below surface of excavation.
 - 9. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
 - 10. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 11. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
 - 12. Promptly repair damages to adjacent facilities caused by dewatering operations.

3.17 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing and inspection Geotechnical Engineer for the testing requirements within Excavation and Fill. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with earthwork operations. The results of the tests shall be forwarded to ARCHITECT. The soils laboratory shall determine the suitability of existing site material prior to beginning fill operations.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.
- D. The soils testing laboratory shall:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements and determine that fill material.
 - 2. Determine that maximum lift thickness comply with requirements.
 - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- E. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- F. Testing agency shall test compaction of soils in place, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Building Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every

5,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

- 3. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
- 4. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- G. Engineered fill, including scarified compacted subgrade, shall be tested for moisture content and compaction during placement. If in-place density tests indicate the required moisture or compaction limits have not been met, the shall be reworked and retested as required until the required moisture and compaction requirements are met.
- H. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

END OF SECTION

SECTION 31 2500 EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for EROSION AND SEDIMENTATION CONTROLS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for EROSION AND SEDIMENTATION CONTROLS shall be included in the bid prices for the work.

1.3 SECTION INCLUDES 1.4 RELATED SECTIONS

- A. 31 1000 Site Clearing
- B. 31 2300 Excavation and Fill
- A. 01 50 00 Temporary Facilities and Controls
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah
 - 2. United States Environmental Protection Agency (USEPA)
 - 3. Oklahoma Department of Environmental Quality (ODEQ)

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Geotextiles for erosion control

1.7 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Silt Fence Posts
 - 2. Curb and drop Inlet sediment bags
 - Silt socks

1.8 DELIVERY, STORAGE, AND HANDLING 1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference

benchmark elevation.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- B. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

PART 2 - PRODUCTS

2.1 GEOTEXTILES FOR EROSION CONTROL

- A. Pervious fabric under riprap for slope protection and gabion separation shall meet the requirements of AASHTO M 288, "Permanent Erosion Control Geotextile Requirements." The fabric shall be a non-woven, needle-punched material constructed of long chain synthetic polymers composed of at least 85 percent polyester, polyolefins or polyamides.
- B. The fabric shall meet the following test requirements:
 - 1. Weight: 6 oz. sq/yd, ASTM D 2646
 - 2. Thickness: 70 mils, ASTM D 1777
 - 3. Grab Strength: 180 lbs, ASTM D1682
 - 4. Puncture Strength: 75 lbs, ASTM D 751
 - a. Tension testing machine with ring clamp, steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
 - 5. Burst Strength: 290 psi, ASTM D 751, diaphragm test method

- 6. Trapezoidal Tear Strength, 50 lbs (either principal direction), ASTM D 1117
- 7. Ultraviolet Degradation at 150 hours: 70% retained strength, ASTM D 4355
- 8. E.O.S.: 50-100, USACE Method

2.2 SILT FENCE POSTS

- A. Minimum 5 feet long:
- B. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.

2.3 TEMPORARY CONSTRUCTION FENCE

A. See 01 50 00 Temporary Facilities and Controls.

PART 3 - EXECUTION

3.1 EROSION AND SEDIMENT CONTROLS, GENERAL

- A. Construction and placement of erosion and sediment control devices shall be performed in conjunction with the progress of general construction. CONSTRUCTION MANAGER shall install the erosion control devices shown and install additional erosion control devices as necessary to prevent silt runoff from the work area onto adjacent areas.
- B. The erosion and sediment controls to be used for this site are:
 - 1. Temporary construction entrance/exit stabilized construction entrances shall be installed at all points where construction or employee vehicles enter or leave the construction or staging areas.
 - 2. Rock bag filter berms rock bag filter berms shall be placed in small open channels. The berms shall be placed so that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
 - 3. Rock bag inlet barrier rock bag inlet barriers shall be placed around all inlets proposed and existing that are receiving runoff from the site.
 - 4. Silt fences silt fences shall be placed along the perimeter of the project where storm water will exit the site. Silt fences shall also be utilized along slope contours where vegetative cover is not sufficiently established to prevent erosion.
 - 5. Sodding/site seeding sodding and seeding shall be used to establish final vegetative cover.
- C. The following are some other controls that may be used in the course of this project.
 - 1. Common vegetative practices
 - a. Temporary seeding, mulching, permanent seeding and planting, preservation of natural vegetation, dust control
 - 2. Structural erosion and sediment control practices
 - a. Silt fence, storm drain inlet protection, outlet protection, berms for fuel storage and dispensing areas
- D. Additional controls not listed above may also be considered for use.

3.2 OTHER CONTROLS

- A. The premises and the job site shall be maintained in a reasonably neat and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and flammable waste materials or trash from the work areas at the end of each working day.
- B. Pavement on-site and on adjoining streets shall be kept free of any sediment or mud tracking from truck tires or from other equipment.
- C. Chemical toilets for the use of all construction personnel shall be provided at a location within the limits of the site. Chemical toilets shall be maintained in a sanitary condition.
- D. Any disposal of construction wastes, hazardous products, and contaminated soils shall be disposed of according to requirements of the City, County, ODEQ, and the U.S. Environmental Protection Agency.
- E. The wheels of vehicles leaving the construction areas shall be cleaned of mud prior to leaving the construction or staging areas. Wheel washing shall be performed in an area stabilized with stone that drains into an approved sediment trapping device.
- F. Adequate controls shall be made to prevent and/or control any release of pesticides, petroleum products, fertilizers and detergents, and hazardous products.
- G. Any spill of pesticides, petroleum products, fertilizers and detergents, and hazardous products shall be contained and removed according to state and federal requirements. Any spill of pesticides, petroleum products, fertilizers and detergents, and hazardous products shall be reported according to state and

federal requirements.

3.3 STORM WATER POLLUTION PREVENTION PLAN

A. A Storm Water Pollution Prevention plan (SWP3) has been prepared for the work. CONSTRUCTION MANAGER shall implement the SWP3, and construct, inspect, and maintain the erosion controls to prevent runoff of silt and sediment from the site. A copy of the SWP3 shall be kept at the site at all times and be made available to inspectors upon request. Inspections reports shall be maintained in the swp3 and the swp3 shall be updated when necessary.

3.4 POSTING OF PUBLIC NOTICE

- A. CONSTRUCTION MANAGER shall be responsible for posting public notice. the notice shall be posted near the main entrance of the construction site that indicates the following information:
 - 1. The permit number for the project or a copy of the NOI if a permit number has not yet been assigned.
 - 2. The name and telephone number of a local contact person.
 - 3. A brief description of the project.
 - 4. The location of this SWP3 if the site is inactive or does not have an on-site location to store the plan.

3.5 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances:
 - 1. Width: As required; 20 feet, minimum.
 - 2. Length: 50 feet, minimum.
 - 3. Provide at each construction entrance from public right-of-way.
 - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
 - c. Along the toe of cut slopes and fill slopes.
 - d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
 - e. Across the entrances to culverts that receive runoff from disturbed areas.
 - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet.
 - b. Slope between 2 and 5 Percent: 75 feet.
 - c. Slope between 5 and 10 Percent: 50 feet.
 - d. Slope between 10 and 20 Percent: 25 feet.
 - e. Slope over 20 Percent: 15 feet.
 - 3. Soil Stockpiles: Protect using one of the following measures:
 - a. Cover with polyethylene film, secured by placing soil on outer edges.
 - b. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.
 - 4. Temporary Seeding: Use where temporary vegetated cover is required.

3.6 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
 - 1. Excavate minimum of 6 inches.
 - 2. Place geotextile fabric full width and length, with minimum 12-inch overlap at joints.
 - 3. Place and compact at least 6 inches of 1.5-to-3.5-inch diameter stone.
- B. Temporary Construction Fences:

- 1. Space steel support posts to ensure mesh remains vertical and at proper height. Securely tie to posts.
- C. Silt Fences:
 - 1. Store and handle fabric in accordance with ASTM D 4873.
 - 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16inch-high barriers with minimum 36-inch-long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 - 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28inch-high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
 - 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32-inch-high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
 - 5. Install with top of fabric at nominal height and embedment as specified.
 - 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 - 7. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 - 8. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- D. Temporary Seeding:
 - 1. When hydraulic seeder is used, seedbed preparation is not required.
 - 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 - 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
 - 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
 - 5. Incorporate fertilizer into soil before seeding.
 - 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
 - 7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 - 8. Repeat irrigation as required until grass is established.

3.7 MAINTENANCE

- A. All erosion and sediment control measures and other protective measures shall be maintained in effective operating condition. If site inspections identify erosion controls that are not operating effectively, maintenance shall be performed before the next anticipated storm event, or as necessary to maintain the continued effectiveness of storm water controls. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable.
- B. If sediment escapes the construction site, off-site accumulations of sediment shall be removed at a frequency sufficient to minimize offsite impacts (e.g., fugitive sediment in street could be washed into storm sewers by the next rain and/or pose a safety hazard to users of public streets).
- C. Sediment shall be removed from sediment traps or sedimentation ponds when the design capacity has been reduced by 50%.
- D. Litter, construction debris, and construction chemicals exposed to storm water shall be prevented from becoming a pollutant source for storm water discharges (e.g., screening outfalls, picked up daily).

3.8 INSPECTIONS

- A. CONSTRUCTION MANAGER shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, structural control measures, and locations where vehicles enter or exit the site, at least once every fourteen (14) calendar days and within 24 hours of the end of a storm event of 0.25 inches or greater.
- B. The following items, locations, and areas shall be inspected.
 - 1. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system.
 - 2. Sediment and erosion control measures shall be observed to ensure that they are operating correctly.
 - 3. Where discharge locations or points are accessible, they shall be inspected to ascertain whether

erosion control measures are effective in preventing significant impacts to receiving waters.

- 4. Where discharge locations are inaccessible, nearby downstream locations shall be inspected to the extent that such inspections are practicable.
- 5. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.

3.9 REPORTS

- A. A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, and major observations relating to the implementation of erosion controls shall be made.
- B. Major observations should include: the location(s) of discharges of sediment or other pollutants from the site; location(s) of erosion controls that need to be maintained; location(s) of erosion controls that failed to operate as designed or proved inadequate for a particular location; and location(s) where additional erosion controls are needed that did not exist at the time of inspection.
- C. Modifications made to erosion controls as a result of inspections shall be recorded.
- D. Reports shall identify any incidents of noncompliance.
- E. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The owner or CONSTRUCTION MANAGER shall sign the report.
- F. Any person signing the report shall make the following certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.
- G. Inspection reports shall be maintained on site.

3.10 MODIFICATIONS OR ADDITIONS TO EROSION CONTROLS

A. Based on the results of the inspection, erosion controls shall be modified as necessary or additional control shall be provided to correct the problems identified. If existing erosion controls need to be modified or if additional controls are necessary, implementation shall be completed before the next anticipated storm event. If implementation before the next anticipated storm event is impracticable, they shall be implemented as soon as practicable.

3.11 STABILIZATION REQUIREMENTS

- A. Fine grading shall be performed according to the grading plan.
- B. All areas disturbed during the course of construction shall be revegetated according to the landscaping plan. If a landscaping plan is not provided, the disturbed areas shall be seeded or hydro-mulched.
- C. Except where the landscaping plan identifies other grasses, groundcover, plants, or shrubs to be planted, a 4 ft wide strip of Bermuda grass sod shall be placed behind all curbs.
- D. CONSTRUCTION MANAGER shall provide sufficient water and fertilizer to establish the sufficient growth of sod and seeds until final stabilization of the area is achieved.
- E. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
- F. where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently ceases is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable
- G. Where construction activity on a portion of the site is temporarily ceased, and earth-disturbing activities will be resumed within 21 days, temporary stabilization measures do not have to be initiated on that portion of site.
- H. in areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonal arid conditions, stabilization measures shall be initiated as soon as practicable.
- I. Temporary seeding or hydro-mulching may be used for temporary stabilization, if necessary.

3.12 CONSTRUCTION COMPLETION AND FINAL STABILIZATION

- A. CONSTRUCTION MANAGER shall remove all temporary erosion control structures upon completion of construction and the establishment of final stabilization.
- B. Final stabilization shall be complete when all soil disturbing activities at the site have been completed and

a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

END OF SECTION

SECTION 31 36 00 GABIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for GABIONS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for GABIONS shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

A. Galvanized steel double twisted woven wire mesh gabion baskets filled with stone and used for various applications including but not limited to retaining walls, mechanically stabilized soil retaining structures, stream bank protection, slope paving, outfall structures, weirs, and drop structures.

1.4 RELATED SECTIONS

- A. 31 10 00 Site Clearing
- B. 31 22 00 Grading
- C. 31 23 00 Excavation and Fill
- D. 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah
- B. Gabions
 - 1. Gabions are defined as double twisted woven wire mesh box shaped baskets, of various sizes and dimensions.
 - 2. The selvedges of the gabion baskets are the thicker perimeter and edge wires to which the wire mesh is secured as to withstand sudden or gradual stress from any direction.
 - 3. Reinforcing wires are the thicker wires incorporated into the netting during
 - 4. fabrication.
 - 5. The internal diaphragms are the internal wire mesh partitions which divide the gabions into cells.
 - 6. Lacing or tie wire is used to assemble and join the gabion units.
 - 7. Connecting wires are the internal wire used to prevent the gabions from bulging.
 - 8. Alternative wire fasteners are ASTM approved wire fasteners used in lieu of lacing wire.

1.6 ACTION SUBMITTALS

- A. STONE
 - 1. Submit photographs of existing gabion walls showing the stone proposed for the project.

1.7 INFORMATIONAL SUBMITTALS 1.8 DELIVERY, STORAGE, AND HANDLING 1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ENGINEER one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

A. CONSTRUCTION MANAGER shall make application; pay permit fees; provide payment and performance bonds required of the CONSTRUCTION MANAGER by the AHJ.

1.11 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.

1.12 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ENGINEER and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ENGINEER and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ENGINEER and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. All existing structures, improvement and utilities designated to remain shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.
- E. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ENGINEER before commencing work. The ENGINEER or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ENGINEER. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.

- 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
- 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ENGINEER one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.15 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 GABIONS

- A. Gabions shall be double twisted hexagonal steel wire mesh galvanized gabions. Gabions shall be fabricated in such a manner that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of the sizes specified and shown in the drawings. Gabions shall be of single unit construction: the base, lid, ends, and sides shall be either woven into a single unit or edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the connecting point does not compromise the engineered structural design of the gabion. Where the length of the gabion exceeds on and one half its horizontal width, the gabion shall be divided by diaphragms of the same mesh and gauge as the body of the gabion, into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying is required at this juncture.
- B. Mesh Formation
 - 1. The double twisted hexagonal wire mesh shall have deformability sufficient to permit minimum of mesh elongation equivalent to 10% of the unstretched length of the mesh test section without reducing the gauge or the tensile strength of the individual wire strands to values less than those for similar wire, one gauge smaller in diameter.
- C. Non-Raveling

- 1. The double twisted hexagonal wire mesh is to be fabricated in such a manner as to be non-raveling. This is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire strand in a section of mesh is cut or broken.
- D. Gabion fill
 - 1. The stone fill material used for filling the gabion units shall be clean, hard stone with pieces ranging from 4 to 8 inches on the greatest dimensions. Stone filling shall not exceed 18-inch vertical drop above the gabion basket. All effort shall be made to ensure that the stone fill material utilized in the design of the structure match the stone fill used in constructing the gabion structure.
- E. Wire Mesh
 - 1. Diameter of mesh wire: 0.120 inches
 - 2. Diameter of selvedge wire: 0.153 inches
 - 3. Diameter of lacing wire: 0.091 inches
 - 4. Coating of wire: finish 5 class 3 zinc coating- ASTM A-641 tested in accordance with ASTM A370-92.
 - 5. Tensile of wire: soft temper in accordance with ASTM A641-92
 - 6. Weight of zinc coating of wire: shall be determined by ASTM A-90
 - 7. Wire diameter of 0.120 inches shall have a weight of zinc coating of: 0.85 oz/sf
 - 8. Wire diameter of 0.153 inches shall have a weight of zinc coating of: 0.90 oz/sf
 - 9. Wire diameter of 0.091 inches shall have a weight of zinc coating of: 0.80 oz/sf
 - 10. Grade of zinc coating of wire: high grade or special high grade in accordance with ASTM B-6, Table 1.
 - 11. Uniformity of coating: shall be determined by ASTM A-239
 - 12. Elongation: not less than 12% in accordance with ASTM A370-92.
 - 13. All of the above wire diameters are subject to a tolerance limit of 0.004 in accordance with ASTM A-641.
- F. Manufactured according to ASTM A975-97 guidelines for Double Twisted Hexagonal Mesh Gabions.

2.2 MANUFACTURERS

A. Terra Aqua Gabions, Inc. 1415 N 32nd Street, Fort Smith, Arkansas 72904, 479-785-5344

PART 3 - EXECUTION

3.1 FOUNDATION PREPARATION

- A. The foundation on which the gabions are to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. Surface irregularities, loose material, vegetation, and all foreign matter shall be removed from foundation surface area. When fill is required, it shall consist of materials conforming to 31 23 00 Excavation and Fill. Gabions and bedding shall not be placed until the foundation preparation is completed and the subgrade surface have been inspected, tested, and approved.
- B. Compaction of bedding or filter material shall be made per 31 23 00 Excavation and Fill. The surface of the finished material shall be to grade and free of mounds, dips or windrows. Extra care shall be taken with foundation preparation in order to ensure a level and smooth surface. Geotextile shall be installed in accordance with 31 23 00 Excavation and Fill.

3.2 ASSEMBLY AND PLACEMENT

- A. Each gabion unit shall be assembled by tying or fastening all connecting seams. The binding wire shall be tightly looped around every other mesh opening along the seams in such a manner that single and double loops are alternated. Alternative wire fasteners may be used in lieu of lacing wire. The alternative wire fasteners shall be applied at approximately 4" 6" intervals on all vertical and horizontal seams. No less than 3 fasteners per one foot on any given seam.
- B. A line of empty gabions, shall be placed into position according to the contract drawings. Binding wire or alternative wire fasteners shall be used to secure each unit to the adjoining one along the vertical reinforced edges and the top selvedges. An approved corner closure tool shall be used to adjoin adjacent gabions to insure a tight, neat seam and minimize gabion wired or fastened to the latter at front and back. The lid shall be secured with an approved closure tool to insure proper closure without excessive mesh deformation.
- C. To achieve optimum alignment and finish for retaining walls, a minimum amount of stretching may be required.
- D. Connecting wire shall be inserted during the filling operation as follows: The connecting wires shall be installed according to manufacturer's instructions every 1' vertical lift of the gabion unit.

3.3 FILLING OPERATION

- A. Empty gabion baskets shall be assembled individually and placed on the approved surface to the lines and grades as shown or as directed, with the position of all creases and that the tops of all sides are level. All gabion baskets shall be properly staggered horizontally and vertically as shown in the construction drawings. Finished gabion structures shall have no gaps along the perimeter of the contact surfaces between adjoining units. All adjoining empty gabion units shall be connected along the perimeter of their contact surfaces in order to obtain a monolithic structure. All lacing wire terminals shall be securely fastened. All joining shall be made through selvedge-selvedge or selvedge-edge wire connection; meshmesh wire connection is prohibited except in the case where baskets are offset or stacked and selvedgemesh or mesh-mesh wire connection would be necessary. As a minimum, a fastener shall be installed at each mesh opening at the location where mesh wire meets selvedge or edge wire.
 - 1. The initial line of gabion basket units shall be placed on the prepared filter layer surface and adjoining empty baskets set to line and grade, and common sides with adjacent units thoroughly laced or fastened. They shall be placed in a manner to remove any kinks or bends in the mesh and to uniform alignment. The basket units then shall be partially filled to provide anchorage against deformation and displacement during the filling operation. The stone shall be placed in the units as specified or directed by the manufacturer.
 - 2. Deformation and bulging of the gabion units, especially on the wall face, shall be corrected prior to additional stone filling. Care shall be taken, when placing the stone by hand or machine, to assure that the PVC coating on the gabions will not be damaged if PVC is utilized. All stone on the exposed face shall be hand placed to ensure a neat compact appearance.
 - 3. Gabions shall be uniformly overfilled by about 1-3 inches to account for future structural settlements and for additional layers. Gabions can be filled by any kind of earth filling equipment. The maximum height from which the stones may be dropped into the baskets shall be 3'.
- B. Stone Placement
 - 1. When excavation and foundation preparation are completed, the pre-assembled gabions shall be placed in their proper location according to the plans provided. Gabions shall then be connected together and aligned prior to filling with stone. The stone fill shall have a gradation as listed or specified within the contract specifications or as listed within this specification. The stone fill shall be placed into the gabion units in 1' lifts. Cells shall be filled to a depth not exceeding 1' at a time. The fill layer should never be more than 1' higher than any adjoining cell. Connecting wires shall be installed from the front to back and side to side of the individual cells at each 1' vertical interval for gabions with a depth of 3'. The voids shall be minimized by using well graded stone fill and by hand placement of the facing in order to achieve a dense, compact stone fill. All corners shall be securely connected to the adjoining basket of the same layer before filing the units. When more than one layer of gabions is required, in order for the individual units to become incorporated into one continuous structure, the next layer of gabions shall be uniformly overfilled by about 1-2 inches to account for structural settlement.
- C. Lid Closing
 - 1. The lids of the gabion units shall be tightly secured along all edges, ends and diaphragms in the same manner as described for assembling. Adjacent lids may be securely attached at the same time. The panel edges shall be pulled to be connected using the appropriate closing tools where necessary. Single point leverage tools, such as crowbars will not be acceptable. All end wire shall then be turned in.

END OF SECTION

SECTION 31 3700 RIPRAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for RIPRAP as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for RIPRAP shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- A. 31 25 00 Erosion and Sedimentation Controls
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. QUALITY ASSURANCE
 - 1. PRECONSTRUCTION CONFERENCE
 - a. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
 - 2. REGULATORY REQUIREMENTS
 - a. All materials and methods shall comply with the requirements of the AHJ.

1.9 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans

are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - a. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - b. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - c. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. UTILITY INTERRUPTIONS

1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed

interruption of utility.

- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

- A. All materials and products shall comply with the following subsections of the Oklahoma Department of Transportation's 2019 Specifications.
 - 1. 701.02 Portland Cement.
 - 2. 701.05 Fine Aggregates
 - 3. 712.02 Filter Fabric.
 - 4. 713.01 Stone for Riprap.
 - 5. 713.02 Filter Blanket.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The placement of RIPRAP shall comply with Section 601 "Riprap" of the Oklahoma Department of Transportation's 2019 Specifications.

END OF SECTION

SECTION 316329 – DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 SUMMMARY

A. Section Includes:

1. Dry-installed drilled piers

1.2 UNIT PRICES

- A. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length may vary to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments are made on net variation of total quantities, based on design dimensions for shafts.
- 1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft.
- 2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at agreed upon location.
- 1. Review methods and procedures related to drilled piers including, but not limited to, the following:
 - a. Review geotechnical report.
 - b. Discuss existing utilities and subsurface conditions.
 - c. Review coordination with temporary controls and protections.
 - d. Review measurement and payment of unit prices.
 - e. Review concrete delivery method.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For concrete reinforcement, detailing fabricating, bending, supporting, and placing.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

CN - Replacement Hospital	31 6329 - 1	DRILLED CONCRETE PIERS
Foy Consulting & Engineering		

Experience shall be relevant to anticipated subsurface materials, water conditions, shaft sizes and special techniques required.

- B. Testing Agency Qualifications: Qualified according to ASTM C1077, ASTM D3740, and ASTM E329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.4/D1.4M, "Structural Welding Code Reinforcing Steel."

1.7 FIELD CONDITIONS

- A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
 - 1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.
- B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer, Owner is not responsible for interpretations or conclusions drawn front this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
 - 2. The geotechnical report is referenced elsewhere in the Project Manual.
- D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
 - 1. Record and maintain information pertinent to each drilled pier and indicate on record Drawings. Cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drilled-Pier Standard: Comply with ACI 336.1 except as modified in this Section.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A61 5/A6 1 5M, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM 706/A706M, deformed.
- C. Galvanized Reinforcing Bars: ASTM 615/A615M, Grade 60, deformed bars, ASTM A767/A767M, Class I zinc coated after fabrication and bending.
- D. Epoxy-Coated Reinforcing Bars: ASTM 615/A615M, Grade 60, deformed bars, ASTM A775/A775M or ASTM A934/A934M, epoxy coated with less than 2 percent damaged coating in each 12-inch bar length.
- E. Plain-Steel Wire: ASTM A82/A82M, as drawn.
- F. Deformed-Steel Wire: ASTM A496/A496M.
- G. Joint-Dowel Bars: ASTM A615/A615M, Grade 60, plain. Cut bars true to length with ends square and free of burrs.

2.3 CONCRETE MATERIALS

A. Reference Specification Section 033000 "Cast-In-Place Concrete" for concrete mix design requirements.

2.4 CONCRETE MIXTURES

- A. Reference Specification Section 033000 "Cast-In-Place Concrete" for concrete mix design requirements.
- 2.5 REINFORCEMENT FABRICATION
 - A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.
 - 1. Contractor shall maintain a separate independent Pier Log. Record the following information for each pier.

- a. Identification mark
- b. Shaft diameter
- c. Bottom of pier elevation
- d. Steel reinforcing cage length, number and size of vertical bars and tie size and spacing
- e. Top of pier elevation
- f. Date and time of drilling is complete
- g. Date and time concrete placement is begun and is completed
- h. Plumbness variation
- i. Condition of drilled hole before placement of concrete
- j. Elevation of proper bearing stratum
- k. Embedment into bearing stratum
- 1. Water depth for bottom of pier at time of concrete placement

3.2 EXCAVATION

- A. Unclassified Excavation. Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
 - 1. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions.
 - 2. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.
- B. Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations as follows:
 - 1. Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work.
 - 2. Special excavation includes excavation that requires special equipment or procedures where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.
 - a. Special excavation requires use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation.
 - b. Earth seams, rock fragments, and voids included in rock excavation area are considered rock for full volume of shaft from initial contact with rock.
 - 3. Obstructions: Payment for removing unanticipated boulders, concrete, masonry, or other subsurface obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underrearning tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.
- C. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

- D. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
 - 1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
 - 2. Remove water from excavated shafts before concreting.
 - 3. Excavate rock sockets of dimensions indicated.
- E. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
 - 1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
 - 2. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.
- F. Slurry Displacement Method: Stabilize excavation with slurry maintained a minimum of 60 inches above ground-water level and above unstable soil strata to prevent caving or sloughing of shaft. Maintain slurry properties before concreting.
 - 1. Excavate and complete concreting of drilled pier on same day, or redrill, clean, and test slurry in excavation before concreting.
- G. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
 - 1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.
- H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
 - 1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit corrective construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by a qualified testing agency.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
 - 1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
 - 2. Vibrate top 60 inches of concrete.
- C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
 - 1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.
- D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
- E. Protect concrete work, according to ACI 301 from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Drilled piers.
 - 2. Excavation.

- 3. Concrete
- 4. Steel reinforcement welding.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
 - 1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities are determined by testing and inspecting agency. Final evaluations and approval of data are determined by EOR.
- D. Concrete Tests and Inspections: Follow same requirements as given in Specification Section 033000, subsection "Field Quality Control".

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 32 1100 BASE COURSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for BASE COURSES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for BASE COURSES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Subgrade Modification
- B. Aggregate Base Course
- C. Lime Treated Base Course
- D. Cement Treated Base Course

1.4 RELATED SECTIONS

- A. 31 22 00 Grading
- B. 31 23 00 Excavation and Fill
- A. 31 25 00 Erosion and Sedimentation Controls
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. For each type of the following manufactured products:
 - 1. Geotextiles
- B. Material Test Reports: For each base course material proposed as follows:
 - 1. Source of base course material.
 - 2. Classification according to ASTM D-2487.
 - 3. Laboratory Compaction curve according to ASTM D-698.

1.7 INFORMATIONAL SUBMITTALS

1.8 DELIVERY, STORAGE, AND HANDLING

A. See Execution.

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference

benchmark elevation.

1.11 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.12 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDTIONS

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with Section 703 Bases and Miscellaneous Aggregates of the Oklahoma Department of Transportation's 2019 Specifications.

2.2 AGGREGATE BASE FOR VEHICULAR PAVEMENTS

- A. General Requirements
 - 1. Provide aggregate base course material consisting of a mixture of coarse and fine graded aggregate that is free of vegetation and other deleterious materials.
 - 2. Coarse aggregate is the material retained on a No. 10 sieve. Provide coarse aggregate consisting of the following durable particles or fragments:
 - a. Gravel, Stone, Disintegrated granite, crushed concrete, or

- b. Provide fine aggregate made of sand, stone dust, or other inert, finely divided mineral.
- 3. Ensure at least 40% of the completed Type A or Type B mixture retained on the No. 4 sieve contains uniformly graded, mechanically crushed particles with at least one fractured face.
- 4. Ensure 100 percent of the completed Type C or Type D mixture retained on the No. 4 sieve contains uniformly graded, mechanically crushed particles with at least two fractured faces. Ensure the completed Type C mixture contains no more than 15 percent natural sand.
- B. Physical Properties
 - Ensure the coarse aggregate retained on the 3/8 in sieve of the completed mixture has no more than 50 percent wear in accordance with the Los Angeles Abrasion Test in accordance with AASHTO T 96. Ensure the aggregate has an Aggregate Durability Index of at least 40 in accordance with AASHTO T 210.
- C. Gradation and Other Requirements
 - 1. Sample the uniform mixture from the project site before compacting. Ensure samples are in accordance with the following Table for Gradation, Plasticity Index, and Liquid Limit for the provided aggregate base types.

Aggregate Base Gradation					
	Percent Passing per Type				
Sieve Size	Туре А	Туре В	Туре С	Type D	
3 in		100			
2 in			100		
1-1/2 in	100	40 -100	90 – 100	100	
1 in			80 – 100	95 – 100	
3/4 in	40 – 100	30 – 75			
1/2 in			60 - 80	25 – 60	
3/8 in	30 - 75	25 -60			
No. 4	25 - 60	20 - 50	40 - 60	0 - 10	
No. 8				0 – 5	
No. 10	20 – 43	15 – 35	25 – 45		
No. 40	8 – 26	7 – 22	15 – 30		
No. 200 ^a	40 – 12.0	3.0 – 10.0	0 – 5.0	0 – 2.0	
Other Requirements					
Plasticity	≤ 6	≤ 6	≤ 6		
Index	20	-	-		
Liquid Limit	≤ 25	≤ 25	≤ 25		
^a Ensure the material passing the No. 200 sieve comprises no greater than					
two-thirds of the quantity of material passing the No. 40 sieve.					
^b When separate aggregates are blended to produce an aggregate mixture, no					
individual aggregate shall have a plasticity index higher than 8.					

2.3 SAND BASE FOR SIDEWALKS

- A. General Requirements
 - 1. Sand base for sidewalks shall consist of sand, stone, rock, screenings, or select sandy soil free of organic material. Ensure there are no frozen lumps or moisture that may prevent the required compaction.
- B. Gradation Requirements

Sand Base Material Gradation		
Sieve Size	Percent Passing	
3/8 in	100	
No. 200	0 - 10	

PART 3 - EXECUTION

3.1 PLACEMENT REQUIREMENTS

A. The placement of BASE COURSES shall comply with 31 23 00 Excavation and Fill.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.3 STORAGE OF MATERIALS

- A. Stockpile base course materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile base course materials away from edge of excavations. Do not store within drip line of remaining trees.

3.4 SUBGRADE PREPARATION AND INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. After proof-rolling, scarify exposed subgrade to a minimum depth of 8 inches and compact to a least 95 percent of its maximum dry density as determined by the ASTM D-698 at a moisture content of optimum or above.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

3.5 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to between -1 and +3 percent of optimum moisture content.
- B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture by -1 and +3 percent is too wet to compact to specified dry unit weight.

3.6 COMPACTION OF SUBGRAGE

- A. Compact subgrade to not less than the following percentages of maximum dry unit weight according to ASTM D-698:
 - 1. Under pavements, scarify and recompact top 8 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 8 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3.7 SUBGRADE TREATMENT

A. The top 8 inches of subgrade shall be treated with hydrated lime. An estimated 5 to 7 percent hydrated lime is needed to adequately modify the on-site soils. The actual percentage of additive shall be determined at the time of construction by the geotechnical engineer. The lime shall be thoroughly blended into the subgrade and allowed to cure for 48 to 72 hours before being remixed and compacted. Before compaction, the treated soil zone shall be adjusted to within 2 percent of the material's optimum moisture as determined by the standard Proctor test method ASTM D-698. After conditioning the soil to the required moisture content, the treated subgrade shall be compacted to a least 98 percent of the material's maximum dry density.

3.8 BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

- 2. Place base course material over subbase course under hot-mix asphalt pavement.
- 3. Shape subbase course and base course to required crown elevations and cross-slope grades.
- 4. Place base course 6 inches or less in compacted thickness in a single layer.
- 5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
- 6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D-698.
- C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D-698.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus base course material and waste materials and legally dispose of them off Owner's property.

3.10 FIELD QUALITY CONTROL

- A. CONSTRUCTION MANAGER shall engage a qualified soil testing laboratory. CONSTRUCTION MANAGER shall coordinate and order all testing in conjunction with base course placement. The results of the tests shall be forwarded to ARCHITECT. The soils laboratory shall determine the suitability of existing site material prior to placement of base courses.
- B. The soils testing laboratory shall:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements and determine that fill material.
 - 2. Determine that maximum lift thickness comply with requirements.
 - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer.
- D. Testing agency shall test compaction of soils in place and base courses as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 sq. ft. or less of paved area, but in no case fewer than three tests.
- E. When testing agency reports that subgrades or base courses have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace materials to depth required; re-compact and retest until specified compaction is obtained.

END OF SECTION

SECTION 32 1200 FLEXIBLE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for FLEXIBLE PAVING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for FLEXIBLE PAVING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Preparatory Coats
- B. Asphalt Paving
 - 1. Plant-Mix Asphalt Paving
- C. Asphalt Paving Wearing Course
- D. Flexible Paving Surface Treatments
- E. Seal Coats

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 32 11 00 Base Courses
- A. 32 17 00 Paving Specialties
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 3. Job-Mix Designs: For each job mix proposed for the Work.

1.7 INFORMATIONAL SUBMITTSALS

- A. Material Certificates: For each paving material.
- B. Material Test Reports: For each paving material, by a qualified testing agency.
- C. Field quality-control reports.

1.8 DELIVERY, STORAGE, AND HANDLING

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.11 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.12 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. A Work Zone Permit must be obtained from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.

- 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.15 ENVIRONMENTAL LIMITATIONS

- A. Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F.
 - 3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.16 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with Section 708 Plant Mix Bituminous Bases and Surfaces of the Oklahoma Department of Transportation's 2019 Specifications.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The placement of FLEXIBLE PAVING shall comply with Section 411 Hot Mix Asphalt / Warm Mix Asphalt of the Oklahoma Department of Transportation's 2019 Specifications.

3.2 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
- D. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons.
- E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing laboratory for the testing requirements and inspections within Flexible Paving. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with Flexible Paving operations. The results of the tests shall be forwarded to ARCHITECT.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.
- D. Thickness: In-place compacted thickness of hot-mix asphalt courses shall be determined according to ASTM D 3549.
- E. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- F. In-Place Density: Testing agency will take samples of un-compacted paving mixtures and compacted pavement according to ASTM D 979.
- G. Reference maximum theoretical density will be determined by averaging results from four samples of hotmix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
- H. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - 1. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
 - 2. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- I. Replace and compact hot-mix asphalt where core tests were taken.
- J. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.5 WASTE HANDLING

A. Remove waste materials and legally dispose of them off Owner's property.

END OF SECTION

SECTION 32 13 00 RIGID PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for RIGID PAVING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for RIGID PAVING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

A. Concrete Paving

1.4 RELATED SECTIONS

- A. 31 22 00 Grading
- B. 31 23 00 Excavation and Fill
- C. 32 11 00 Base Courses
- D. 32 13 73 Concrete Paving Joint Sealants
- E. 32 16 13 Curbs and Gutters
- A. 32 17 00 Paving Specialties
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah
- B. Cementitious Materials Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and slag cement.

1.6 ACTION SUBMITTALS

- A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Paving Plan:
 - 1. Provide a paving plan that shows the proposed concrete placed each day.
 - 2. Provide a joint layout plan that shows isolation joints, longitudinal construction joints, longitudinal contraction joints, transverse contraction joints, and planned transverse construction joints.

1.7 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Applied finish materials.
 - 4. Bonding agent or epoxy adhesive.
 - 5. Joint fillers.
- B. Material Test Reports: For each of the following:
 - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.8 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual Section 3, "Plant Certification Checklist").
- B. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- C. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- D. Preconstruction Conference
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
 - 2. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 3. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. CONSTRUCTION MANAGER's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete paving subcontractor.
- E. Regulatory Requirements
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.9 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.

D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. A Work Zone Permit must be obtained from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

 CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION

MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

- A. All materials and products shall comply with the following Section or Subsection of the Oklahoma Department of Transportation's 2019 Specifications.
 - 1. 701 Portland Cement Concrete.
 - 2. 702.01 Fly Ash.
 - 3. 702.02 Ground Granulated Blast Furnace Slag
 - 4. 702.03 Steel Reinforcement, Dowel Bars & Tie Bars.

2.2 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Class AA
 - a. Minimum 28 Day Compressive Strength: 4,000-psi
 - b. Minimum Cement Content: 564 lb/yd3
 - c. Air Content: 6.5% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.44 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 2. Class A
 - a. Minimum 28 Day Compressive Strength: 3,000-psi
 - b. Minimum Cement Content: 517 lb/yd3
 - c. Air Content: 6% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 3. Class A (vehicular pavement)
 - a. Minimum 28 Day Compressive Strength: 3,500-psi
 - b. Minimum Cement Content: 517 lb/yd3
 - c. Air Content: 6.5% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 4. Class AP
 - a. Minimum 28 Day Compressive Strength: 3,000-psi
 - b. Minimum Cement Content: 470 lb/yd3
 - c. Air Content: 6% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 5. Class C
 - a. Minimum 28 Day Compressive Strength: 2,400-psi
 - b. Minimum Cement Content: 395 lb/yd3
 - c. Air Content: 6% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.62 lb/lb
 - e. Slump: 3 inches, plus or minus 1 inch.

- C. Cementitious Materials: Use fly ash, ground granulated blast-furnace slag, as needed to reduce the total amount of portland cement which would otherwise be used. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - a. November through March: Fly ash meeting the requirements of this section may be substituted for up to 15% of the required cement. Ground granulated blast furnace slag meeting the requirements of AASHTO M 302 Grade 100 or Grade 120 may be substituted for up to 25% of the required cement. A combination of up to 25% ground granulated blast furnace slag and up to 15% fly ash may be substituted for up to 40% of the required cement.
 - b. April through October: A combination of up to 25% ground granulated blast furnace slag and up to 20% fly ash may be substituted for up to 45% of the required cement.
 - c. Substitution shall be by weight: 1.0 pound for each 1.0 pound of cement. The concrete mix design shall be appropriately adjusted. These substitutions will not be allowed for high early strength concrete, Class P concrete or concrete containing Type IP, Type I (PM), or Type I (SM) cement. If the specified minimum cement content is satisfied, additional fly ash or ground granulated blast furnace slag, or silica fume complying with ASTM C 1240, may be added to the mix when approved as part of the mix design.
- D. Water Cement Ratio. Using the weight in pounds of each material, calculate the water-cement ratio (W/C) by the following equation: W/C = Water/ (Cement + Fly Ash + Blast Furnace Slag + Silica Fume) The water actually used is determined by the water measured into the batch plus the free water on wet aggregate minus the water absorbed by dry aggregate plus water in any admixture solutions and shall not exceed the limit specified.
- E. Slump. The slump shall be as shown, or as specified in the contract documents, or as approved by the ARCHITECT, and the consistency required shall be that which will provide satisfactory workability for the type work being done. Slump tests will be made during the progress of the work as a measure of uniformity of the consistency of the concrete. If using a high-range water reducing admixture, limit the slump to a maximum of 9 inches.
- F. Compressive Strength. Compressive strength is based on the average of three test cylinders. When the class of concrete is not expressly indicated on the Plans, the following requirements shall govern:
 - 1. Class AA. Use Class AA concrete in superstructure items, such as bridge floors, approach slabs, reinforced concrete piles, drilled shaft foundations, parapet walls, concrete rail and handrails.
 - 2. Class A. Use Class A concrete for pavements and in substructures items, such as pier caps, columns, abutments, retaining walls, box culverts, and all reinforced concrete not requiring Class AA concrete.
 - Class AP. Use Class AP concrete in shoulders, merge areas and gore areas for PCC pavements, unless otherwise directed by plan notes.
 - 4. Class C. Use Class C concrete for soil erosion control structures.

2.3 CONCRETE MIXING

- A. Design and produce concrete mixtures that conform to the Class of concrete specified in this section and base the mix design on absolute volume. Proportion the coarse and fine aggregate in accordance with ACI 211.1. Use the least amount of sand and mixing water which will ensure concrete of the required workability for placement conditions. Meet the minimum strength within 72 hours of placement for high early strength concrete. Submit the mix design at least 14 days before production to the ARCHITECT. Include at least the following information with each mix design:
 - 1. Project identification
 - 2. Name and address of contractor and producer
 - 3. Mix design designation
 - 4. Intended use of the mix design
 - 5. Expected travel time from batch to placement
 - 6. If the concrete will be pumped or not
 - 7. Aggregate sources, gradation, moisture content, saturated surface dry batch mass, LA abrasion (AASHTO T 96), and freeze thaw durability (AASHTO T 103).
 - 8. Fineness modulus of fine aggregate.
 - 9. Cement type and source
 - 10. Type of cement replacement, if used, and source
 - 11. Type of admixtures and sources
 - 12. Material proportions
 - 13. Air content
 - 14. Slump
 - 15. Water / cement ratio

- 16. Strengths at 7 and 28 days
- 17. Strengths at 72 hours for high early strength concrete.
- B. Do not place any concrete until the mix design is approved. Submit new mix designs if the mix design is rejected by the ARCHITECT, the source of any material changes, or the mix design produces unacceptable workability or production test results.

2.4 CONCRETE MATERIALS

- A. Portland cement: Shall conform to the requirements of AASHTO M 85 or AASHTO M 240. Type I, Type I (SM), Type I (PM), and Type IP shall be used in concrete for general concrete construction. Type II shall be used in concrete exposed to moderate sulphate action or moderate heat of hydration. Type III may be used when high early strength concrete is required. Unless otherwise approved by the ARCHITECT, the product of only one mill of any one brand and type of portland cement shall be used on any structure or adjacent structures. Provide suitable means of storing and protecting the cement against dampness.
 - Cement which for any reason has become partially set or which contains lumps of caked cement will be rejected. Cement salvaged from discarded or used bags shall not be used. All methods of sampling and testing shall be in accordance with the requirements of AASHTO M 85 or AASHTO M 240.
- B. Water
 - 1. Provide water in accordance with AASHTO M 157, except as modified by the following:
 - a. Water quality testing is not required if obtained from an approved ODEQ public water source.
 - b. For other water sources, submit water quality test from the concrete producer showing compliance with AASHTO M 157 and the Chemical Limits for Mix Water listed below before use.
 - c. A blend of concrete wash water and other water sources may be used if the concrete producer submits certification that the water meets the requirements of AASHTO M 157 and Chemical Limits for Mix Water and Acceptance Criteria for Questionable Water Supplies listed below.
 - d. Test the blended water weekly for 4 weeks, or provide previous test reports. Test blended water monthly for compliance.
 - e. Chemical Limits for Mix Water
 - 1) Chloride (CI) shall less than 1,000 ppm (ASTM D 512)
 - 2) Sulfate shall be less than 1,000 ppm (ASTM D 516)
 - 3) Alkalis shall be less than 600 ppm (ASTM D 4191 and ASTM D 4192)
 - 4) Total solids shall be less than 50,000 ppm (AASHTO T 26)
 - 2. Acceptance Criteria for Questionable Water Supplies
 - a. Compressive strength shall be a minimum 90% of the control at 7 days (AASHTO T 106)
 - b. The time of set shall not deviate from the control less than 1 or more than 1.5 (AASHTO T 131)
- C. Fine Aggregates
 - This specification applies to the quality and size of fine aggregates for Portland cement concrete pavements or bases, and incidental structures. Mortar sand shall meet the requirements of AASHTO M 45.
 - 2. General Requirements.
 - a. Provide fine aggregates that consists of a single source natural sand in accordance with AASHTO M 6, Class A, except as modified by the Gradation paragraph below.
 - b. Alternatively, provide a fine aggregate that consists of a combination of natural sands or a combination of natural na manufactured sands in accordance with AASHTO M 6, Class A, except as modified by the following:
 - 1) Mix the two materials under controlled conditions and stockpile as a finished aggregate. Alternatively, the two materials may be combined from separate stockpiles during batching operations at a hydraulic cement concrete plant.
 - 2) Ensure the combined fine aggregate meets the gradation requirements below.
 - If a manufactured sand is used in combination with natural sand, ensure the fine aggregate blend has an acid insoluble reside of at least 60 percent by weight when tested in accordance with OHD L-25.
 - 4) Obtain crushed fine aggregate (manufactured sand) from a coarse aggregate source on ODOT Material Division's "Approved Products List" for use in hydraulic cement concrete.

- 3. Deleterious Substances
 - a. The amount of deleterious substances shall not exceed the following limits: Clay lumps and friable particles 3%, Coal and Lignite 0.25%
- 4. Organic Impurities
 - a. All fine aggregate shall be free from injurious amounts of organic impurities. Aggregates subjected to the colorimetric test for organic impurities and producing a color darker than the standard shall be rejected unless they pass the mortar strength test as specified below. Should the aggregate show a darker color than that of samples originally approved for the work, its use shall be withheld until tests satisfactory to the ARCHITECT have been made to determine whether the increased color is indicative of an injurious amount of deleterious substances. A fine aggregate failing in the test may be used provided that, when tested for the effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with Section 10 of AASHTO T 71 is not less than 95 percent.
- 5. Gradation
 - a. Provide fine aggregate with a fineness modulus between 2.3 and 3.1, that is well graded from coarse to fine, and when tested in accordance with AASHTO T 27 and AASHTO T11 meets the following gradation requirements.
 - 1) Sieve size: 3/8-in, percent passing: 100%.
 - 2) Sieve size: No. 4, percent passing 95-100%.
 - 3) Sieve size: No. 8, percent passing 80-100%.
 - 4) Sieve size: No. 16, percent passing 50-85%.
 - 5) Sieve size: No. 30, percent passing 25-60%.
 - 6) Sieve size: No. 50, percent passing 5-30%.
 - 7) Sieve size: No. 100, percent passing 0-10%.
 - b. The gradation requirements above represent the extreme limits of suitability. Ensure the gradation from one source does not have large changes in percentages of gradation.
 - c. Use the average fineness modulus to determine the uniformity of the fine aggregate. The average fineness modulus is the average of the last 10 tests maintained by the ODOT Division Resident Engineer. Fine aggregates will be rejected from any one source having a variation in fineness modulus greater than 0.20 either way from the average. The fineness modulus of an aggregate is determined by adding the total percentages of material in the sample that are coarser than each of the following sieves (cumulative percentages retained), and dividing the sum by 100; No. 100, No. 50, No. 30, No. 16, No. 8, No. 4, 3/8 inch.
- D. Coarse Aggregate
 - 1. Provide coarse aggregate in accordance with AASHTO M 80, Class A, except as modified by the following:
 - Ensure coarse aggregate produces Class A concrete with a durability factor of at least 50. Determine the durability factor after 350 cycles of alternate freezing and thawing in accordance with AASHTO T 161, Procedure A.
 - b. The Los Angeles Abrasion percent wear shall be limited to a maximum of 40 percent after 500 revolutions when tested in accordance with AASHTO T 96.
 - c. The sodium sulfate soundness requirement shall not apply.
 - d. Ensure at least 70 percent of the coarse aggregate retained on the No. 4 sieve is crushed stone or mechanically crushed gravel with at least two fractured faces.
 - e. Limit the quantity of flat or elongated pieces to 15 percent or less, at a ratio of 1:5, when tested in accordance with ASTM D 4791.
 - 2. Gradation
 - a. No. 357
 - 1) Sieve size 2-1/2-in., percent passing 100%.
 - 2) Sieve size 2-in., percent passing 95-100%.
 - 3) Sieve size 1-in., percent passing 35-70%.
 - 4) Sieve size 1/2-in., percent passing 10-30%.
 - 5) Sieve size No. 4, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-1.5%.

- b. No. 57
 - 1) Sieve size 1-1/2-in., percent passing 100%.
 - 2) Sieve size 1-in., percent passing 95-100%.
 - 3) Sieve size 1/2-in., percent passing 25-60%.
 - 4) Sieve size No. 4, percent passing 0-10%.
 - 5) Sieve size No. 8, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- c. No. 67
 - 1) Sieve size 1-in., percent passing 100%.
 - 2) Sieve size 3/4-in., percent passing 90-100%.
 - 3) Sieve size 3/8-in., percent passing 20-55%.
 - 4) Sieve size No. 4, percent passing 0-10%.
 - 5) Sieve size No. 8, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- d. No. 7
 - 1) Sieve size 3/4-in., percent passing 100%.
 - 2) Sieve size 1/2-in., percent passing 90-100%.
 - 3) Sieve size 3/8-in., percent passing 40-70%.
 - 4) Sieve size No. 4, percent passing 0-15%.
 - 5) Sieve size No. 8, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- e. No. 8
 - 1) Sieve size 1/2-in., percent passing 100%.
 - 2) Sieve size 3/8-in., percent passing 85-100%.
 - 3) Sieve size No. 4, percent passing 10-30%.
 - 4) Sieve size No. 8, percent passing 0-10%.
 - 5) Sieve size No. 16, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- 3. Provide the specified sizes of coarse aggregate for the following types of concrete:
 - a. No. 57 for Class A and Class AP concrete;
 - b. Nol. 357 for massive Class A concrete;
 - c. No. 57, No. 67, or No. 357 for Class C concrete;
 - d. No. 57 or No. 67 for Class AA concrete.

2.5 ADMIXTURES

- A. Provide air entraining admixtures in accordance with AASHTO M 154 and ASTM C 260.
- B. Provide chemical admixtures in accordance with AASHTO M 194 for the type of admixture supplied. Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
 - 1. Color: As indicated on Drawings.

2.6 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
- B. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or

adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.7 STEEL REINFORCEMENT

- A. Bar Steel Reinforcement Billet Steel
 - 1. Provide plain or deformed billet steel bars for concrete reinforcement and dowels in accordance with AASHTO M 31, Grade 60, except provide deformed billet steel bars for bent tie bars used in concrete paving in accordance with AASHTO M 31, Grade 40.
- B. Welded Steel Wire Fabric
 - 1. Provide cold drawn steel wire fabric for concrete reinforcement in accordance with AASHTO M 55 or AASHTO M 221.
 - 2. Provide reinforcing fabric in flat sheets or rolls. Straighten bent or distorted materials before use. Ensure the fabric is free of excessive rust, scale, or coating that may impair the concrete bond.
- C. Cold Drawn Steel Wire
 - 1. Provide cold drawn steel wire, in accordance with AASHTO M 32, for spiral ties and other reinforcing shown on the Plans as "W" (Wire) sizes.
- D. Epoxy Coated Reinforcing Bars
 - 1. Provide epoxy coated (an electro-statically applied organic coating) reinforcing bars and epoxy coating material in accordance with AASHTO M 285, except the following:
 - a. Provide reinforcing steel bars in accordance with Bar Steel Reinforcement Billet Steel.
 - Provide finished epoxy coating in a color and tone that easily gives visual indications of damage or corrosion staining.
- E. Tie Bars
 - 1. ASTM A 615, Grade 60, deformed.
- F. Hook Bolts
 - 1. ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G. Bar Supports
 - Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.8 FIBER REINFORCEMENT

- A. Polypropylene fibers shall be 100 percent polypropylene, collated, fibrillated fibers manufactured to graduated lengths of equal proportions for secondary reinforcement. Polypropylene fibers shall be in accordance with ASTM C 1116 for Type III.
- B. Steel fibers shall be in accordance with ASTM A 820, for Type II, cut-sheet steel. Provide steel fibers with and aspect ratio of 30:60 and from 1-1/2 to 2 inches long.

2.9 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.10 RELATED MATERIALS

- A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 DETECTABLE WARNING MATERIALS

- A. Detectable Warning Stamp: Semi-rigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
 - 1. Size of Stamp: One piece matching detectable warning area shown on Drawings.
- B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The placement of RIGID PAVING shall comply with Section 414 Portland Cement Concrete Pavement of the Oklahoma Department of Transportation's 2019 Specifications.

3.2 EXAMINATION AND PREPARATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
- D. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons.
- E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Joint Spacing Requirements
 - 1. Avoid odd-shaped slabs.
 - 2. In parking lots, longitudinal joints shall be parallel to the direction of vehicle travel, and can be made to delineate drive lanes and parking stalls. Transverse joints shall divide the paving lanes into panels.
 - 3. Longitudinal joint spacing shall not exceed 12.5 feet.
 - 4. The maximum transverse joint spacing for drives shall be 24 to 30 times the slab thickness or 15 ft, whichever is less. Divide the length between the concrete being placed into equally spaced joints.
 - 5. Slabs shall be as square as possible. The length of a panel shall not be more than 25% greater than its width.
 - 6. All transverse contraction joints shall be continuous through the curb and have a depth equal to ¼ to 1/3 the pavement thickness.
 - In isolation joints, the filler shall be full depth and extend through the curb. Isolation joints shall be used to isolate the pavement from light standard foundations, storm sewer inlets, manholes, and buildings.
 - 8. If there is no curb, longitudinal joints shall be tied with deformed tie bars.
 - 9. Offsets at radius points shall be at least 1.5 ft wide. Joint intersection angles less than 60 degrees shall be avoided.
 - 10. Minor adjustments in joint location made by shifting or skewing to meet inlets and manholes is allowable.
 - 11. Place joints to meet drainage structures, if possible.
- C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Provide tie bars at sides of paving strips where indicated.
 - 3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

- 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
- Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
- L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- M. Hot-Weather Placement: Comply with ACI 305.1 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is CONSTRUCTION MANAGER's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand

floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

- 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
- 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
- 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8-inch-deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - b. Water.
 - c. Continuous water-fog spray.
 - d. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
- F. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

- A. Comply with tolerances in Oklahoma Department of Transportation's 2019 Specifications and as follows:
 - 1. Elevation: 1/2 inch.
 - 2. Thickness: Plus 3/8-inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot unleveled straightedge not to exceed 1/4 inch.
 - 4. Alignment of tie-bar end relative to line perpendicular to paving edge: ½ inch per 12 inches of tie bar.
 - 5. Lateral Alignment and Spacing of Dowels: 1 inch.
 - 6. Vertical alignment of dowels: ¹/₄ inch.
 - 7. Joint Spacing: 3 inches.
 - 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 9. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

- A. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.11 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing laboratory for the testing requirements within Rigid Paving. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with Rigid Paving operations. The results of the tests shall be forwarded to ARCHITECT.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.

- D. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency:
 - a. Obtain at least one composite sample for each 100 cu.yd. or fraction thereof of each concrete mixture placed each day.
 - b. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 - 5. Concrete Density: ASTMC 138
 - 6. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three 6-inch diameter by 12-inch long standard cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days. Test specimens shall be 6-in diameter and 12-inch long cylinders. If testing agency uses 4-inch diameter by 8-in long cylinders, three specimens are required at 28-days.
 - a. A compressive-strength test shall be the average compressive strength from two 6-inch diameter by 12-inch long specimens obtained from same composite sample and tested at 28 days.
 - b. If 4-inch diameter by 8-in long cylinders are used, the compressive-strength test shall be the average compressive strength from three specimens obtained from the same composite sample and tested at 28 days.
- E. Strength of each concrete mixture will be satisfactory if average of the compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- F. Test results shall be reported in writing to ARCHITECT, concrete manufacturer, and CONSTRUCTION MANAGER within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by ARCHITECT but will not be used as sole basis for approval or rejection of concrete.
- H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by ARCHITECT.
- I. Concrete paving will be considered defective if it does not pass tests and inspections.
- J. Additional testing and inspecting, at CONSTRUCTION MANAGER's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- K. Prepare test and inspection reports.

3.12 ARCHITECT'S ACCEPTANCE OF PAVEMENT

- A. Pavement slabs with unsound concrete, uncontrolled cracking, malfunctioning sawed joints, spalling, honeycombing, surface irregularities, insufficient thickness, or other deficiencies associated will poor quality pavements may be rejected by ARCHITECT.
- B. Pavement rejected by ARCHITECT shall be removed and replaced at no additional cost to Owner.
- C. When replacing rejected slabs, remove a width of at least one lane and a length of at least 15 ft. If the removal is within 15 ft of any transverse joint, remove the slab to the joint.
- D. If a deficient unit does not warrant removal, as directed by ARCHITECT, the Owner will not pay for the deficient unit.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by ARCHITECT.

- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 1373 CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for CONCRETE PAVING JOINT SEALANTS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for CONCRETE PAVING JOINT SEALANTS shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Cold-applied joint sealants
- B. Hot-applied joint sealants

1.4 RELATED SECTIONS

- A. 32 12 00 Flexible Paving
- A. 32 13 00 Rigid Paving
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

A. Product Data: Joint-Sealants.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of joint sealant and accessory, from manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

1.8 DELIVERY, STORAGE, AND HANDLING 1.9 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PROJECT CONDTIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with Subsection 701.08 "Joint Fillers and Sealer" of the Oklahoma

Department of Transportation's 2019 Specifications.

2.2 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.
- B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.6 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and

replace them with dry materials.

- D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place joint sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT JOINT SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within cement concrete pavement.
 - 1. Joint Location:
 - a. Expansion and isolation joints in cast-in-place concrete pavement.
 - b. Contraction joints in cast-in-place concrete slabs.
 - c. Other joints as indicated.
 - 2. Silicone Joint Sealant for Concrete: Single component, non-sag; Single component, self-leveling.
 - 3. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade.
 - 4. Hot-Applied Joint Sealant for Concrete: Single component.
- B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
 - 1. Joint Location:
 - a. Joints between concrete and asphalt pavement.
 - b. Joints between concrete curbs and asphalt pavement.
 - c. Other joints as indicated.
 - 2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.

END OF SECTION

SECTION 32 16 13 CURBS AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for CURBS AND GUTTERS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for CURBS AND GUTTERS shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

A. Cast-In-Place Concrete Curb and Gutters

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 32 12 00 Flexible Paving
- C. 32 13 00 Rigid Paving
- A. 32 13 73 Concrete Paving Joint Sealants
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Paving Plan:
 - 1. Provide a paving plan that shows the proposed concrete placed each day.
 - 2. Provide a joint layout plan that shows isolation joints, longitudinal construction joints, longitudinal contraction joints, transverse contraction joints, and planned transverse construction joints.

1.7 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Applied finish materials.
 - 4. Bonding agent or epoxy adhesive.
 - 5. Joint fillers.
- B. Material Test Reports: For each of the following:
 - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.8 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production

Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

- B. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- C. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- D. Preconstruction Conference
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
 - 2. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 3. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Subcontractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete paving subcontractor.
- E. Regulatory Requirements
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.9 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.11 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. A Work Zone Permit must be obtained from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

- A. All materials and products shall comply with the following Section or Subsection of the Oklahoma Department of Transportation's 2019 Specifications.
 - 1. 701 Portland Cement Concrete.
 - 2. 702.01 Fly Ash.
 - 3. 702.02 Ground Granulated Blast Furnace Slag
 - 4. 702.03 Steel Reinforcement, Dowel Bars & Tie Bars.

2.2 CAST-IN-PLACE CONCRETE CURB AND GUTTERS

A. Class A PC Concrete (3,500 psi at 28 days, air entrained) shall be used for concrete curbs and gutters.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The placement of CURBS AND GUTTERS shall comply with Section 414 "Portland Cement Concrete Pavement" of the Oklahoma Department of Transportation's 2019 Specifications.

3.2 EXAMINATION AND PREPARATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
- D. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons.
- E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 JOINTS

- A. Expansion Joints Set 1/2-inch expansion joints at maximum 100 ft spacing using 1/2 inch by 4-inch premolded expansion joint material.
- B. Contraction Joints Set contraction joints at 15 ft to 20 ft spacing.
- C. Fill all joints to surface with silicone sealant.

3.4 TOLERANCES

- A. Comply with tolerances in Oklahoma Department of Transportation's 2019 Specifications and as follows:
 - 1. Elevation: 3/4 inch.
 - 2. Thickness: Plus 3/8-inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot unleveled straightedge not to exceed 1/2 inch.
 - 4. Joint Spacing: 3 inches.
 - 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 6. Joint Width: Plus 1/8 inch, no minus.

3.5 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing laboratory for the testing requirements within Rigid Paving. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with Rigid Paving operations. The results of the tests shall be forwarded to ARCHITECT.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.
- D. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu.yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or

from each batch if fewer than five are used.

- 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
- 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
- 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
- 6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- E. Strength of each concrete mixture will be satisfactory if average of any three-consecutive compressivestrength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- F. Test results shall be reported in writing to Architect, concrete manufacturer, and CONSTRUCTION MANAGER within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- I. Concrete paving will be considered defective if it does not pass tests and inspections.
- J. Additional testing and inspecting, at CONSTRUCTION MANAGER's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- K. Prepare test and inspection reports.

3.6 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 1700 PAVING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for PAVING SPECIALTIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for PAVING SPECIALTIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Parking Bumpers
- B. Pavement Markings
- C. Preformed Traffic-Calming Devices

1.4 RELATED SECTIONS

- A. 32 12 00 Flexible Paving
- B. 32 13 00 Rigid Paving
- C. 32 13 73 Concrete Paving Joint Sealants
- A. 32 16 13 Concrete Curbs and Gutters
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For Pavement Markings.
 - 1. Indicate Pavement Markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.7 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.8 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.

C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.9 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any Work Zone Permits required from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. ENVIRONMENTAL CONDTIONS
 - 1. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 3000-psi (28-day) minimum compressive strength, 5-1/2 inches high by 8 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or drilled vertical holes through wheel stop for anchoring to substrate.
- B. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
- C. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, 10-inch minimum length or hardware as standard with wheel-stop manufacturer.

2.2 PAVEMENT MARKINGS

- A. Performance Requirements
 - 1. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".
- B. Pavement Marking Paint
 - 1. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - a. Colors: White, Yellow, Blue, and Red.

2.3 PREFORMED TRAFFIC-CALMING DEVICES

- A. Speed Bumps: Solid, integrally colored, 96 percent postconsumer or commingled postconsumer and preconsumer recycled rubber or plastic; UV stabilized. Provide factory-formed or -drilled vertical holes for anchoring to substrate.
 - 1. Size: 2 inches high by 10 inches wide by 72 inches long; with tapered, square, or rounded ends.
 - 2. Size: Modular assembly 3 inches high by 12 feet in overall width, with overall length as dimensioned on Drawings; and with tapered, square, or rounded ends.
 - 3. Color: Black.
 - 4. Embedded Markings: Molded-in, yellow reflective markings, permanently inset in exposed surface.

- 5. Mounting Hardware: Galvanized-steel lag screw, shield, and washers; 1/2-inch diameter, 8-inch minimum length or hardware as standard with device manufacturer.
- 6. Adhesive: As recommended by device manufacturer for adhesion to pavement.

PART 3 - EXECUTION

3.1 PARKING BUMPERS

- A. EXAMINATION
 - 1. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. INSTALLATION
 - 1. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
 - 2. Install wheel stops in bed of adhesive before anchoring.
 - 3. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

3.2 PAVEMENT MARKINGS

A. EXAMINATION

- 1. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- 2. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

B. APPLICATION

- 1. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- 2. Allow paving to age for a minimum of 30 days before starting pavement marking.
- 3. Sweep and clean surface to eliminate loose material and dust.
- 4. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - a. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
- C. FIRE LANES
 - Where fire lines are indicated, a 6-in wide red stripe with 4-inch high white letters with a 3/4-inch stroke stating, "FIRE LANE NO PARKING" shall be provided showing the boundary of the fire lane. The words "FIRE LANE NO PARKING" must be grouped together as a phase. The phrase shall be painted a maximum distance of every 40 feet C-C along the length of the fire lane. When a curb is along the fire lane, the face and top of the curb shall be painted with the phrase painted on the face of the curb.
- D. PROTECTING AND CLEANING
 - 1. Protect pavement markings from damage and wear during remainder of construction period.
 - 2. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.3 PREFORMED TRAFFIC-CALMING DEVICES

- A. EXAMINATION
 - 1. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. INSTALLATION
 - 1. General: Install manufactured traffic-calming devices according to manufacturer's written instructions

unless otherwise indicated.

- 2.
- Install devices in bed of adhesive before anchoring. Securely anchor devices to pavement with hardware spaced as recommended in writing by manufacturer for heavy traffic. Recess head of hardware beneath top surface of device. 3.

END OF SECTION

SECTION 32 3223 SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work shall consist of furnishing and construction of a Segmental Retaining Wall System or equal in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans.
- B. Work includes preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the lines and grades shown on the construction drawings.
- C. Work includes furnishing and installing geogrid soil reinforcement of the type, size, location, and lengths designated on the construction drawings.

1.02 RELATED SECTIONS

A. Section 31 23 00 – Excavation and Fill

1.03 REFERENCE DOCUMENTS

A. American Society for Testing and Materials (ASTM)

1.	ASTM C140	Sampling and Testing Concrete Masonry Units			
2.	ASTM C1372	Specification for Dry-Cast Segmental Retaining Wall Units			
3.	ASTM D422	Particle-Size Analysis of Soils			
4.	ASTM D698	Laboratory Compaction Characteristics of Soil -Standard Effort			
5.	ASTM D1557	Laboratory Compaction Characteristics of Soil -Modified Effort			
6.	ASTM D3034	Polyvinyl Chloride Pipe (PVC)			
7.	ASTM D4318	Liquid Limit, Plastic Limit and Plasticity Index of Soils			
8.	ASTM D4475	Horizontal Shear Strength of Pultruded Reinforced Plastic Rods			
9.	ASTM D4476	Flexural Properties of Fiber Reinforced Pultruded Plastic Rods			
10.	ASTM D4595	Tensile Properties of Geotextiles - Wide Width Strip			
11.	ASTM D5262	Unconfined Tension Creep Behavior of Geosynthetics			
12.	ASTM D5818	Evaluate Installation Damage of Geosynthetics			
13.	ASTM D6637	Tensile Properties of Geogrids – Single or Multi-Rib			
14.	ASTM D6638	Connection Strength - Reinforcement/Segmental Units			
15.	ASTM D6706	Geosynthetic Pullout Resistance in Soil			
16.	ASTM D6916	Shear Strength Between Segmental Concrete Units			
American Association of State Highway and Transportation Officials (AASHTO)					

- 1. AASHTO M 252 Corrugated Polyethylene Drainage Pipe
- C. Geosynthetic Research Institute (GRI)
 - 1. GRI-GG4 Determination of Long Term Design Strength of Geogrids
 - 2. GRI-GG5 Determination of Geogrid (soil) Pullout
- D. National Concrete Masonry Association (NCMA)
 - 1. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW
 - 2. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW

1.04 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall check all materials upon delivery to assure that the proper type, grade, color, and certification has been received.
- B. Contractor shall protect all materials from damage due to jobsite conditions and in accordance with manufacturer's recommendations. Damaged materials shall not be incorporated into the work.

Β.

PART 2 - PRODUCTS

2.01 DEFINITIONS

- A. Modular Unit a concrete retaining wall element machine made from Portland cement, water, and aggregates.
- B. Structural Geogrid a structural element formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.
- C. Unit Drainage Fill drainage aggregate, which is placed within and immediately behind the modular concrete units.
- D. Reinforced Backfill compacted soil, which is placed within the reinforced soil volume as outlined on the plans.

2.02 MODULAR CONCRETE RETAINING WALL UNITS

- A. Modular concrete units shall conform to the following architectural requirements:
 - 1. Face color concrete gray, unless otherwise specified. The Owner may specify standard manufacturers' color.
 - 2. Face finish sculptured rock face in angular tri-planer configuration. Other face finishes will not be allowed without written approval of Owner.
 - 3. Bond configuration running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.
 - 4. Exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused lighting.
- B. Modular concrete materials shall conform to the requirements of ASTM C1372 Standard Specifications for Segmental Retaining Wall Units.
- C. Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with ASTM C140 Sampling and Testing Concrete Masonry Units:
 - 1. Compressive strength: \geq 3000 psi (21 MPa);
 - 2. Absorption: 8 % (6% in northern states) for standard weight aggregates;
 - 3. Dimensional tolerances: ± 1/8" (3 mm) from nominal unit dimensions not including rough split face, ±1/16" (1.5 mm) unit height top and bottom planes;
 - 4. Unit size: 8" (203 mm) (H) x 18" (457 mm)(W) x 18" (457 mm)(D) minimum;
 - 5. Unit weight: 100 lbs/unit (45 kg) minimum for standard weight aggregates.
- D. Modular concrete units shall conform to the following performance testing:
 - 1. Inter -unit shear strength in accordance with ASTM D6916 (NCMA SRWU-2): 1500 plf (21 kN/m) minimum at 2 psi (13 MPa) normal pressure;
 - 2. Geogrid/unit peak connection strength in accordance with ASTM D6638 (NCMA SRWU-1): 900 plf (13 kN/m) minimum at 2-psi (13 MPa) normal force.
- E. Modular concrete units shall conform to the following constructability requirements:
 - 1. Vertical setback: 1/8" (3 mm) ± per course (near vertical) or 1" (25 mm) + per course per the design;
 - 2. Alignment and grid positioning mechanism fiberglass pins, two per unit minimum;
 - 3. Maximum horizontal gap between erected units shall be $\leq 1/2$ inch (13 mm).

2.03 SHEAR CONNECTORS

- A. Shear connectors shall be 1/2-inch (12 mm) diameter thermoset isopthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units with the following requirements:
 - 1. Flexural Strength in accordance with ASTM D4476: 128,000 psi (882 MPa) minimum;
 - 2. Short Beam Shear in accordance with ASTM D4475: 6,400 psi (44 MPa) minimum.
- B. Shear connectors shall be capable of holding the geogrid in the proper design position during

grid pre-tensioning and backfilling.

2.04 BASE LEVELING PAD MATERIAL

A. Material shall consist of a compacted crushed stone base or non-reinforced concrete as shown on the construction drawings.

2.05 UNIT DRAINAGE FILL

A. Unit drainage fill shall consist of clean 1" (25 mm) minus crushed stone or crushed gravel meeting the following gradation tested in accordance with ASTM D-422:

Sieve Size	Percent Passing	
1 inch (25 mm)	100	
3/4-inch (19 mm)	75-100	
No. 4	0 - 10	
No. 50	0 - 5	

B. One cubic foot (0.028 m3), minimum, of drainage fill shall be used for each square foot (0.093 m2) of wall face. Drainage fill shall be placed within cores of, between, and behind units to meet this requirement.

2.06 REINFORCED BACKFILL

A. Reinforced backfill shall be free of debris and meet the following gradation tested in accordance with ASTM D-422:

Percent Passing	
100	
100-75	
0-60	
0-35	

Plasticity Index (PI) <15 and Liquid Limit <40 per ASTM D-4318.

- B. The maximum aggregate size shall be limited to 3/4 inch (19 mm) unless field tests have been performed to evaluate potential strength reductions to the geogrid design due to damage during construction.
- C. Material can be site-excavated soils where the above requirements can be met. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the backfill or in the reinforced soil mass.
- D. Contractor shall submit reinforced fill sample and laboratory test results to the Architect/Engineer for approval prior to the use of any proposed reinforced fill material.

2.07 GEOGRID SOIL REINFORCEMENT

- A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high-density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.
- B. Ta, Long Term Allowable Tensile Design Load, of the geogrid material shall be determined as follows:

Ta = Tult / (RFcr*RFd*RFid*FS) Ta shall be evaluated based on a 75-year design life.

1. Tult, Short Term Ultimate Tensile Strength shall be determined in accordance with ASTM D4595 or ASTM D6637.

Tult is based on the minimum average roll values (MARV).

2. RFcr, Reduction Factor for Long Term Tension Creep

RFcr shall be determined from 10,000-hour creep testing performed in accordance with ASTM D5262. Reduction value = 1.45 minimum.

3. RFd, Reduction Factor for Durability

RFd shall be determined from polymer specific durability testing covering the range of expected soil environments. RFd = 1.10 minimum.

4. RFid, Reduction Factor for Installation Damage

RFid shall be determined from product specific construction damage testing performed in accordance with ASTM D5818 (GRI-GG4). Test results shall be provided for each product to be used with project specific or more severe soil type. RFid = 1.05 minimum.

5. FS, Overall Design Factor of Safety

FS shall be 1.5 unless otherwise noted for the maximum allowable working stress calculation.

- C. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the "Hinge Height" divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with ASTM D6638 Connection Strength between Geosynthetic Reinforcement and Segmental Concrete Units (NCMA SRWU-1).
- D. Soil Interaction Coefficient, Ci

Ci values shall be determined per ASTM D6706 (GRI:GG5) at a maximum 0.75-inch (19 mm) displacement.

E. Manufacturing Quality Control

The geogrid manufacturer shall have a manufacturing quality control program that includes QC testing by an independent laboratory.

The QC testing shall include:

Tensile Strength Testing Melt Flow Index (HDPE) Molecular Weight (Polyester)

2.08 DRAINAGE PIPE

A. If required, the drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with AASHTO M252.

2.09 GEOTEXTILE FILTER FABRIC

A. When required, Geotextile filter fabric shall be 4.0 oz/sy, polypropylene, needlepunched nonwoven fabric.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proof roll foundation area as directed to determine if remedial work is required.
- B. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner.

3.02 BASE LEVELING PAD

A. Leveling pad material shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6 inches and extend laterally a minimum of 6" in front and

behind the modular wall unit.

- B. Soil leveling pad materials shall be compacted to a minimum of 95 % Standard Proctor density per ASTM D-698 or 92% Modified Proctor Density per ASTM D1557.
- C. Leveling pad shall be prepared to insure full contact to the base surface of the concrete units.

3.03 MODULAR UNIT INSTALLATION

- A. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated.
- B. Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.
- C. Install shear/connecting devices per manufacturer's recommendations.
- D. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.
- E. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

3.04 STRUCTURAL GEOGRID INSTALLATION

- A. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.
- B. Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer.
- C. The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid.
- D. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

3.05 REINFORCED BACKFILL PLACEMENT

- A. Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage.
- B. Reinforced backfill shall be placed and compacted in lifts not to exceed 6 inches where hand compaction is used, or 8 to 10 inches where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.
- C. Reinforced backfill shall be compacted to a minimum of 95 % Standard Proctor density per ASTM D-698 or 92% Modified Proctor Density per ASTM D1557. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be dry of optimum, + 0%, 3%.
- D. Only lightweight hand-operated equipment shall be allowed within 3 feet (1m) from the tail of the modular concrete unit.
- E. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.
- F. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH (15 KPH). Sudden braking and sharp turning shall be avoided.
- G. At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

3.06 CAP INSTALLATION

A. Cap units shall be glued to underlying units with an all-weather adhesive recommended by the manufacturer.

3.07 AS-BUILT CONSTRUCTION TOLERANCES

A. Vertical alignment: ± 1.5 " over any 10' distance.

- B. Wall Batter: within 2 degrees of design batter.
- C. Horizontal alignment: ± 1.5 " over any 10' distance.
- D. Corners, bends & curves: ± 1 ft to theoretical location.
- E. Maximum horizontal gap between erected units shall be $\leq 1/2$ inch

3.08 FIELD QUALITY CONTROL

- A. Quality assurance should include foundation soil inspection. Verification of geotechnical design parameters, and verification that the contractor's quality control testing is adequate as a minimum. Quality assurance shall also include observation of construction for general compliance with design drawings and project specifications. Quality assurance is best performed by the site geotechnical engineer.
- B. Quality Control The Contractor shall engage inspection and testing services to perform the minimum quality control testing described in the retaining wall design plans and specifications. Only qualified and experienced technicians and engineers shall perform testing and inspection services.
- C. Quality control testing shall include soil and backfill testing to verify soil types and compaction and verification that the retaining wall is being constructed in accordance with the design plans and project specifications.

END OF SECTION

SECTION 32 9219 SEEDING (NATIVE DRILL)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Temporary cover, seeding and maintenance.
- B. Maintenance.

1.2 RELATED SECTIONS

- A. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.3 DEFINITIONS

A. Weeds: Includes but not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 MAINTENANCE DATA

A. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, watering, and recommended coverage of herbicide and fertilizer.

1.5 QUALITY ASSURANCE

- A. General:
 - 1. Do not make substitutions for specified materials.
 - 2. Ship materials with certificates of inspection required by governing authorities.
- B. Analysis and Standards:
 - 1. Provide standard packaged products with manufacturer's certified analysis.
 - 2. For other materials provide analysis in accordance with methods established by the Association of Official Agricultural Chemists.

1.6 QUALIFICATIONS

- A. Seed Producer: Company specializing in seed production and harvesting with minimum five years of experience, and certified by the State of Oklahoma.
- B. Installer: Company approved by the seed producer.

1.7 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of herbicide mixture.

1.8 SUBMITTALS

- A. Seed: submit seed manufacturer's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for the each grass seed species.
 - 1. Submit to the Owner the empty bags which had the annual rye or native grass seed mix seed.
- B. Herbicide
- C. Temporary Irrigation System Method for non-automatic irrigation native grass seed areas.
- D. Agricultural Soils Test of On-site Topsoil with Recommendations

1.9 DELIVERY, STORAGE, AND HANDLING

A. Seeds shall be delivered in a waterproof, sealed and unopened package as shipped by the seed manufacturer.

1.10 COORDINATION

A. Coordinate with installation of underground irrigation system piping.

1.11 JOB CONDITIONS

- A. Proceed with seeding operations after underground irrigation system or the temporary irrigation system has been approved.
- B. Work within seasonal limitations of grass specie.
- C. When detrimental conditions are encountered, notify the Owner's Representative.

1.12 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after applications until grass is well established and exhibits a vigorous growing condition and acceptance of all landscape work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Grass Seed:
 - 1. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.
 - 2. Native Short Mix:

Common Name	Botanical Name	Pounds Per Live Seed / Acre
Western Wheatgrass	Agropyron smithii	3.00
Sideoats Grama	Bouteloua curtipendula	6.00
Blue Grama	Bouteloua gracilis	3.00
Buffalograss	Buchloe cadtyloides	8.00
Partridge Pea	Cassi fasciculate	3.00
Green Spragletop	Lepochloa dubia	3.00
Love Grass	Eragrostis curvula	2.00

- 3. Warm Season Teff Grass (Eragrostis tef).
- 4. Cool Season Annual Ryegrass (Lolium multiflorium lam.).
- 5. After arrival on the job site, seed containers will be kept in a weather protected, cool and dry.
- B. Erosion Control Measures:
 - 1. Provide clean, seed-free, threshed straw of wheat.
 - 2. Or Approved Equal
- C. Topsoil: Refer to SECTION: Landscape Grading.
- D. Water: Provided by the Owner.
- E. Temporary Irrigation System: Water the annual ryegrass for temporary cover and the native grass areas for growth and permanent establishment.
- F. Soil Amendments:
 - 1. Provide as the soils test dictates the following:
 - a. Nitrogen: Furnish slow-release granular commercial product.
 - b. Lime: Furnish raw ground limestone containing not less than 95 percent carbonates, 98% passing a 20 mesh sieve and 50% passing a 100 mesh sieve.
 - c. Aluminum Sulfate
 - d. Bonemeal: Furnish commercial, raw, finely ground containing 4% nitrogen and 20% phosphoric acid.
 - e. Gypsum: furnish U.S. Grade Fine Gypsum.
 - f. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.
- G. Herbicide:
 - 1. Plateau by BASF, approved by the seed manufacturer or approved equal.

PART 3 - EXECUTION

3.1 PLANTING SEASON

- A. Seed
 - 1. Cool Season Cover: Annual Ryegrass Fall Mid August to October and Spring February to April.
 - 2. Warm Season Cover: Teff Grass Summer May to August
 - 3. Native Grass Seed Mix Spring March 15 and May 15.

3.2 EXAMINATION

A. Verify that prepared on-site topsoil is ready to receive the work of this section including removal of hard pan areas, finish grading, etc.

3.3 PREPARATION OF SUBSTRATE

- A. Refer to SECTION: Landscape Grading
- B. Provide soil amendments and nutrients as per on site topsoil agricultural text.

3.4 APPLICATION

- A. Initial Application Seeding Rate:
 - 1. Warm Season Annual Teff Grass Seed Mix Rate: Eight (8) pounds per acre.
 - 2. Cool Season Annual Rye Grass Seed Mix Rate: Twenty (25) pounds per acre.
 - 3. Native Grass Seed Mix: Seed weight rate of seventeen (17) pound per acre (equal to eleven (11) Pure Live Seed (PLS) pounds per acre.
- B. Drill Seeding:
 - All seed is to be drilled one-quarter (1/4) inch into the soil with a mechanical grass drill with depth bands and an agitator in the seed box. Rows shall be spaced not more than seven (7) inches apart. Drill half of required seed in one compass direction and then drill the remaining half in a direction ninety degrees (90°) to the first half.
- C. Broadcast Seeding Small Areas
 - 1. Some portions of the project area is not accessible by the drill application. In these areas, uniformly apply seed at the same rate at cover with soil to a depth of one-quarter (1/4) inch to one-half (1/2) inch by hand raking the areas.
 - 2. Broadcast seeding shall be accomplished using a hand-operated "cyclone-type" seeder or rotary broadcast equipment attached to construction or revegetation machinery. All machinery shall be equipped with metering devices. Broadcasting by hand shall be acceptable on small, isolated areas. Prior to hand broadcast seeding, divide the seed required into two portions. Apply the first half of the seed and then follow up by applying the second portion to ensure complete coverage by seed. When broadcast seeding, passes shall be made over each site to be seeded in a manner to ensure an even distribution of seed When using hoper type equipment, see shall be frequently mixed with the hopper to discourage seed settling and even planting distribution of the seed.
- D. Cover Broadcast Seeding:
 - a. Following the drill seeding of all areas, the cover seed mix should be broadcast over areas as a temporary cover.
- E. Provide Erosion Control Measures:
 - 1. Apply straw mulch shall be applied immediately after seeding has been completed with a mechanical spreader at a rate not less than one and one-half (1-1/2) ton per acre and not more than two (2) tons per acre. Straw mulch shall then be anchored to the soil with a standard commercial crimper which shall crimp the mulch four (4) inches or more into the soil.
- F. Watering:
 - 1. Apply water with a fine spray immediately after each area has been mulched. Saturate to four (4)inches of the soil without erosion.

3.5 MAINTENANCE

A. The Contractor shall maintain the grass for a minimum of 90-days after installation or until completion and acceptance of all landscape work, whichever period is longer.

- B. Water to prevent grass and soil from drying out.
- C. Roll surface or topdress to remove irregularities.
- D. Control growth of weeds. The Contractor shall notify the Owner's Representative prior to herbicide spot application, favorable to the establishment of a Native Grass Short Mix. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- E. Immediately seed areas which show deterioration or bare spots.
- F. Protect seeded areas with warning signs during maintenance period.
- A. <u>Seeded Areas Outside Construction Fencing</u>
 - 1. <u>Seeded areas outside of the temporary construction fence shall be maintained by Construction</u> <u>Manager for a minimum of 30-days after installation or until grass is established and accepted by</u> <u>Architect, whichever period is longer.</u>
 - a. Water to prevent grass and soil from drying out.
 - b. Roll surface and top-dress with imported topsoil to remove irregularities.
 - c. <u>Control growth of weeds.</u> <u>Construction Manager shall notify Architect prior to herbicide spot</u> <u>application, favorable to the establishment of a Native Grass Short Mix.</u> <u>Apply herbicides in</u> <u>accordance with manufacturer's instructions.</u> Remedy damage resulting from improper use of <u>herbicides.</u>
 - d. Immediately seed areas which show deterioration or bare spots.
- B. Seeded Areas Inside Construction Fencing
 - 1. <u>Seeded areas inside of the temporary construction fence shall be maintained by Construction</u> <u>Manager until Final Acceptance of the entire project or until accepted by Architect.</u>
 - a. <u>Water to prevent grass and soil from drying out.</u>
 - b. <u>Roll surface and top-dress with imported topsoil to remove irregularities. Control growth of weeds. Construction Manager shall notify Architect prior to herbicide spot application, favorable to the establishment of a Native Grass Short Mix. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.</u>
 - c. Immediately seed areas which show deterioration or bare spots.

3.6 ACCEPTANCE OF AREAS

- A. When seeding is substantially completed, including maintenance, Owner's Representative shall, upon request, make an inspection to determine acceptability.
- B. Seeded areas will be acceptable, provided requirements, including maintenance, have been complied with, and healthy, uniform, close stand of specified grass is established, free of weeds, bare spots, open joints and surface irregularities.
- C. Where inspected work does not comply with requirements, replace defected work, and continue specified maintenance until re-inspected by the Owner's Representative and found to be acceptable.
- D. Once the work is accepted as complete, the Contractor will maintain the seeded areas until final acceptance of all landscape work for the project.

END OF SECTION

SECTION 32 9223 SODDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fertilizing.
- B. Sod installation.
- C. Maintenance

1.2 RELATED SECTIONS

- A. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.3 REFERENCES

A. ASPA (American Sod Producers Association) Guideline Specifications to Sodding.

1.4 SUBMITTALS

- A. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.
- B. Certification: Submit sod certification for grass species and location of sod source.

1.5 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Grass Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.6 QUALITY ASSURANCE

- A. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
- B. Sod Producer: Company specializing in sod production and harvesting with minimum five-years' experience and certified by the State of Oklahoma.
- C. Installer: Shall have over five-years of documented experience in the scope of work specified.

1.7 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer mixture and herbicide mixture.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sod on pallets. Protect exposed roots from dehydration.
- B. Do not deliver more sod than can be laid within 24 hours or sod will be rejected.

1.9 COORDINATION

A. Where underground sprinkler systems are required, coordinate with installation of underground sprinkler system piping, spray heads, valves and quick coupler valves.

1.10 JOB CONDITIONS

- A. Proceed with sodding operations after underground sprinkler system has been approved by the Landscape Architect.
- B. Work within seasonal limitations of the grass species.
- C. When detrimental conditions are encountered, notify the Landscape Architect.

1.11 MAINTENANCE SERVICE

A. Maintain sodded areas immediately after placement until final Acceptance of the project. The lawn shall be well established and exhibit a vigorous growing condition.

PART 2 - PRODUCT

2.1 MATERIALS

- A. Sod: ASPA Certified grade; "U-3" Bermuda Grass (or approved equal), a cultivated grass, Oklahoma grown, free of stones, burned or bare spots; containing no more than 10 weeds per 1,000 square feet.
- B. Imported Topsoil: Refer to SECTION ## ####.
- C. Fertilizer: Recommended for grass, with 50 percent of the elements derived from organic sources; controlled-release, granular or pellet form, uniform in composition, slow releasing, delivered in fully labeled sealed packages, and shall conform to applicable state or federal regulations, and a composition of the following: nitrogen 10 percent, phosphoric acid 20 percent, and soluble potash 10 percent.
- D. Water: During construction, the domestic water from the Project property will be provided to the Contractor by the Owner. The Contractor shall utilize the water in a conservative manner.
- E. Postemergent Herbicide: As manufactured by LESCO or GORDONS.

2.2 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with ASPA Guidelines. Big rolls are preferred.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installation areas. Report unsatisfactory conditions in writing to Landscape Architect. Do not proceed until unsatisfactory conditions have been corrected.
- B. Verify that prepared topsoil is ready to receive the work of this section.
- C. Starting installation constitutes acceptance of condition or satisfactory for installation of sod by Contractor, who shall correct damage and defects or unsatisfactory work at no additional cost.

3.2 PREPARATION OF SUBSOIL

A. Comply with SECTION ## ####: Landscape Grading

3.3 FERTILIZING

- A. Apply fertilizer (10-20-10) at a rate of 2.5 lbs. per 1,000 square feet.
- B. Apply after smooth raking of topsoil and prior to installation of sod.
- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2-inches of imported topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.4 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately (within 24 hours of harvesting) after delivery to site to prevent deterioration. Sod will be rejected if not installed within this time period.
- C. Place sod parallel with the adjacent street and building.
- D. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12-inches minimum. Do not stretch or overlap sod pieces.
- E. Lay smooth. Align with adjoining grass areas and flush with grade.
- F. Place top elevation of sod 1/2-inch below adjoining paving and curbs.
- G. Water sodded areas immediately after installation. Saturate sod to 4-inches of soil. Water by hand or by the irrigation system daily to prevent the root system from drying. Sod shall be kept moist. Dry sod will be rejected and replanted according to this specification.
- H. Once conditions are favorable, roll sodded areas to ensure a good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with a roller not exceeding 250 lbs.

3.5 MAINTENANCE

- A. Maintain the existing lawn and newly sodded grass areas between the street curb and the parking lot for a minimum of 30-days after installation or until Final Acceptance of the entire project, whichever period is longer. The grass shall be mowed a minimum of three times and maintained at a maximum height of 3 inches. Do not cut more than 1/3 of a grass blade at during one mowing.
- B. Neatly trim edges and hand clip where necessary.
- C. Water to prevent grass and soil from drying out.
- D. Roll surface and top-dress with imported topsoil to remove irregularities.
- E. Weed Control: Apply a weed control herbicide. Notify the Landscape Architect prior to herbicide application. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting

from improper use of herbicides.

- F. Immediately sod areas which show deterioration or bare spots.
- G. Protect sodded areas with warning signs during maintenance period.
- A. Sod Outside Construction Fencing
 - 1. <u>Sod outside of the temporary construction fence shall be maintained by Construction Manager for a</u> minimum of 30-days after installation or until grass is established and accepted by Architect, whichever period is longer.
 - a. <u>The grass shall be mowed and maintained at a height of 3 inches</u>. Do not cut more than 1/3 of a grass blade during one mowing. Neatly trim edges.
 - b. Water to prevent grass and soil from drying out.
 - c. Roll surface and top-dress with imported topsoil to remove irregularities.
 - d. Immediately sod areas which show deterioration or bare spots.

B. Sod Inside Construction Fencing

- 1. <u>Sod inside of the temporary construction fence shall be maintained by Construction Manager until</u> <u>Final Acceptance of the entire project or until accepted by Architect.</u>
 - a. <u>The grass shall be mowed and maintained at a height of 3 inches</u>. Do not cut more than 1/3 of a grass blade during one mowing. Neatly trim edges.
 - b. Water a minimum of 30-days after installation or until grass is established to prevent grass and soil from drying out, whichever period is longer.
 - c. Roll surface and top-dress with imported topsoil to remove irregularities.
 - d. Immediately sod areas which show deterioration or bare spots.

3.6 ACCEPTANCE OF SODDED AREAS

- A. When sodding is substantially completed, including maintenance, the Landscape Architect will, upon request, make an inspection to determine acceptability.
- B. Sodded lawns will be acceptable, provided requirements, including maintenance, have been complied with, and healthy, uniform, close stand of specified grass is established, free of weeds, bare spots, open joints and surface irregularities.
- C. Where inspected work does not comply with requirements, replace defected work, and continue specified maintenance until reinspected by the Landscape Architect and found to be acceptable.
- D. Once the work is accepted as complete, the Contractor will maintain the sodded areas until Final Acceptance of the project.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 1000 WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for WATER UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for WATER UTILITIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Water Utilities Distribution Piping
- B. Water Distribution Equipment
- C. Disinfection of Water Utility Distribution

1.4 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. Tahlequah Public Works Authority (TPWA)
 - 2. Oklahoma Department of Environmental Quality

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe Pipe submittals shall include a notarized certification from the manufacturer that pipe is manufactured and tested in accordance with the applicable specifications. The certifications shall indicate the pipe diameter, the pressure rating, resin classification, and the batch number from which the pipe was manufactured.
 - 2. Valves
 - 3. Fire Hydrants
 - 4. Fittings
 - 5. Steel Casing
 - 6. Mechanical Joint Restraints
 - 7. Meters
 - 8. Tracer Wire
 - 9. Manholes, Vaults, and Covers
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 GUARANTEE

A. CONSTRUCTION MANAGER shall guarantee all materials and appurtenances furnished and work performed for a period of one (1) year from the date of substantial completion. CONSTRUCTION MANAGER shall warrant and guarantee for a period of one (1) year from the date of substantial completion the completed system is free from all defects due to faulty materials or workmanship and CONSTRUCTION MANAGER shall promptly make such corrections as may be necessary by reason of such defects or workmanship. TPWA or OWNER will provide notice of observed defects with reasonable promptness.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage
 - 1. Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials, and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, and hydrants free of dirt and debris.
- B. Handling
 - 1. Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take exceptional care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry do not drag pipe to the trench. Store plastic piping, jointing materials and rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.10 QUALITY ASSURANCE

- A. TPWA PRECONSTRUCTION CONFERENCT
 - 1. Conduct a preconstruction conference with TPWA prior to beginning any work.
- B. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ENGINEER one week (7 days) prior to the date of the meeting.
- C. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the AWWA and Oklahoma Department of Environmental Quality shall be used.

1.11 PERMITS

A. CONSTRUCTION MANAGER shall make application; pay permit fees; provide payment and performance bonds required of the CONSTRUCTION MANAGER by the AHJ.

1.12 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.13 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities, or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed, and accessible unless noted on the plan.

1.14 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or

horizontally. ARCHITECT and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.

- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.15 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.16 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and lookout guards for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in

excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.17 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications for Construction of Public Improvements.

2.2 PIPE

- A. Ductile Iron Pipe
 - 1. All ductile iron pipe shall conform to ANSI Specification A21.51; AWWA Specification C151, and cement lining in accordance with ANSI Specification A21.4 and AWWA Specification C104. Pipe shall be pressure rated at 350-psi with surge allowance of 100-psi, with pipe thickness to conform with depth of cover and laying conditions.
- B. PVC Pressure
 - Materials used to produce PVC pipe, couplings, and fittings shall be manufactured in accordance with ASTM D-2241, ASTM D-3139, Commercial Standard CS 256, and approved by the National Sanitation Foundation (NSF). The pipe shall be made from clean, virgin, class 12454-B PVC compound conforming to ASTM Resin Specifications D-1784 Type 1, Grade 1. Standard joint length shall be twenty (20) feet. The pipe shall have a minimum Standard Dimension ration (SDR) of twenty-one for Class 200-psi pipe. The pipe shall be marked continuously along the length with the following: manufacturer's name, nominal size, class pressure rating, PVC 1120, NSF, and identification code. Pipe certification sheets shall be submitted by the manufacturer to show compliance with these specifications.

2.3 POLYETHYLENE ENCASEMENT

- A. Ductile iron pipe and fittings shall be wrapped with polyethylene tube wrap.
- B. Polyethylene tube wrap shall be made from virgin polyethylene resin in accordance with ASTM Specification D1248. Thickness shall not be less than 8 mils (.008-in). The material shall be chemically inert and moisture resistant to form an effective seal against penetration by water or vapor. Tensile strength shall be 12.4 MPa (1800 psi) with elongation of 500 percent. The material shall be Polyetube, as manufactured by Polyetube Corporation, Birmingham, Alabama, or equal. The tube shall be of such length that a one-foot overlap is provided at each joint in the pipe.
- C. Minimum flattened polyethylene tube widths shall be as follows for specific pipe sizes and joint types:

Nominal Pipe Sizes (inches)	Push-On Joint Flat Tube Width (inches)	Mechanical Joint Flat Tube Width (Inches)
4	14	16
6	17	20
8	21	24
10	25	27
12	29	30
14	33	34
16	37	37
18	41	41
20	45	45
24	53	53

D. Tape for polyethylene tube shall be plastic-backed adhesive tape, Polykan #900 or Scotchrap #50 or

equal, two inches (2-in) in width.

2.4 FITTINGS

- A. Fittings for all pipe 4-in or larger shall be standard mechanical joint ductile iron unless otherwise indicated on the plans or noted by details. Ductile Iron Fittings shall conform to ANSI Specifications A21.10 and A21.11 and AWWA Specifications C110.
- B. Fittings shall be manufactured in accordance with ANSI Specification A21.4 and AWWA Specification C104 and shall be furnished with a complete set of joint materials for each socket opening.

2.5 JOINTS

A. Mechanical joints shall conform to and be tested in accordance with ANSI Specification A21.11 and AWWA Specification C11.

2.6 JOINT RESTRAINTS

- A. Joint restraints at fire hydrants shall conform to ASTM A307.
- B. Joint restraints for PVC pipe shall be MIDCO's PERMA-GRIP Mechanical restrained fittings for Class 200, SDR-21 PVC pipe.
- C. Joint restraints for ductile iron pipe shall be MEGALUG joint restraints manufactured by EBAA Iron Sales.
- D. Flanged joints shall conform to ANSI Specification A21.15 and AWWA Specification C115 for 125 pounds flange with appropriate bolts per standard ASA specification for each flange size.

2.7 PVC PIPE COUPLINGS

A. Couplings including bell ends, shall be Ring-Tite, Bell-Ring, or Push Joint connected, with fittings furnished by the pipe manufacturer and certified to be suitable for use with the pipe furnished. Couplings shall have a minimum pressure rating of 200-psi and be constructed with deep sockets.

2.8 GATE VALVES

- A. Gate valves shall be manufactured by AVK.
- B. Gate valves shall conform to and be tested in accordance with the ASSW Standard for Resilient Seated Gated Valves for water and sewage systems and ANSI/AWWA Specification C509. Valves shall be bubble tight from either direction at a rated design working pressure of 200-psi. Valves shall have a single disc gate with synthetic rubber seat bonded or mechanically attached to the disc; a non-rising stem with 2-in AWWA operating nut; opening counterclockwise with O-ring stem seals. Valve interiors shall have a corrosion resistant coating acceptable for potable water and end connection to fit the pipe or connection to which it is attached. Valves installed with stems placed at depths greater than 36-iin shall have extension attached to the operating nut as part of the valve component.
- C. Each valve shall have the manufacturer's name or initials, pressure rating and year of manufacture cast on the body and shall be furnished complete with the set of joint materials for each socket.

2.9 BUTERFLY VALVES

- A. Butterfly valves shall be manufactured by AVK.
- B. Butterfly valves shall be meet or exceed the requirements of AWWA C504. Valve ends shall be mechanical joint and be rated for a rated design working pressure of 200-psi.

2.10 TAPPING SLEEVES AND VALVE

- A. Tapping sleeves manufactured by SMITH BLAIR or FORD are acceptable.
- B. Tapping valves shall be flanged by mechanical joint resilient seat conforming with AWWA C509.

2.11 VALVE BOXES

A. Valve boxes shall be the cast iron extension type with screw or slide adjustment and flared base. The minimum thickness of the metal shall be 3/16-in. The word WATER shall be cast in the cover. The boxes shall be of such length and will be adapted to the depth of cover over the pipe at the valve location, with bottom section, extension pieces, and top section as needed.

2.12 VALVE AND LINE MARKERS

A. Identification markers shall be of metal fabrication with baked enamel finish noting TPWA as the owner and the type of facility identified. Marker must be at least 80 square inches in area and shall have attachments to be firmly secured to a galvanized rod or post five (5) feet in length for erection at the location needed.

2.13 STEEL PIPE CASING

- A. All steel pipe casing shall be new, smooth walled, welding steel pipe. The pipe shall be straight, round, and sound with not dents or splits and shall be a standard wall thickness as noted:
 - 1. 18-in pipe and over 0.375-in minimum thickness
 - 2. 12-in pipe 0.330-in minimum thickness
 - 3. 10-in pipe 0.307-in minimum thickness
 - 4. 8-in pipe 0.277-in minimum thickness
- B. Pipe shall be delivered in lengths that will best fit the crossings as noted in the plans with a minimum number of joints to be welded. Pipe shall be subject to inspection by TPWA before, during, and after unloading of pipe at the job site. TPWA reserves the right to reject any and all pipe not in satisfactory conformance with the specifications.
- C. Casing spacers shall be manufactured by RACI Spacers, Inc., Tulsa; M-2 THINsulator by TD Williamson, Inc., Tulsa; or APS Casing Spacers by Advance Prod. & Systems, Inc. Lafayette, LA.

2.14 FIRE AND FLUSHING HYDRANTS

- A. Fire hydrants shall be AVK and shall conform to and be tested in accordance with the AWWA Standard for Dry-Barrel Fire Hydrants, AWWA C502.
- B. Fire hydrants shall have a 5-1/4-in compression main valve; 6-in inlet connection; mechanical joint hub; bury length as specified on the plans; two 2-1/2-in hose nozzles with TAHLEQUAH (e.g. Mueller 301 threads); one 4-1/2-in pumper nozzle with National Standard threads per the City of Tahlequah Fire Department; and safety Red finish paint above the ground line.
- C. Flushing hydrants shall have a 2-1/4-in main valve opening with on 2-1/2-in hose muzzle with TAHLEQUAH THREADS and Safety Red finish paint above the ground line.
- D. All other specifications shall meet the model requirements and size and have a 10-year guarantee.

2.15 AIR RELEASE VALVES

- A. Air release valves shall be manufactured by Val-Matic.
- B. Valves shall be a heavy-duty air release type for 150-psi working pressure, tested to 300-psi, and size shown on the plans. The body, cover and baffle shall be cast iron. All internal parts to be stainless steel and/or bronze, and the inside valve coated with rust inhibitor.
- C. Tapping saddle for air release valves shall be CLOW, twin seal brass saddle and corporation stop with IP threads on outlet piping connection. Valve and piping shall be offset from the main line and properly supported to avoid stresses on piping connections. The valve discharge shall have open end piping extended with a screened downward facing elbow. Valve shall be place in 24-in meter box with lid with keyed locking mechanism and TPWA lettering.

2.16 TRACER WIRE

A. Tracer wire shall be #12 AWG solid copper tracer wire, insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. Tracer wire shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities.

2.17 CAST-IN-PLACE CONCRETE

- A. Concrete for capping channel crossings, road crossings, and thrust blocking shall be per ACI 301 Concrete Standard Specifications for Concrete for Buildings.
- B. Concrete shall have a maximum slump of 4-in, a compressive strength of 3,500-psi at 28-days.

2.18 BEDDING MATERIALS

A. Sand, pea gravel, or 3/4-in washed rock shall be used as bedding.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The installation of WATER UTILITIES shall comply with the current edition of the AHJ's Standard Specifications for Construction of Public Improvements.

3.2 PROTECTION OF MATERIALS

A. All materials for the project shall be transported, delivered, and stored in a manner to prevent damage to the materials. All damaged, broken or otherwise defective materials will be rejected. Store lubricants, gaskets, jointing materials, and other packaged materials in a dry, protected area in which the

manufacturer's name and all other applicable data is plainly marked and visible.

B. Pipe shall be delivered to the job site by means which will adequately support it and not subject it to undue stress. The load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be stored and protected and shall not be strung along the line of trenching more than two days prior to placing.

3.3 UTILITY CROSSINGS

A. Provide a minimum clearance of twenty-four (24) inches between the outer edges of the water pipe and crossing utility conduit unless conditions restrict such clearance.

3.4 SEPARATION OF WATER AND SEWER PIPELINES

- A. Horizontal: Water and sewer mains shall be separated by at least ten (10) feet, measured inside edge to inside edge. In cases where this separation is unattainable, water and sewer mains may be closer if the sewer line is built equal to the water main and located in a separate trench or on an undisturbed earth shelf in accordance with DEQ Regulation 252:626-19-2.
- B. Vertical: Water mains crossings sewer lines shall be laid at least twenty-four (24) inches above the top of the sewer, measured pipe to pipe. If water crossing above sewer is unattainable, the minimum vertical separation shall be twenty-four (24) inches and if the sewer main has non-resilient joints, lengths between joints less than 10 feet or shows evidence of damage or leakage, the sewer pipe shall be replaced with one full length of PVC or ductile water pipe with resilient joints sized to exactly match the existing pipe diameter in accordance with DEQ Regulation 252:626-19-2.
- C. Crossings: In all cases where water and sewer mains or services cross, one full length of ductile iron water pipe (minimum 20-foot section) shall be centered on the crossing of the sanitary sewer line in accordance with DEQ Regulation 252:626-19-2.
- D. Service Line Separation: Water and sewer services shall meet the horizontal separation requirements listed above, except where water and sewer services unavoidably must enter the building with less than 10-foot separation, the services shall diverge to achieve the required separation within 10 feet of the building wall. Water and sewer services crossing other services or mains shall meet the vertical separation requirements listed above, except PVC water pressure pipe (minimum 10-foot length) shall be used as encasement for sewer services crossing above water pipelines. Sewer services may also be laid between 18 inches and 12 inches below water mains or services if the sewer service is similarly encased in accordance with DEQ Regulation 252:626-19-2.

3.5 TRENCH

A. The trench wall shall be straight with a minimum trench width of eight (8) inches or three (3) times the pipe diameter, whichever is greater. At the grade line with the upper portion of the trench sloped to prevent cave-in or collapse of the trench. The bottom of the trench shall be finished to provide a uniform bearing for the pipe. Changes in grade in the trench bottom shall be made as shown on the drawings so the pipe will rest on the trench bottom.

3.6 PLACEMENT

A. In no case shall more than 300-feet of ditch be opened at one time in advance of the pipe laid, without consent of ARCHITECT. Each joint of pipe shall be swabbed clean and lubricated before being lowered into the trench and must be so lowered and handled as to ensure the pipe is being placed in an undamaged condition. Pipe must be lowered and entered one joint at a time to join two or more pipes before same are laid. Valves, special casting, etc., shall be placed where shown on the plans. Where necessary to cut pipes to place special castings, valves or for any other causes great care must be taken not to crack either piece of pipe and to mark out true and straight around the pipe. When pipe-laying is stopped at night or for any other causes or when special castings are left open for future connections, the Contractor shall close openings with iron or wood plug, lightly yarned into place to exclude dirt, water, small animals, etc. Pipe shall be so laid as to have a bearing for its entire length except at bells where holes shall be dug as specified. No pipe shall be laid when trench conditions or the weather are unsuitable or laid in water.

3.7 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be installed on ductile iron pipe and fittings.
 - 1. The polyethylene encasement shall be approximately twenty-four (24) inches longer than the length of the pipe section to provide a twelve (12) inch overlap on each adjacent pipe section. Tube ends shall be taped in place.
 - 2. Any rips, punctures, or other damages to the polyethylene shall be repaired with adhesive tape or

with a short length of polyethylene tube cut open, wrapped around the pipe, and secured with adhesive tape.

3.8 PIPE DEFLECTION

A. The maximum deflection in any pipe joint, made necessary by vertical and horizontal curves or offsets, shall not exceed the amount as recommended by the manufacturer of the pipe. Elbows shall be used if deflection exceeds the maximum recommended by the manufacturer.

3.9 PIPE BEDDING AND EMBEDMENT

- A. Bedding material shall be placed six (6) inches below and twelve (12) inches over the pipe.
- B. Bedding material shall be placed before the pipe is lowered into the trench.
- C. ODOT Type A aggregate backfill shall be used under paving.
- D. Sand shall be used in dry areas. Three-quarter (3/4) inch washed rock shall be used in wet areas.
- E. Backfill shall be carefully placed to avoid dropping rocks or large clods on the pipe. All backfill within eight (8) inches of the edges of the pipe shall contain no stones

3.10 PIPE COVER

A. Pipe shall have a minimum thirty-six (36) inches of cover over the top of the pipe unless approved by TPWA. Where ledge or solid rock is encountered, the pipe may be raised to a minimum depth of thirty (30) inches of cover over the top of the pipe.

3.11 TRENCH BACKFILL

- A. The trench shall be backfilled immediately after laying pipe to avoid leaving open ditches overnight. Any excavation that remains open overnight shall be properly barricaded and lighted to avoid any injury to persons or property.
- B. Trench backfill under pavement shall be ODOT Type A aggregate backfill.
- C. See 31 2300 Excavation and Fill for backfill and compaction requirements.

3.12 TRENCH SETTLEMENT

A. Wherever trenches have settled prior to final acceptance by TWPA, the trenches shall be backfilled to surface and compacted and smoothed to conform to the elevation of the adjacent ground surface.

3.13 VALVE BOX PROTECTION

A. All installed valve boxes shall have a minimum 24-in x 24-in x 6-in thick concrete pad set in place around the valve box. Concrete shall be Class A, 3,500-psi concrete at 28-days.

3.14 JOINT RESTRAINT

- A. Joint restraints for PVC pipe shall be MIDCO's PERMA-GRIP Mechanical restrained fittings for Class 200, SDR-21 PVC pipe.
- B. Joint restraints for ductile iron pipe shall be MEGALUG joint restraints manufactured by EBAA Iron Sales.
- C. Bell restraints shall be installed a minimum of 40-ft in all directions from a mechanical joint.

3.15 THRUST BLOCKING

- A. Concrete thrust blocking shall be installed at all points of lateral thrust such as tees, elbows, crosses, hydrants, dead ends, valves, etc., unless authorized by TPWA.
- B. Thrust blocking shall meet the following requirements:
 - 1. Place thrust block in such a manner around the piping so that the block will absorb the thrust forces in that location.
 - 2. Thrust blocks shall be poured-in-place high early strength concrete with a compressive strength of minimum 3,500 psi at 3 days.
 - 3. Thrust blocks shall extend from the piping to the undisturbed trench wall and shall meet the minimum restrictive areas in the table below.
 - 4. Blocking shall be placed so that the pipe and fittings will be accessible for repair.
 - 5. The following table is computed using a minimum thickness of 4" or the pipe diameter, whichever is greater. The length of contact surface with the pipe shall be the pipe diameter plus 4-inches.

Minimum Restrictive Areas and Volumes for Thrust Blocking								
Pipe Size, in.	90 Degree Bend		45 Degree Bend		22 1/2 Degree Bend		Dead End or Tee	
	Res. Area (ft²)	Volume (ft ³)	Res. Area (ft²)	Volume (ft ³)	Res. Area (ft ²)	Volume (ft ³)	Res. Area (ft²)	Volume (ft ³)
1.5	0.21	0.50	0.11	0.50	0.06	0.50	0.15	0.50
2.0	0.32	0.50	0.18	0.50	0.09	0.50	0.23	0.50
2.5	0.47	0.50	0.26	0.50	0.13	0.50	0.33	0.50
3.0	0.70	0.50	0.38	0.50	0.19	0.50	0.49	0.50
4.0	1.15	0.50	0.82	0.50	0.32	0.50	0.81	0.50
6.0	2.47	1.00	1.34	0.50	0.68	0.50	1.75	1.00
8.0	4.28	2.00	2.32	1.00	1.17	0.50	3.03	1.50
10.0	6.44	4.00	3.47	2.00	1.77	1.50	4.75	3.00

3.16 BORING

- A. Where so indicated on the Drawings, pipeline crossings of highways, roads, railroads, canals, and other structures shall be made by installation of a steel pipe casing under the structure.
 - 1. Crossings for water service lines and water mains shall be a minimum of six (6) feet below the surface of the roadway and two (2) feet below other structures and canal inverts, unless otherwise shown on the Drawings.
 - 2. Pipe within steel casing shall be adequately protected with redwood, cedar or plastic skids to prevent damage during installation and provide proper long-term line support. At least four skids, equally spaced around the perimeter of the pipe, shall be used. Each set of skids shall be 3" minimum in length. A spacing of one (1) foot will be used between skid sets. The skid shall be held to the pipe with stainless steel straps or clamps.
 - 3. After the carrier pipe is installed in the casing and tested, the void between the casing pipe and the carrier pipe shall be filled with a six (6) inch concrete plug at each end.
 - 4. When the casing pipe is to be installed by boring, the casing shall be kept inline and grade by suitable rails in the approach pit. The deviation from line and grade of the casing pipe shall provide installation of the carrier pipe within 1.0% horizontal deviation and 1.0% vertical deviation.
 - 5. Boring methods which involve jetting or washing techniques are not allowed.

3.17 TRACER WIRE

A. Tracer wire shall be installed for all PVC pipe installed by trenching. The tracer wire shall be attached to the water line and shall be brought to the surface and attached at all valve boxes, meter boxes, hydrants, and any other appurtenances where the wire can be accessed. Tracer wire shall be soldered to fuse wire breaks and to connect another strand of wire.

3.18 DETECTABLE WARNING TAPE

- A. Detectable warning tape for open cut/open ditch shall be placed approximately 12-18 inches beneath the ground surface and directly above the water line.
- B. See 31 2300 Excavation and Fill for warning tape specifications.

3.19 PAVEMENT REPAIR

- A. Any street or paved surface removed or damaged during water utility installation shall be replace or repaired as soon as possible, unless otherwise approved by ARCHITECT.
- B. Concrete and asphalt streets, parking lots, and driveways shall be cut in straight lines a minimum of twelve (12) inches on undisturbed soil from the excavated area and replaced per the construction drawings.

3.20 FIELD QUALITY CONTROL

- A. Flushing:
 - Waterlines shall be flushed clean prior to start of pressure testing or disinfection processes. The waterlines will be flushed again after disinfection of the lines to rid the lines of excessive chlorinated water. The duration of flushing shall be adequate to accomplish successful cleaning and removal of excessive chlorine in the lines.
- B. Hydrostatic Pressure Tests:

- 1. All pipelines shall be tested by means of hydrostatic pressure of not less than the pressure rating required in accordance with AWWA C605.
- 2. CONSTRUCTION MANAGER shall provide test plugs and all necessary anchors, braces, and other devices necessary to withstand the hydrostatic pressure on such plug or plugs without placing any hydraulic thrust on the pipeline or any part thereof. The CONSTRUCTION MANAGER shall be solely responsible for any and all damage to the pipeline and public and private property which might be caused by the failure of such test plugs or supports incidental thereto.
- 3. Water leakage shall not exceed 10 gallons per inch of pipe diameter per mile of pipe per 24 hours at a 150-psi test pressure.
- 4. After the section of line to be tested has been filled with water, the specified test pressure shall be applied by means of a force pump of such design and capacity that such pressure can be applied and maintained for the duration of the test period, which shall be not less than two (2) hours for 24" and smaller pipe; and not less than six (6) hours for 30" and larger diameter pipe.
- 5. All water supplied to the line after the initial filling thereof shall be metered by means of a tested water meter approved by the Engineer.
- 6. Any and all leaks on the line or lines constructed under this contract, which appear during the specified hydrostatic test or at any subsequent time before final acceptance of the whole works, shall be located and repaired by and at the expense of the CONSTRUCTION MANAGER.
- C. Disinfection:
 - 1. Disinfection of water lines shall be in accordance with the current edition of AWWA C651 "Disinfecting Water Mains".
 - 2. Upon completion of all construction activities, the CONSTRUCTION MANAGER shall disinfect all water mains with a chlorine solution having an active available chlorine concentration of 100 parts per million, maintaining the pipe full of solution and under normal pressure for 24 hours. The residual chlorine solution at the end of the 24-hour disinfecting period shall not be less than 10 ppm. Upon completion, the water mains shall be flushed until the residual chlorine is not greater than 0.4 parts per million. The method of disinfecting the mains shall comply with Oklahoma Department of Environmental Quality Standards. Disinfection must be in accordance with AWWA Standard Specifications and require obtaining safe bacteriological samples on 2 consecutive days before placing the waterline into service. A set of samples shall be collected every 1,200 feet along new waterlines.

END OF SECTION

SECTION 33 3000 SANITARY SEWER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SANITARY SEWER UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SANITARY SEWER UTILITIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Sanitary Sewer Piping
- B. Sanitary Sewer Manholes
- C. Sanitary Sewer Clean-outs

1.4 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. Tahlequah Public Works Authority
 - 2. Oklahoma Department of Environmental Quality

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe
 - 2. Manholes
 - 3. Manholes Rings and Covers
 - 4. Manhole Coating
 - 5. Fittings
 - 6. Clean-outs
 - 7. Tracer Wire
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the AWWA and Oklahoma Department of Environmental Quality shall be used.

1.9 PERMITS

A. CONSTRUCTION MANAGER shall make application; pay permit fees; provide payment and performance bonds required of the CONSTRUCTION MANAGER by the AHJ.

1.10 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.11 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.12 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.

- 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
- 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.15 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications.

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. SOLID WALL PVC All solid wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below or as modified herein.
 - 1. ASTM D-3034
 - a. Standard Specification for "Type PSM Poly (Vinyl Chloride) (VC) Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from four (4") inches to fifteen (15") inches in diameter.
 - b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 12364-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM D-1784.
 - c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the

requirements of ASTM D-3212.

2.3 BEDDING AND EMBEDMENT MATERIAL

A. Bedding and embedment material shall be 3/4-inch washed rock.

2.4 BACKWATER VALVES

- A. Cast-Iron Backwater Valves
 - 1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 - 2. Horizontal type; with swing check valve and hub-and-spigot ends.
 - 3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
 - 4. Terminal type; with bronze seat, swing check valve, and hub inlet.
- B. Plastic Backwater Valves:
 - 1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.5 CLEANOUTS

- A. Cast-iron Cleanouts
 - 1. Manufacturers: Subject to compliance with requirements.
 - 2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - 3. Top-Loading Classification(s): Heavy Duty.
 - 4. Sewer Pipe Fitting and Riser to Clean-out: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts
 - 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 MANHOLES

- A. Standard Precast Concrete Manholes
 - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 2. All concrete for manhole and base shall be Class A concrete with a minimum compressive strength of 4,000 psi.
 - 3. Diameter: 48 inches minimum.
 - 4. Wall Thickness:
 - a. The minimum wall thickness shall not less than 5-in and shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser.
 - b. Manholes with 60-in and 48-in diameters shall have a 5-inch minimum thickness, and lengths to provide depth indicated.
 - c. Manholes with 72-in diameters shall have a 6-inch minimum thickness, and lengths to provide depth indicated.
 - d. Manholes with 84-in diameters shall have a 7-inch minimum thickness, and lengths to provide depth indicated.
 - e. Manholes with 96-in diameters shall have an 8-inch minimum thickness, and lengths to provide depth indicated.
 - 5. Base section shall have a 9-inch minimum floor slab thickness. Floor slab shall be integral with base section. Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 - 6. Provided riser sections as needed to achieve the required manhole depth.
 - 7. Top section shall be eccentric-cone type unless flat-slab-top type is indicated, and top of cone of size that matches grade rings.
 - 8. Joint sealant shall meet ASTM C 990, bitumen or butyl rubber.
 - 9. Pipe connectors shall be resilient pipe connectors per ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 - 10. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615/A, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on

one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

- 11. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
- 12. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
- B. Designed Precast Concrete Manholes:
 - 1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
 - 2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
 - 3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 - 5. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 - 6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
 - 7. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.
- C. Frames and Covers
 - 1. Manhole frames and covers shall be to the dimensions and specifications of the current AHJ's Standard Specifications.
- D. Manhole Coatings
 - 1. High-Build Epoxy Coatings
 - a. The coating material shall be a two (2) part, one hundred (100%) percent solids epoxy-resin with fibrous and flake fillers specifically designed for sanitary sewer applications. The coating material shall have the following minimum properties as listed below:
 - 1) Tensile Strength Minimum 8,000 psi ASTM D-638 (7-day cure at 25 deg C)
 - 2) Tensile Elongation Minimum 20% ASTM D-638 (7-day cure at 25 deg C)
 - 3) Compressive Strength Minimum 80 Shore D ASTM D-2240 (7-day cure at 25 deg C)
 - 25% Sulfuric Acid 28 days without deterioration after continuous contact with fresh chemical at 25 deg C ASTM C-267
 - 5) Solids by Volume 100%
 - 2. Polyurea Coating Systems
 - a. The coating material shall be urethane-based one hundred (100%) percent solids resin with chemically resistant fillers specifically designed for sanitary sewer applications. The coating material, tested at 25°C, shall have the following minimum properties as listed below:
 - 1) Tensile Strength Minimum 1,800 psi ASTM D-412 (7-day cure at 25 deg C)
 - 2) Recoverable Elongation Minimum 300% ASTM D-412 (7-day cure at 25 deg C)
 - 3) Surface Hardness Minimum 80 Shore D ASTM D-2240 (7-day cure at 25 deg C)
 - 20% Sulfuric Acid 28 days without deterioration after continuous contact with fresh chemical at 25 deg C ASTM C-267
 - 5) Solids by Volume 100%

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

- 1. Cement: ASTM C 150, Type II.
- 2. Fine Aggregate: ASTM C 33, sand.
- 3. Coarse Aggregate: ASTM C 33, crushed gravel.
- 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 2 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 8 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 4000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The installation of SANITARY SEWERAGE UTILITIES shall comply with the current edition of the AHJ's Standard Specifications.

3.2 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Provide a minimum of 6-inch of bedding material below the pipe. Provide a minimum of 12-inch of bedding material over the pipe.
- C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- G. Install gravity-flow, non-pressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - 3. Install piping with 36-inch minimum cover.
 - 4. Install PVC pipe according to ASTM D 2321 and ASTM F 1668.

3.4 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3-inch above finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping where indicated.
- B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
- C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.7 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth areas.
 - 2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in cast-in-place concrete block, 18-inch by 18-inch by 12-inch deep.
- C. Set cleanout frames and covers in earth areas with tops 1-inch above surrounding earth grade.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

- A. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains.
- B. Make connections to existing piping and underground manholes.
- C. Use commercially manufactured wye or saddle fittings with stainless steel bands for piping branch connections. Remove section of existing pipe, install wye or saddle fitting into existing piping, and encase entire wye or saddle fitting with not less than 2 ft depth x 2.2 ft width x 2.0 ft length of concrete with 28-day compressive strength of 3000 psi.
- D. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
- E. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
- F. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
- G. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
- H. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 MANHOLE COATINGS

- A. Surface Preparation
 - 1. The CONSTRUCTION MANAGER shall use cleaning methods that are adequate to remove loose material from the manhole. All existing manhole steps or ladder are to be removed. The CONSTRUCTION MANAGER shall take all necessary precautions to prevent falling debris from damaging the manhole trough and/or entering the sewer. Infiltration through existing manhole walls that would adversely affect the material used in the annular space shall be eliminated or reduced to an acceptable level.
 - 2. Mechanical cleaning shall be done to provide a good bond between the epoxy coating and the substrate. Water blasting with a minimum of five thousand (5,000 psi) pounds per square inch shall be done to remove oil, grease, and foreign materials from all surfaces to be coated. For brick manholes, use a minimum of six thousand (6,000 psi) pounds per square inch of water pressure. In areas where the concrete has become softened due to chemical attack, several millimeters of the wall surface shall be removed using water pressures of twenty-five thousand (25,000 psi) pounds per square inch to thirty-five thousand (35,000 psi) pounds per square inch, or as recommended by

the coating manufacturer, to ensure that a sound substrate is exposed. Surfaces shall be made damp or dry as required by the manufacturer before application of coating system begins.

- B. Application
 - 1. The material shall be mixed and applied, in two (2) or three (3) coats, in accordance with the manufacturer's written instructions, using approved equipment. When applying a Polyurea coating, all surfaces to be coated shall be primed as required by the manufacturer. The material shall be applied to all interior surfaces of the manhole with a minimum thickness of one hundred (100) mils.
 - 2. The CONSTRUCTION MANAGER shall allow a minimum of two (2) hours cure time before returning the manhole to active flow conditions or as recommended by the manufacturer. After seven (7) day cure, the liner's surface shall be free of runs, sags, and other irregularities that indicate improper application practice. When directed by the ARCHITECT, liner shall be repaired following the manufacturer's recommendation and to the ARCHITECT's satisfaction.

3.10 IDENTIFICATION

- A. Comply with requirements in Section 31 2300 Excavation and Fill for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
- B. Use warning tape or detectable warning tape over ferrous piping.
- C. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

- A. Deflection Testing
 - 1. Deflection tests shall be performed not less than thirty (30) days after backfill has been placed. The maximum allowable deflection shall not exceed five (5%) percent of the pipe's base internal diameter (Base ID). Tests must be run using a rigid ball or mandrel with a diameter equal to 95% of the inside diameter of the pipe taking into account manufacturing tolerances. Tests must be performed without mechanical pulling devices. Base ID for PVC pipes shall be calculated from measurements taken in accordance with ASTM D 2122 and according to procedures outlined in Appendix XI of ASTM D 3034. For PE pipes Base ID shall be calculated from measurements taken in accordance with ASTM D 2122 and according to procedures recommended by the manufacturer and approved by the ARCHITECT. For other flexible pipes, base ID shall be calculated in accordance with the manufacturer's recommended procedures and approved by the ARCHITECT.
 - 2. A mandrel (go/no-go) device cylindrical in shape shall be hand-pulled by the CONSTRUCTION MANAGER through all sewer lines. Any sections of pipe not passing the mandrel test shall be uncovered and the CONSTRUCTION MANAGER, at no additional cost to OWNER, shall replace the pipe to the satisfaction of the ARCHITECT. The repaired sections shall be re-tested. All tests for pipes twenty-four inch (24") and larger shall be performed in the presence of the ARCHITECT.
 - 3. In lieu of mechanical measurement of deflection by a mandrel, manual measurement can be performed using an internal micrometer or telescoping gage accurate to plus or minus (±) one-thousandth (0.001") inch. The manual measurement of the vertical internal diameter shall be taken at the centerline of the installed pipe.
- B. Leakage Testing
 - After backfilling has been completed, the CONSTRUCTION MANAGER shall conduct infiltration, exfiltration, or air tests. All tests shall be performed in the presence of the ARCHITECT for pipes twenty-four inches (24") and larger. Immediately prior to conducting a test, the ground water level shall be determined by boring a vertical hole adjacent to the pipe and measuring the distance to the water level, or by the use of a one-inch (1-inch) diameter pipe installed horizontally through the upstream manhole wall with a clear plastic tube connected to the pipe and extending vertically.
 Infiltration Test
 - a. Where sewers are laid under the groundwater, infiltration testing shall be conducted. If at any time the infiltration between two adjacent manholes is observed and measured to exceed ten (10) gallons per inch of nominal pipe diameter per mile of sewer per day. The CONSTRUCTION MANAGER shall locate the leakage and shall make such repairs as are necessary to reduce the infiltration. The infiltration shall be measured under the direction of the ARCHITECT by use of a weir or other suitable flow rate-measuring device furnished and installed by the CONSTRUCTION MANAGER.
 - 3. Exfiltration Test

- a. Where sewers are laid above the groundwater table, exfiltration testing shall be conducted. Exfiltration tests shall be conducted by blocking off the other openings in the upper manhole and plugging the line where it enters the lower manhole of the reach to be tested, filling the line and the manhole with water at least five foot (5') higher than the top of the pipe or five feet (5') higher than the ground water elevation whichever is higher, and measuring the water required to keep the water level in the manhole at a constant elevation. The test section shall be filled not less than twelve (12) hours prior to testing. The total exfiltration shall not exceed ten (10) gallons per inch of nominal pipe diameter per mile (idm) of pipe per day for each reach tested. For purposes of determining the maximum allowable leakage, manholes shall be considered as sections of pipe having an idm equal to the diameter times depth of the manhole. The exfiltration test shall be maintained on each reach for at least two (2) hours or longer if, in the opinion of the ARCHITECT, this is necessary to locate all leaks.
- b. The CONSTRUCTION MANAGER shall provide all necessary piping between the reach to be tested and the source of water supply, together with equipment and materials required for the tests. The methods used and the time of conducting the exfiltration tests shall be subject to the approval of the ARCHITECT.
- c. If the leakage in any reach exceeds the allowable maximum, the CONSTRUCTION MANAGER shall locate the leakage and shall make such repairs as are necessary for the pipe to pass testing. The pipe reach shall be retested after the leaks are repaired.
- 4. Air Test
 - a. Air tests shall be conducted on each manhole-to-manhole section of sewer. The air test shall be performed in accordance with the following specifications.
 - b. Equipment Cherne Air-Loc Equipment as manufactured by Cherne Industrial of Hopkins, Minnesota or approved equal. Equipment used shall meet the following requirements:
 - 1) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
 - 2) Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking.
 - c. All air used shall pass through a single control panel.
 - d. Three (3) individual hoses shall be used for the following connections:
 - 1) From the control panel to pneumatic plugs for inflation;
 - 2) From the control panel to sealed line for introducing the low-pressure air; and
 - 3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
- 5. Procedures
 - a. All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to twenty-five (25 psi) pounds per square inch gauge. The sealed pipe shall be pressurized to five (5 psi) pounds per square inch gauge. If a ground water level over the top of the pipe is present, the pressure in psig shall be increased by the height of ground water level above top of pipe at upstream manhole divided by two and one third (2 1/3). The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
 - b. After a manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedures, the plugs shall be placed in the line at each manhole and inflated to twenty-five (25 psi) pounds per square inch gauge. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches four (4 psi) pounds per square inch gauge. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (three and one half (3 ½ psi) pounds per square inch gauge minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from three and one half (3 ½ psi) to two and one half (2 ½ psi) pounds per square inch gauge is not less than that shown in the following table:

Pipe Nominal Size (Inches)	Minimum Test Time (min:sec)	Length for Minimum Time (Feet)
6	2:50	751
8	3:47	564
10	4:43	450
12	5:40	376

c. If the air leakage in any reach exceeds the allowable, it shall be re-tested after the leaks are repaired.

3.12 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 33 3123 SANITARY SEWERAGE FORCE MAIN PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SANITARY SEWERAGE FORCE MAIN PIPING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SANITARY SEWERAGE FORCE MAIN PIPING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

A. Sanitary Utility Sewerage Force Main Piping

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- A. 33 00 00 Sanitary Sewerage Utilities
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe
 - 2. Fittings
 - 3. Tracer Wire
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ENGINEER one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the AWWA and Oklahoma Department of Environmental Quality shall be used.

1.9 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ENGINEER and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ENGINEER and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ENGINEER and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ENGINEER before commencing work. The ENGINEER or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ENGINEER. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic

department.

- B. UTILITY INTERRUPTIONS
 - Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ENGINEER one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

 CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIRMENTS

- A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications.B. Polyethylene Pipe and Fittings shall meet the following standards:
 - 1. AWWA C 901-02, Standard for PE Pressure Pipe and Tubing, 0.5 in. through 3 in. for Water Service;
 - 2. AWWA C 906-99, Standard for PE Pressure Pipe and Fittings, 4-in. through 63 in. for Water Distribution and Transmission;
 - 3. ASTM D 3035-03a, Standard Specification for PE Plastic Pipe Based on Controlled Outside Diameter;
 - 4. ASTM D3350-02a, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials;
 - 5. NSF/ANSI 14-2003, Standard for Plastics Piping System Components and Related Material.

2.2 PIPE

- A. PLASTIC PIPE
 - 1. Polyethylene Pipe (PE)
 - a. Pipe
 - 1) Materials. Materials used for the manufacture of polyethylene pipe and fittings shall be PE 3608 (formerly PE 3408) high density polyethylene meeting cell classification 345464C for black or 345464E for stripes per ASTM D 3350; and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade HDB rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

- 2) Polyethylene pipe shall be manufactured in accordance with AWWA C901-02 for sizes 1-1/4" thru 3" IPS diameters and to the requirements of ASTM D3035. Pipe 4" and above DIPS and IPS sized shall be manufactured to the requirements of ASTM F714 and AWWA C906-07.
- 3) Permanent identification of the piping service shall be provided by co-extruding color stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed on the pipe outside surface shall not be acceptable. IPS sized pipes shall have four equally spaced, longitudinal color stripes. DIPS sized pipes shall have three equally spaced pairs of longitudinal color stripes. The stripe color shall be green.
- b. Fittings
 - 1) All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe.
 - 2) Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked.
 - 3) Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full-service pressure rating of the mating pipe.
- c. Polyethylene Flange Adapters
 - Flange adapters shall be made with enough through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing or restrain the gasket against blowout.
- d. Back-up Rings and Flange Bolts
 - 1) Flange adapters shall be fitted with back-up rings pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.
- 2. PVC Pipe
 - a. PVC pipe shall SDR 21 PVC (Class 200) pipe and fittings shall conform to the latest revisions of ASTM D2241, CS 256-63 and the National Sanitation Foundation. Each pipe length shall be marked to include manufacturers name, nominal size, class pressure rating, PVC 1120, NSF Logo, and identification code. All pipe shall be of the same brand and manufacturer.
 - b. SDR 21 PVC pipe shall be Type 1, Grade 1, conforming to ASTM D1784 and having a working pressure as shown below at 73.4 °F based on a working fiber stress of 2,000 psi. Unless otherwise specified, all pipe shall conform to the following minimum requirements:

Table 1: IPS Pressure Pipe Specifications						
Pipe Size	Average	NOM I.D.	MIN T	MIN E (IN)	APPROX	APPROX
(in)	O.D.	(IN)	(IN)		D ⁹ (IN)	WEIGHT
	(IN)					(LBS/FT)
	Rated 200 psi (SDR 21)* (G) (P)					
1.5	1.900	1.709	0.090	3.45	2.26	0.44
2	2.375	2.135	0.113	3.70	2.83	0.54
2.5	2.875	2.585	0.137	3.95	3.42	0.79
3	3.500	3.146	0.167	4.20	4.17	1.17
4	4.500	4.046	0.214	4.50	5.36	1.93
6	6.625	5.955	0.316	5.20	7.89	4.23
8	8.625	7.754	0.410	5.90	10.27	7.18
10	10.750	9.667	0.511	6.70	12.79	11.20
12	12.750	11.465	0.606	8.10	15.17	15.82

c. Pipe markings shall include the following, marked continuously down the length: Manufacturer's Name; Nominal Size; Class Pressure Rating; PVC 1120; NSF Logo; and Identification Code.

2.3 GATE VALVES

A. Gate Valves shall be AVK, non-rising stem, open left, resilient seat, designed for two hundred (200) pounds working pressure and shall conform to latest AWWA Specification No. C500-52, or latest revision. Valves shall be hub end, flange, mechanical joint, or inside pipe thread and cast-iron hand wheel, or operating nut, as specified on the plans or in the Form for bidders.

2.4 VALVE BOXES

A. All valve boxes shall be standard slip joint 4-piece cast iron of the extension type suitable for a depth of cover over the pipeline as required by the backfill requirements at each valve. Each valve box shall be provided with a suitable cast iron base and cover. Covers shall have cast thereon an appropriate name designating the service for which the valve is to be used.

2.5 MJ ADAPTERS

A. MJ Adapters 4" thru 16" may be provided with optional stainless-steel stiffener upon request. MJ Adapters 14" and above shall be provided with Heavy Duty Backup Ring Kits. All MJ adapters above 18" must be provided with stainless steel stiffeners.

2.6 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

A. The installation of SANITARY SEWERAGE FORCE MAIN PIPING shall comply with the current edition of the AHJ's Standard Specifications.

3.2 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.3 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.4 PIPE JOINING

- A. ADOPTED JOINING REQUIRMENTS
 - 1. Polyethylene Pipe fusion shall meet the following standards:
 - a. ASTM D 2657-03, Standard Practice for Heat Joining Polyolefin Pipe and Fittings;
 - b. ASTM D3261-03, Standard Specification for Butt Heat Fusion PE Plastic Fittings for PE Plastic Pipe and Tubing;
 - c. ASTM F1055-98e1, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

3.5 HEAT FUSION JOINING

- A. Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are in accordance with ASTM F2620. The CONSTRUCTION MANAGER shall ensure that persons making heat fusion joints have received training in the recommended procedure. The CONSTRUCTION MANAGER shall maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.
 - 1. Butt Fusion of Unlike Wall Thickness

- a. Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. SDR's for polyethylene pipe are 7.3, 9, 11, 13.5, 17, 21, 26, 32.5 and 41.
- 2. Heat Fusion Training Assistance
 - a. Upon request and at the requestor's expense, training personnel from the Distributor shall be made available.
- B. Joining by Other Means.
 - 1. Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.
 - 2. ID Stiffener and Restraint
 - a. A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.
- C. Branch Connections.
 - 1. Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe by heat fusion joining.

3.6 INSTALLATION

- A. General
 - 1. When delivered, a receiving inspection shall be performed, and any shipping damage shall be reported to the Manufacturer within 7 days. Installation shall be in accordance with ASTM D 2774, Manufacturer's recommendations, and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.
- B. Delivery and Handling of Materials
 - 1. All pipes shall be delivered in all respects sound and conformable to these specifications. Inspection by the Owner or its representative shall not relieve the CONSTRUCTION MANAGER or any of his obligations in this respect. Any defective pipe which may be passed by the Owner or its representatives at the work or elsewhere, shall always be liable to rejection when discovered until the final completion and adjustment of the contract. Care shall be taken in handling the pipe to avoid injury and no pipe or other material of any kind shall be placed in the pipes during transportation or at any other time.
 - a. Responsibility for Material Furnished by CONSTRUCTION MANAGER: The CONSTRUCTION MANAGER shall be responsible for all material furnished by him and he shall replace, at his own expense, all such material that is found to be defective in manufacture or that has become damaged in handling after delivery by the manufacturer.
 - b. Responsibility for Safe Storage: The CONSTRUCTION MANAGER shall be responsible for the safe storage of all materials intended for the work until such materials are incorporated in the completed project and accepted by the Owner.
 - c. Handling Pipe and Accessories: Pipe, fittings, specials, and other accessories shall be unloaded at the point of delivery hauled to and distributed at the site of the project by the CONSTRUCTION MANAGER and shall always be handled with extreme care to avoid damage thereto. The same to be hauled on equipment, equipped with pneumatic tires. Equipment, tools and methods used in unloading reloading, hauling, and laying pipe and accessories shall be such that no damage is done to the pipe. Hooks used for insertion in ends of pipe shall have broad, well-padded contact surfaces and shall be of such design and length that they will provide uniform support for a distance back from the end of the pipe of not less than one-third of the internal pipe diameter.
 - d. Where pipe is to be laid in front of or adjacent to business houses or manufacturing

establishments, or where homes have well-kept front yards, the pipe shall be delivered to the site of the work as the pipe is laid. Local storage of the pipe at the site of the work will not be permitted. By permission of the Engineer, twelve (12) joints of pipe may be allowed on the site of the work at any one time, but it is to be laid before stopping work at night, and all trench backfilling shall closely follow the pipe laying.

- C. Placing Pipe in Trench
 - 1. Proper equipment, implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the CONSTRUCTION MANAGER for the safe and convenient prosecution of the work. All pipe, fittings, hydrants and valves shall be carefully lowered into the pipe, or to the trench subgrade.
- D. Alignment and Assembly of Pipe
 - 1. Pipe shall be accurately installed to the alignment and profile indicated on the approved pipe installation drawings furnished for the purpose. Grades and elevations shall be determined by the pipe subgrade prepared as specified under Excavation and Backfill.
 - 2. The maximum deflection in any pipe joint, made necessary by vertical and horizontal curves or offsets, shall not exceed the amount as recommended by the manufacturer of the pipe.
 - Laving all pipe shall be commenced as soon as possible after excavation is started and 3. CONSTRUCTION MANAGER must use every means at his command to keep pipe laving up with the trenching. In no case shall more than 300 feet of ditch be opened at one time in advance of the pipe laid, without consent of the Engineer. Each joint of pipe shall be swabbed clean and lubricated before being lowered into the trench and must be so lowered and handled as to ensure the pipe is being placed in an undamaged condition. Pipe must be lowered and entered one joint at a time unless permission is given by the Engineer to join two or more pipes before same are laid. Valves, special casting, etc., shall be placed where shown on the plans unless their location is changed by the Engineer. Where necessary to cut pipes to place special castings, valves or for any other causes great care must be taken not to crack either piece of pipe and to mark out true and straight around the pipe. When pipe-laying is stopped at night or for any other causes or when special castings are left open for future connections, the CONSTRUCTION MANAGER shall close openings with iron or wood plug, lightly varned into place to exclude dirt, water, small animals, etc. Pipe shall be so laid as to have a bearing for its entire length except at bells where holes shall be dug as specified. No pipe shall be laid when trench conditions or the weather are unsuitable, or laid in water, except by permission of the Engineer.
- E. Separation of Water and Sewer Pipelines
 - 1. Horizontal: Water and sewer mains shall be separated by at least ten (10) feet, measured inside edge to inside edge. In cases where this separation is unattainable, water and sewer mains may be closer if the sewer line is built equal to the water main and located in a separate trench or on an undisturbed earth shelf in accordance with DEQ Regulation 252:626-19-2.
 - 2. Vertical: Water mains crossings sewer lines shall be laid at least twenty-four (24) inches above the top of the sewer, measured pipe to pipe. If water crossing above sewer is unattainable, the minimum vertical separation shall be twenty-four (24) inches and if the sewer main has non-resilient joints, lengths between joints less than ten (10) feet or shows evidence of damage or leakage, the sewer pipe shall be replaced with one full length of PVC or ductile water pipe with resilient joints sized to exactly match the existing pipe diameter in accordance with DEQ Regulation 252:626-19-2.
 - 3. Crossings: In all cases where water and sewer mains or services cross, one full length of ductile iron water pipe [minimum 20-foot section] shall be centered on the crossing of the sanitary sewer line in accordance with DEQ Regulation 252:626-19-2.
 - 4. Service Line Separation: Water and sewer services shall meet the horizontal separation requirements listed above, except where water and sewer services unavoidably must enter the building with less than 10-foot separation, the services shall diverge to achieve the required separation within 10 feet of the building wall. Water and sewer services crossing other services or mains shall meet the vertical separation requirements listed above, except PVC water pressure pipe (minimum 10-foot length) shall be used as encasement for sewer services crossing above water pipelines. Sewer services may also be laid between 18 inches and 12 inches below water mains or services if the sewer service is similarly encased in accordance with DEQ Regulation 252:626-19-2.
- F. Bury Depth
 - 1. Where the drawings do not show a profile grade the cover on the pipe shall be three (3-ft) feet below the top of the curb or where there is no curb three (3-ft) feet below the established grade of the center line of the surface. The minimum cover on the pipe shall be not less than three and one-half

(3¹/₂-ft) feet at ditch crossings.

- G. Foundation & Bedding
 - Pipe shall be laid on grade and on a stable foundation. Unstable trench bottom soils shall be removed, and a 6-in foundation or bedding of compacted granular material shall be installed to pipe bottom grade. Excess groundwater shall be removed from the trench before laying the foundation or bedding for the pipe. A trench cut in rock or stony soil shall be excavated to 6-in below pipe bottom grade and brought back to grade with compacted granular bedding. All ledge rock, boulders and large stones shall be removed.
- H. Pipe Handling
 - 1. When lifting with slings, only wide fabric choker slings capable of safely carrying the load shall be used to lift, move, or lower pipe and fittings. Wire rope and chain are prohibited. Slings shall be of sufficient capacity for the load and shall be inspected before use. Worn or damaged equipment shall not be used.
- I. Large Diameter Fabricated Fittings
 - 1. One plain-end connection of 16-inch IPS and larger fabricated directional fittings (elbows, tees, etc.) shall be butt fused to the end of a pipe length. The remaining fitting connections shall be made in the trench using butt fusion, flange or other connection means in accordance with 3.2. Flange and other mechanical connections shall be assembled and tightened in accordance with the connection manufacturer's instructions and 4.4. Handling, lifting, moving or lowering a 16-inch IPS or larger fabricated fitting that is connected to more than one pipe length is prohibited. The installing contractor at his expense shall correct fitting damage caused by such improper handling.
- J. Mechanical Joint & Flange Installation
 - 1. Mechanical joint and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. MJ Adapters and flanges shall be centered and aligned to the mating component before assembling and tightening bolts. In no case shall MJ gland or flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.
- K. Backfilling
 - 1. Embedment material soil type and particle size shall be in accordance with ASTM D 2774. Embedment shall be placed and compacted to at least 90% Standard Proctor Density in 6-inch lifts to at least 6-inches above the pipe crown. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe spring line are filled and free of voids.
- L. Protection against shear and bending loads
 - 1. In accordance with ASTM D 2774, connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls. The area surrounding the connection shall be embedded in properly placed, compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads.
- M. Warning Tape
 - 1. Install warning tape directly above utilities, 12-in below finished grade, except 6-in below subgrade under pavements and slabs.
- N. Final Backfilling
 - 1. Final backfill shall be placed and compacted to finished grade. Native soils may be used provided the soil is free of debris, stones, boulders, clumps, frozen clods or the like larger than 8-in in their largest dimension.

3.7 TESTING

A. Fusion Quality

- 1. The CONSTRUCTION MANAGER shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the CONSTRUCTION MANAGER's fusion operator while on site. Upon request by the Owner, the CONSTRUCTION MANAGER shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM F2620. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The CONSTRUCTION MANAGER at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions. Testing of large diameter fusion (>12-in) may require special equipment and safety precautions.
- B. Leak Testing
 - 1. Hydrostatic testing of completed lines shall be performed in accordance with the current edition of AWWA C605.
 - 2. Coordinate leak testing operations with Owner's construction inspector.
 - 3. The hydrostatic test pressure shall not be less than 1.25 times the maximum anticipated sustained working pressure at the highest point along the test section unless the pressure exceeds the design pressure limit for any pipe, thrust restraint, valve fitting, or other appurtenance of the test section. In no case shall the test pressure exceed the design pressure limit for any pipe, thrust restraint, valve, fitting, or other appurtenance of the test section.
 - 4. All pipelines shall be tested by means of hydrostatic pressure of not less than the pressure rating of the pipe. If test plugs are used, they shall be furnished and installed by the Contractor at his own expense, together with all necessary anchors, braces and other devices necessary to withstand the hydrostatic pressure on such plug or plugs without placing any hydraulic thrust on the pipeline or any part thereof. The Contractor shall be solely responsible for any and all damage to the pipeline and public and private property which might be caused by the failure of such test plugs or supports incidental thereto. The allowable leakage is 10 gallons per inch of pipe diameter per mile of pipe per 24 hours at 150 psi testing pressure.
 - 5. After the section of line to be tested has been filled with water, the specified test pressure shall be applied by means of a force pump of such design and capacity that such pressure can be applied and maintained for the duration of the test period, which shall be not less than two (2) hours for 24" and smaller pipe; and not less than six (6) hours for 30" and larger diameter pipe.
 - 6. All water supplied to the line after the initial filling thereof shall be metered by means of a tested water meter approved by the Engineer.
 - 7. Any and all leaks on the line or lines constructed under this contract, which appear during the specified hydrostatic test or at any subsequent time before final acceptance of the whole works, shall be located and repaired by and at the expense of the CONSTRUCTION MANAGER.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 4000 STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for STORM DRAINAGE UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for STORM DRAINAGE UTILITIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Storm Drainage Utility Piping
- B. Storm Drainage Manholes, Frames, and Covers
- C. Storm Drainage Inlets and Structures

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- A. 32 13 00 Rigid Paving
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe
 - 2. Manholes and Inlets
 - 3. Manholes Rings and Covers
 - 4. Fittings
 - 5. Clean-outs
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the City of Oklahoma City's Standard Specifications for Construction of Public Improvements shall be used.

1.9 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDTIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.

- 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 POLYPROPYLENE PIPE

- A. Pipe
 - 1. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO M330, Section 6.1, for the respective diameters.
 - 2. 12-inch through 30-inch pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330.
 - 3. 36-inch through 60-inch pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.
- B. Pipe Joints
 - 1. Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.
 - 12-inch through 60-inch shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
 - 3. 12-inch through 60-inch diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.

- C. Fittings
 - Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

2.2 CORRUGATED POLYETHYLENE PIPE

- A. Pipe
 - 1. Virgin material for pipe and fitting production shall be high-density polyethylene conforming with the minimum requirements of cell classification 424420C for 4-inch through 10-inch diameters, and 435400C for 12-inch through 24-inch diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12-inch through 24-inch virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectively. Bells shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified coupler. The pipe stock used to manufacture the bell-bell coupler shall meet the performance requirements for fabricated fittings as specified in ASTM D3034.
 - 2. Pipe shall have a smooth interior and annular exterior corrugations.
 - 3. 4-inch through 10-inch shall meet AASHTO M252.
 - 4. 12-inch through 24-inch shall meet AASHTO M294, Type S or ASTM F2306.
- B. Pipe Joints
 - Pipe joints shall meet the requirements of AASHTO M252, M294 or ASTM F2306. The 4-inch through 24-inch pipe shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. Bells shall be bell-bell couplers manufactured from PVC. Bell-bell couplers shall be installed on one side by the manufacturer.
- C. Fittings
 - 1. Fittings shall conform to AASHTO M252, M294 or ASTM F2306. Fabricated fittings shall be welded at all accessible interior and exterior junctions.

2.3 REINFORCED CONCRETE PIPE (RCP)

- A. Pipe
 - 1. Round pipe shall meet the requirements of ASTM C76/AASHTO M170, ASTM C361, and AWWA C302.
 - 2. Arch pipe shall meet the requirements of ASTM C506/AASHTO M259.
 - 3. Elliptical pipe shall meet the requirements of ASTM C507/AASHTO M207.
- B. Pipe Joints
 - 1. Joints for round pipe shall meet the requirements of ASTM C443/AASHTO M315.
 - 2. Joints for arch pipe shall meet the requirements of ASTM C990.

2.4 CORRUGATED METAL PIPE (CMP)

- A. Steel Pipe and Fittings (Type I Round, Type II Arch)
 - 1. Metallic coated corrugated steel culverts: AASHTO M36, Type I Round, Type II Arch, with fittings of similar form and construction as pipe.
 - a. Zinc coated (galvanized) sheet steel: AASHTO M218
 - b. Aluminum coated (Type II) hot-dipped sheet steel: AASHTO M274
 - 2. Externally coated or clad culverts
 - a. Bituminous coated corrugated metal culvert pipe and pipe arches: Type A per AASHTO M190
 - b. Pre-coated corrugated steel culverts: AASHTO M245
 - 3. Connecting bands shall be corrugated steel with O-ring seals.

2.5 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. SOLID WALL PVC All solid wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below or as modified herein.
 - 1. ASTM D-3034
 - a. Standard Specification for "Type PSM Poly (Vinyl Chloride) (VC) Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from four (4") inches to fifteen (15") inches in diameter.
 - b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 12364-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM D-1784.
 - c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
 - 2. ASTM F-679
 - a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from eighteen (18") inches to thirty-six (36") inches in diameter.
 - b. The pipe and fitting materials shall be made of PVC plastic having a minimum cell classification of 12364-C or 12454-C as defined in ASTM D-1784. Homopolymer PVC compounds must equal or exceed the requirements of the above listed minimum cell classification number.
 - c. Integral Bell Gasket Joint shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
 - 3. ASTM F-789
 - a. Standard Specification for "Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from four (4") inches to eighteen (18") inches in diameter.
 - b. The pipe shall be made of PVC plastic having a minimum cell classification of 12164-B as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-C or 13343-C as defined in ASTM D-1784.
 - c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212. Joints shall also be compatible to ASTM D-3034 joint dimensions.
- B. PROFILE WALL (PVC) All profile (open or closed) wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below and modified herein. Regardless of size, open profile wall pipes will be allowed only on sections of pipe when there are no apparent service connections. Otherwise, open profile wall pipe will not be allowed.
 - 1. ASTM F-794
 - a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter". Pipe and fittings shall have a minimum stiffness of fortysix (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12") inches to forty-eight (48") inches in diameter.
 - b. The pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B or 12364-C as defined in ASTM D-1784.
 - c. Gasketed Joint Systems shall be used. The integral bell gasketed joint, coupling or fitting joints shall be designed so that when assembled, the gasket will be compressed radially on the pipe spigot or in the bell to form a watertight seal. The joints shall be designed to comply with and show no leakage when tested in accordance with ASTM D-3212.
 - d. Closed profile PVC pipes manufactured with a gasketed joint coupling system, with no bell and spigot, may be used for slip-lining installations.
 - e. Couplings shall form a watertight seal when assembled with plain end pipe and show no sign of leakage when tested in accordance with ASTM D-3212.
 - 2. ASTM F-949

- a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings". Pipe and fittings shall have a minimum stiffness of fifty (50 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12") inches to thirty-six (36") inches in diameter.
- b. The pipe shall be made of PVC plastic having a minimum cell classification 12454-B or 12454-C as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12464-B, 12464-C, or 13343-C as defined in ASTM D-1784.
- c. Elastomeric Gasketed Joints shall be used to provide watertight seal and shall meet the requirements of ASTM D-3212.
- C. SPECIAL PVC PIPE Special PVC pipe and fittings shall conform to the requirements of the appropriate standards listed below or as modified herein.
 - 1. ASTM D-2241
 - a. Standard Specifications for Polyvinyl Chloride (PVC) Pressure-rated Pipe (SDR Series). Pipe and fittings shall have a minimum SDR of thirty-two and one-half (32-1/2) and may be supplied in sizes ranging from four (4) inches to thirty-six (36) inches in diameter.
 - b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-B, 12454-C, or 14333-D as defined in ASTM D-1784.
 - c. Elastomeric gasketed joints meeting the requirements of ASTM D-3212 shall be used to provide a watertight seal.
 - 2. AWWA C-900 and AWWA C-905
 - a. Standards for PVC Pressure Pipe from four (4") inches through twelve (12") inches, and fourteen (14") inches through thirty-six (36") inches, respectively. Pipes shall have a minimum DR rating of eighteen (18) for diameters four (4") inches through twelve (12") inches. For pipes greater than twelve (12") inches in diameter, the minimum DR shall be thirty-two and one-half (32 1/2).
 - b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-A or 12454-B as defined in ASTM D-1784.
 - c. Elastomeric gasketed joints meeting the requirements of ASTM D-3139, when measured in accordance with ASTM-2122, shall be used to provide a watertight seal.

2.6 BACKWATER VALVES

- A. Cast-Iron Backwater Valves:
 - 1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 - 2. Horizontal type; with swing check valve and hub-and-spigot ends.
 - 3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
 - 4. Terminal type; with bronze seat, swing check valve, and hub inlet.
- B. Plastic Backwater Valves:
 - 1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.7 CLEANOUTS

- A. Cast-iron Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements.
 - 2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - 3. Top-Loading Classification(s): Heavy Duty.
 - 4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.8 PVC CLEANOUTS:

A. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.9 MANHOLES AND JUNCTION BOXES

- A. Standard Precast Concrete Manholes:
 - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant

joints.

- 2. All concrete for manhole and base shall be Class A concrete with a minimum compressive strength of 4,000 psi.
- 3. Diameter: 48 inches minimum.
- 4. Wall Thickness:
 - a. The minimum wall thickness shall not less than 5-in and shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser.
 - b. Manholes with 60-in and 48-in diameters shall have a 5-inch minimum thickness, and lengths to provide depth indicated.
 - c. Manholes with 72-in diameters shall have a 6-inch minimum thickness, and lengths to provide depth indicated.
 - d. Manholes with 84-in diameters shall have a 7-inch minimum thickness, and lengths to provide depth indicated.
 - e. Manholes with 96-in diameters shall have an 8-inch minimum thickness, and lengths to provide depth indicated.
- 5. Base section shall have a 9-inch minimum floor slab thickness. Floor slab shall be integral with base section. Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
- 6. Provided riser sections as needed to achieve the required manhole depth.
- 7. Top section shall be eccentric-cone type unless flat-slab-top type is indicated, and top of cone of size that matches grade rings.
- 8. Joint sealant shall meet ASTM C 990, bitumen or butyl rubber.
- 9. Pipe connectors shall be resilient pipe connectors per ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
- 10. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
- 11. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
- 12. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
- B. Designed Precast Concrete Manholes:
 - 1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
 - 2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
 - 3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 - 5. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 - 6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
 - 7. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.
- C. Frames and Covers
 - 1. Manhole frames and covers shall be to the dimensions and specifications of the jurisdictional utility standards.

2.10 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 2 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 8 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 4000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

2.11 CONCRETE CHANNELS, SWALES, AND FLUMES

A. The materials and execution for concrete channels, swales, and flumes shall per the requirements of 32 1300 Rigid Paving.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping with 36-inch minimum cover.
 - 2. Install corrugated steel piping according to ASTM A 798.
 - 3. Install corrugated aluminum piping according to ASTM B 788.
 - 4. Install PE corrugated sewer piping according to ASTM D 2321.
 - 5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 6. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

- 1. Join corrugated steel sewer piping according to ASTM A 798.
- 2. Join corrugated aluminum sewer piping according to ASTM B 788.
- 3. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
- 4. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
- 5. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
- Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
- 7. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.4 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping where indicated.
- B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
- C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth areas.
 - 2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in cast-in-place concrete block, 18-inch by 18-inch by 12-inch deep.
- C. Set cleanout frames and covers in earth areas with tops 1-inch above surrounding earth grade.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 - 1. Use Light-Duty, top-loading classification drains in earth areas.
 - 2. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
- B. Embed drains in 4-inch minimum concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.

3.7 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3-inch above finished surface elsewhere unless otherwise indicated.

3.8 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.10 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.11 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains.
- B. Make connections to existing piping and underground manholes.

- 1. Use commercially manufactured fittings for piping branch connections. Remove section of existing pipe; install fitting into existing piping; and encase entire fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
- 2. Make branch connections from side into existing piping, NPS 4 to NPS 10. Remove section of existing pipe, install fitting into existing piping, and encase entire fitting with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
- 3. Make branch connections to manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
- 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.12 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Removing Piping
 - 1. Pipe indicated to be removed shall be excavated and removed from the project site and legally disposed according to City, State, and Federal regulations.
 - 2. Backfill trench and voids according to 31 2300 Excavation and Fill.
- B. Abandoned Piping
 - 1. Pipe indicated to be abandoned in place shall be filled with Portland Cement grout having a minimum twenty-eight (28) day compressive strength of five hundred pounds per square inch (500 psi).
- C. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 - 1. Remove manhole or structure and close open ends of remaining piping.
 - 2. Remove top of manhole or structure down to at least 48 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
 - 3. Backfill to grade according to 31 23 00 Excavation and Fill.

3.13 IDENTIFICATION

- A. Materials and their installation are specified in 31 23 00 Excavation and Fill. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for

leaks and defects.

- 1. Do not enclose, cover, or put into service before inspection and approval.
- 2. Test completed piping systems according to requirements of authorities having jurisdiction.
- 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
- 4. Submit separate report for each test.
- 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
 - b. Test plastic piping according to ASTM F 1417.
 - c. Test concrete piping according to ASTM C 924.
- C. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.15 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION

SECTION 33 4600 SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SUBDRAINAGE as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SUBDRAINAGE shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Perforated-wall pipe and fittings.
- B. Drainage conduits.
- C. Geotextile filter fabrics.

1.4 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 01 8113 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ Authority Having Jurisdiction
 - 1. Tahlequah Public Works Authority

1.6 ACTION SUBMITTALS

- A. Product Data:
 - 1. Drainage conduits, including rated capacities.
 - 2. Geotextile filter fabrics.
 - 3. Drainage aggregate.

1.7 DELIVERY, STORAGE, AND HANDLING

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
- C. PERMITS
 - 1. CONSTRUCTION MANAGER shall make application; pay permit fees; provide payment and performance bonds required of the CONSTRUCTION MANAGER by the AHJ.
- D. TOPOGRAPHIC SURVEY
 - OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.
- E. EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION
 - 1. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not

designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

F. UNDERGROUND UTILITIES

- 1. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- 2. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- 3. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- 4. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

G. CONSTRUCTION CONTROL

- 1. Do not commence work until temporary erosion and sedimentation control measures are in place.
- 2. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- 3. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

H. PROJECT CONDTIONS

- 1. TRAFFIC
 - a. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - b. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - c. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - d. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any

existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

- 2. UTILITY INTERRUPTIONS
 - a. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- 3. SUBSURFACE CONDITIONS
 - a. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

4. EXCAVATION AND TRENCH SAFETY SYSTEMS

- a. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.
- 5. HAZARDOUS CONDITIONS
 - a. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
 - 1. 3-inch through 24-inch: ASTM F 667, SCS 606, and AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. Fittings shall comply with ASTM F 667.
 - 3. Pipe material shall be high density polyethylene conforming with the minimum requirements of cell classification 424410C as defined and described in the latest version of ASTM D3350; or ASTM D1248 Type III, Class C, Category 4, Grade P33.
 - 4. Couplings: Manufacturer's standard, band type.
 - 5. Perforated PVC Sewer Pipe and Fittings: AASHTO M 278, ASTM D 2729, bell-and-spigot ends, for loose joints.
- B. SOLID WALL PIPES AND FITTINGS
 - 1. Solid Wall Pipes and Fittings shall be PE or PVC pipe according to the requirements of 33 4000 "Storm Drainage Utilities".

2.2 SOIL MATERIALS

A. Drainage Aggregate: Drainage aggregate shall be composed of hard, durable mineral particle free from organic matter, clay balls, soft particles and other impurities or foreign matter. The material shall conform to the following grading requirements:

Sieve No. or Size	Percent passing by weight
1-1/2 in.	100
¾ in.	50 to 100
No. 4	20 to 40
No. 16	7 to 20
No. 50	0 to 5
No. 100	0 to 2

B. Satisfactory Soils shall be according to 31 2300 "Excavation and Fill".

2.3 GEOTEXTILE FILTER FABRICS

- A. Geotextiles for pipe underdrain and drainage systems shall meet the requirements of AASHTO M 288, "Subsurface Drainage Geotextile Requirements." Geotextile shall be according to AASHTO M 288, Table 2, with from 15 to 50 percent of in-situ soil passing the No. 200 sieve.
- B. Geotextiles shall have a flow rate range from 110 to 330 gpm/sq. ft, when tested according to ASTM D 4491.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
- Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.3 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated on Drawings and manufacturer's requirements.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 6 inches.
- J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.4 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

- E. Install drainage piping as indicated on Drawings and manufacturer's requirements.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.5 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated on Drawings and manufacturer's requirements.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 6 inches.
- I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.6 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
 - 2. Underslab Subdrainage: Install piping level.
 - 3. Retaining-Wall Subdrainage: When water discharges at end of wall into storm water piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
 - 4. Lay perforated pipe with perforations down.
- B. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- C. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- D. Install thermoplastic piping according to ASTM D 2321.

3.7 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.
- B. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, pushon joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.8 BACKWATER VALVE INSTALLATION

- A. Comply with requirements for backwater valves specified in Section 33 40 00 Storm Drainage Utilities.
- B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
- C. Install horizontal backwater valves in manholes or pits where indicated.

3.9 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 33 4000 Storm Drainage Utilities.
- B. Cleanouts for Subdrainage:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser

extensions to clean-out. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.

- 3. In non-vehicular-traffic areas, use NPS 4 cast-iron pipe and fittings for piping branch fittings and riser extensions to clean-out. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.
- 4. Comply with requirements for concrete specified in Section 32 13 00 Rigid Paving.
- C. Cleanouts for Underslab Subdrainage:
 - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.10 CONNECTIONS

A. Comply with requirements for piping specified in Section 33 4000 Storm Drainage Utilities. Drawings indicate general arrangement of piping, fittings, and specialties.

3.11 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in 31 2300 Excavation and Fill.
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.
 - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
 - 2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.13 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION