EXHIBIT B - SCOPE OF SERVICES

The parties agree that the Design-Builder's Scope of Services for Final Design and Construction Services includes and is limited to the following:

2.1 Project Management:

(1) Design-Builder will host monthly project update meetings and will provide meeting minutes with updated Action Item log.
(2) Design-Builder will host a weekly on-site construction coordination meeting with Owner to document work completed the past week, planned work for the next week and key interfaces between Design-Builder and Owner.
(3) Design-Builder will provide a monthly invoice that includes the following:
    (a) AIA Payment application with approved schedule of values and based on percent complete.

2.2 Engineering Services:

(1) Progress the design to Issued for Construction (IFC) and produce a deliverable for the Owner's review. The IFC drawings and specifications will include feedback from Owner's previous review of the Pre-Final documents.
(2) Complete 'Application for Construction Permit-Wastewater Treatment Facility (MO 780-1289). Submit one stamped hardcopy and stamped digital copy of plans and specifications and all change orders to MDNR for review and approval.
(3) Review and approve compliance submittals for equipment and materials to be incorporated into the Work. PDF versions of the final approved ("A" status) equipment submittals will be provided to Owner for Owner's information and records.
(4) Provide engineering submittal management associated with submittals throughout the construction period.
(5) Review third party test reports for equipment and materials to be incorporated into the project.
(6) Provide clarification and interpretation of the Issued for Construction design documents throughout the construction period. (Respond to Requests for Information [RFIs])
(7) Revise Issued for Construction design documents as needed to support major changes in scope during construction.
(8) Prepare a PDF set of Conformed As-Constructed design documents incorporating changes made to the Issued for Construction design documents during the construction process.
(9) Complete Arc Flash Hazard Study for new electrical gear and provide labels and documentation for proper PPE selection.

2.3 Procurement:

(1) Issuance and subsequent execution of supplier/vendor purchase orders.
(2) Receive, review, and process supplier/vendor payment applications, in accordance

with the terms of the purchase orders.

(3) Perform supplier/vendor purchase order administration including the review and processing of RFIs, potential change order requests, change orders, etc.
(4) Manage equipment and material deliveries as needed to facilitate the project schedule.
(5) Review equipment and materials delivered to the site for compliance with the IFC documents and approved submittals prior to being implemented to the Work.

2.4 Construction Services:

(1) Facilitate site preconstruction conference.
(2) Conduct weekly construction coordination meetings with subcontractors.
(3) Receive, review, and process subcontractor payment applications.
(4) Perform subcontract administration including the review and processing of RFIs, potential change order requests, change orders, etc.
(5) Manage Subcontractors to construct installation of the Work in accordance with the Contract Documents.
(6) Third party services, including surveying and materials testing.

2.5 Commissioning & Start-up:

(1) Design-Builder will lead all commissioning and start-up activities as required in the IFC documents in collaboration with the Owner, key equipment suppliers and subcontractors.
(2) Design-Builder will prepare an Operations and Maintenance (O&M) manual for the improvements.

EXHIBIT C – ASSUMPTIONS, CLARIFICATIONS & EXCLUSIONS

GENERAL / COMMERICAL

1. The Scope of Services, Contract Time and Contract Price are based on Exhibit K – Pre-Final Design Documents.
2. The Contract Price and Contract Times are based on the Contract being executed and Notice to Proceed issued on or before April 13, 2023.
3. The Contract Price and Contract Times are based on a standard 5-day week working 8 hours per day.
4. Taxes including sales, use, or special use on permanent equipment and materials is not included as a Tax Exemption Certificate has been provided by Owner to Design-Builder.
5. American Iron and Steel requirements are not included. The Missouri Domestic Products Law does apply and is presumed to apply only to final assembly in the United States, not sourced raw material. The Contract Price and Contract Times assume that a variance to this requirement will be granted for the following items: submersible pumps, various instruments, ductile pipe, ductile fittings, hardware, gaskets, megalugs, variable frequency drives, panelboards, transformers, and breakers. These items are either not readily available domestically or procuring them domestically would be cost and/or schedule prohibitive. If the items listed above are required to be procured domestically, it will be considered a change in the Work, and subject to adjustments to the Contract Price and Contract Times.
6. Labor rates for all craft labor are based upon Missouri Division of Labor Standards Wage and Hour Section, Annual Wage Order No. 29 for Greene County Missouri, dated March 10, 2022, Building Construction Rates, attached herein. Federal Davis-Bacon wage and fringe rates are not included.
7. COVID-19. The uncertainty and potential disruptions to the labor force and supply chain caused by the global outbreak and spread of COVID-19 (“coronavirus”) may have an impact on this Project, the exact cost and duration of which Design-Builder can neither predict nor control. Government orders and restrictions may also delay or prevent performance as anticipated. Design-Builder will be granted with a period of relief in performance and appropriate cost relief where circumstances arise that are beyond Design-Builder’s control, including COVID-19 related events. To the extent applicable, the doctrines of “commercial impracticability” or “frustration of purpose” under the Uniform Commercial Code may also excuse performance if delivery pursuant to our contract’s terms has been made “impracticable” by the occurrence of a contingency, the non-occurrence of which both parties assumed when the contract was made. At this time, it is impossible to foresee or to predict the full impact of COVID-19 around the world and, therefore, have not included price or schedule contingency specifically for COVID-19.
8. The Contract Times are based on current lead times provided by the equipment and material suppliers. If these lead times are impacted by supply chain issues, the Design-Builder may request an increase in the Contract Time and price.

9. Owner's contingency, Owner's allowances, or Owner's other costs are not included in the Contract Price.
10. Performance & Payment Bonds are included.
11. Builder's Risk Insurance is included.
12. Spare parts are not included, unless called out in the Exhibit K – Pre-Final Design Documents.
13. Excludes charges for consumption fees for providing utility services (water, sewer). All consumption fees to be paid directly by Owner.
14. Owner will provide all water for construction and testing to Design-Builder at no cost.
15. Local Building Permit fees have not been included as it was assumed these fees would be waived by the Owner.
16. General Conditions assume CIP 3, CIP 6 and CIP 7 Phase 2 amendments are approved and running concurrent with this project.
17. After bid solicitation was complete, MDNR provided target requirements for MBE/WBE participation. The contract price is based on the best/most responsible bidder and does not meet the specific participation goals.

SITE CONSTRUCTION AND ACCESS

1. Owner will provide adequate material staging, parking, and lay-down space for use during construction at the treatment plant site. Design-Builder has included cost for installing stone for the laydown area, as well as restoring the disturbed area at Project Completion.
2. We have assumed excess spoils may be hauled to the Owner's site adjacent to the existing WWTP.
3. All fill required for the project will be obtained from the project site.
4. It is assumed that Design-Builder will not encounter any existing Hazards including, but not limited to, lead, asbestos, or contaminated soils. Mitigation/abatement of all existing hazardous substances is not included.
5. Seeding of disturbed areas is included. Landscape plantings or sodding are not included.
6. It is assumed groundwater will not be encountered in any excavations. Design-Builder has included pumping for precipitation water.
7. No provisions for restoration due to flooding within the regulatory floodplain or floodway are included in the work. Any delays or site access limitations will be considered a force majeure event in accordance with the General Conditions.
8. Design-Builder has assumed that the existing North creek crossing on site is adequate to support plant operations and construction traffic while the new South crossing is constructed. The construction of a secondary temporary crossing is not included.
9. No provisions for improvements and/or restoration of any off-site streets, right-of-ways, alleyways, or any other roadway for plant access to facilitate construction traffic and deliveries are included.

DEMOLITION

1. It is assumed that all trees, fencing, etc. as indicated on the Drawings for removal by Owner will be removed prior to mobilization.

PROCESS MECHANICAL & EQUIPMENT

1. Based on review of the bids received for the process equipment, Owner and Design-Builder have mutually agreed to using the following equipment manufacturers:
    a. Filters – Aqua-Aerobics (JCI)
    b. Screening Equipment – Parkson (Haynes)
    c. Submersible Pumps – JCI Industries, LLC (Flygt)
    d. Chem Feed – Grundfos/Snyder/March (JCI)
    e. Slide Gates and Actuators –HydroGate/Rotork (Mid America Valve)
2. The pumps will be factory painted.
3. It is assumed that all existing gates, valves, pumps, etc. to remain are operational.
4. It is assumed that the Owner will drain and remove remaining debris from the Peak Flow Clarifier as necessary for the work to be completed. Design-Builder has only included the cleaning and preparation of surfaces as required by the coating manufacturers.
5. Any chemicals required for the filter, etc. following substantial completion are not included.
6. Effluent water quality is based on the filter performance only. No warranty or guarantee is included for effluent water quality downstream of the combined filter/primary treatment. No costs for compliance sampling, permit violation fees, damages, etc. are included.
7. Work at the peak wet weather clarifier incudes painting of the mechanism, catwalk/bridge, launder trough, and interior basin wall. No grouting, mechanical improvements, etc. are included.

ELECTRICAL, INSTRUMENTATION, & CONTROLS

1. Based on review of the bids received for the Instrumentation, Control Panel, and System Integration scope of work, Owner and Design Builder have mutually agreed to use R. E. Pedrotti Inc. for instrumentation, and system integration.
2. Excludes any new security devices or systems (cameras, card readers, etc.)
3. Bar screens will include a local screen only until the future MBR project when remote monitoring/control will be added.

COMMISSIONING & START-UP

1. Performance testing of the Cloth-Media Disc Filtration equipment will require operation during an acclimation period. This equipment is meant to be utilized during Wet Weather events. Since this performance test is weather dependent, completion of the performance test will not be a condition of Substantial Completion. Completion of the performance test will be a condition of Final Completion.
2. SCADA upgrades assume the existing plant AVEVA Wonderware HMI software is to be updated with new screens and that the existing licenses are properly sized. No new Wonderware software licenses or upgrades are included. Additionally, Design-Builder has assumed the existing AVEVA Wonderware Historian and Dream Reports software

licenses are adequately sized for updated reports. No new AVEVA Historian or Dream Report software licenses are included.

3. Design-Builder has assumed that the Owner will provide plant operations. Design-Builder will be responsible for the start-up and commissioning of all new processes, with the understanding that the Owner shall be responsible for operating the plant to facilitate these start-ups.
4. Hardware, software, and programming to mitigate issues with the existing network are not included.

EXHIBIT E – ANTICPATED LOST DAYS TO INCLEMENT / ADVERSE WEATHER

The chart below provides the days per month that the Design-Builder anticipates will be lost due to inclement / adverse weather. The days shown in this Exhibit B shall not accumulate month-to-month, but are to be used for determining only the anticipated adverse weather in a given month. Adverse Weather shall be as defined in Article 6 of the Agreement.

Anticipated Lost Days per Month	
Month	**Anticipated Lost Days**
January	2
February	2
March	1
April	2
May	3
June	3
July	2
August	2
September	2
October	2
November	1
December	1

EXHIBIT G – ALLOWANCES

The parties have agreed to establish the following Allowance Items and Allowance Values. Allowance items are elements of work that are identified to potentially occur, but it cannot be determined if they will occur or the magnitude of the occurrence, so they are not included in the Design-Builder's current Scope of Work. The Allowance Value is the value which the parties have agreed to establish for an Allowance Item in accordance with Article 7.7 of the Agreement.

If Allowances are utilized, the Design-Builder shall be compensated for its costs and the Design-Builder's markup. Design-Builder and Owner shall agree to the compensation method prior to work being performed. It is noted that use of an Allowance may also require a schedule adjustment in certain situations.

1. Fatty Clay and/or Other Unsuitable Subgrade Bearing Material - Over-Excavation and Replacement Fill, $50,000: This Allowance Item is established to fund the over-excavation and replacement of unsuitable fatty clays and/or other unsuitable existing bearing materials, with acceptable fill material at locations to include, but not limited to, new structure foundations, slabs, pads, paving, pipe trenches, ductbanks, etc. as recommended by the third-party testing services firm.

2. Rock Excavation and/or Karst encountered, $75,000: This Allowance Item is established to fund the excavation of rock and/or karst if encountered at excavations, including any over-excavation and material replacement associated with rock and/or karst. The geotechnical explorations did not indicate that rock and/or karst would be encountered at the planned design elevations, however there is the potential to encounter these items. If encountered, the third-party services testing firm will be engaged to provide recommendations on limits of excavation/removal and any replacement material required.

3. Precast Concrete Wall Sealer, $30,000: This Allowance Item is established to fund the sealing of the exterior of the vertical precast walls at the Filter and Disinfection Building. This item includes furnishing and applying the sealer per manufacturer recommendations, including all surface preparation.

4. Existing SCADA Upgrades, $50,000: This Allowance Item is established to fund work required to mitigate issues with the existing network and migrate the existing SCADA software to new hardware at the WWTP. Proposed solutions as coordinated with the City would mitigate existing network connectivity errors and modernize the existing system to support future expansion. Items contemplated to be included under this allowance include:
    a. Wall Mount Rack and 1200VA UPS.
    b. Remove existing network switch and install and configure new switch in the existing Admin Building Main PLC Panel.
    c. Install and configure updated Wonderware software on newly configured Server VM.
    d. Onsite implementation, integration, and testing of updated Wonderware software, including onsite training.
    e. Electrical installation to support modifications, including a dedicated 120V outlet

and a CAT 6 ethernet cable to the Wall Mount Rack.

The allowance budget does not include furnishing a new SCADA Server, a Stratix 5700 Ethernet Switch, or VM licenses.

5. Temporary Alum Feed at Peak Flow Clarifier for Filter Influent, $50,000: This Allowance item is established to fund furnishing and installing a temporary alum feed system at the Peak Flow Clarifier to improve the disc filter performance if needed. The MBR project will include a permanent alum feed, and the intent of this allowance item is to fund furnishing and installing a temporary system. System to include providing power to the system as needed, chemical feed pump, chemical tote, chemical supply, and interconnecting piping components.

6. Unforeseen Conditions, $25,000: This Allowance Item is established to fund differing site conditions that may be encountered through execution of the work. Examples of these items include, but are not limited to, the presence of unmarked utilities or existing utilities that were not previously identified in the Contract Documents, actual existing tie-in locations differ from what is shown on the Contract Documents, unforeseen underground obstructions that have not been previously identified, additional work at tie-in locations due to poor quality of existing piping, inoperable/malfunctioning existing valves, slide gates, etc.

7. Off-Site Plant Access Road Improvements/Repairs, $30,000: This Allowance Item is established to fund improvements and/or repairs to off-site plant access roads, from Hwy 174 North to the existing plant entrance gate, to facilitate construction traffic. Examples of improvements/repairs intended to be funded through this allowance include, but are not limited to, filling of potholes, widening turn-ins, filling ruts, etc. Design-Builder and Owner to establish an acceptable construction traffic routing plan to minimize impacts to existing roads.

EXHIBIT H – PERMIT & EASEMENT MATRIX

The project is anticipated to require the permits listed in Table 1 and the Easements listed in Table 2.

Table 1: Anticipated Permits Required

Anticipated Permit	Administering Agency	Assumed Agency Review Timeline	Party Responsible for Obtaining Permit
Nationwide Permit/State Water Quality Certification (Section 404/401 Permit – Wetlands Permit)	USACE/MDNR	60 days	BMcD
Floodplain Development Permit	Greene County	30-60 days	BMcD
NPDES General Stormwater Permit	MDNR	Permit issued after NOI is submitted electronically	BMcD (SWPPP has been drafted)

Table 2: Anticipated Easements Required

Parcel ID/Address	Approximate Size (SF)	Type	Party Responsible for Obtaining Easements

All work is within City of Republic owned property and no easements are required.

EXHIBIT I – GEOTECHNICAL SOILS REPORT

Geotechnical Engineering Report

Republic Wastewater Treatment Plant Improvements
Revision No. 1
Republic, Missouri
August 19, 2022
Terracon Project No. B5205029/B5215111

Prepared for:
Burns & McDonnell Engineering Co.
Kansas City, Missouri

Prepared by:
Terracon Consultants, Inc.
Springfield, Missouri

August 19, 2022

Burns & McDonnell Engineering Co.
9400 Ward Parkway
Kansas City, Missouri 64114

Attn: Ms. Allison White, P.E.
P: (314) 328 5431
E: alwhite@burnsmcd.com

Re: Geotechnical Engineering Report
Republic Wastewater Treatment Plant Improvements
Revision No. 1
408 N. West Ave. – Northwest of Wade Street Intersection
Republic, Missouri
Terracon Project No. B5205029/B5215111

Dear Ms. White:

We have completed a subsurface exploration and geotechnical engineering exploration for the referenced project. This study was performed in general accordance with Burns & McDonnell Engineering Co. (BMcD) Work Authorization TRCN366G, dated September 18, 2020 and Amendment to Work Authorization TRCN366G, dated January 21, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

David A. Williams, P.E.
Project Engineer

Kole C. Berg, P.E.
Principal/Senior Consultant
Missouri: PE-2002016417

REPORT TOPICS

INTRODUCTION 1
SITE CONDITIONS 1
PROJECT DESCRIPTION 2
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Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

FIGURES

GEOMODEL
10-POINT SYSTEM EVALUATION TABLE

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION, BORING LOCATION AND EXPLORATION PLANS
GEOLOGIC MAP
EXPLORATION RESULTS
ROCK CORE PHOTOGRAPHS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

A geotechnical exploration has been performed for the proposed Republic Wastewater Treatment Plant Improvements located at 408 N. West Ave. in Republic, Missouri. In 2020, twelve (12) borings, designated B-1 through B-8, B-2A, B-4A, B-5A, and B-7A, were performed to depths of approximately 25½ to 64½ feet below the existing ground surface. In 2022, twelve (12) borings, designated B-11 through B-22, were performed to depths of approximately 18½ to 50 feet below the existing ground surface. The following geotechnical considerations were identified:

- A previous geotechnical investigation (Geotechnical Engineering Report, Republic Wastewater Treatment Plant Improvements, dated December 18, 2020, Terracon Project No. B5205029) was performed near the additional planned improvements. Information from the previous geotechnical investigation has been incorporated into this Geotechnical Engineering Report.

- The subject site is located within karst prone bedrock material. During the 2020 field exploration of Boring B-5, a sudden loss of drilling fluid and limited drilling resistance were noted from depths of approximately 25 to 32 feet below the ground surface. These conditions are associated with the presence of voids and soft clay seams in the underlying limestone and are an indication of karst activity.

- Demolition of the existing buildings should include removal of all above-grade and below-grade elements including floor slabs, foundation walls, and footings. All existing utilities should also be properly abandoned and/or relocated. This should include removal of all poorly compacted trench backfill extending into the proposed building area. Excavations created by demolition and removal of existing features should be backfilled with engineered fill that is placed and compacted as recommended in this report.

- Existing undocumented fill was encountered to depths ranging from approximately 2 to 10 feet in Boring B-1, B-3 through B-7, B-4A, B-5A, B-11, B-16, B-20, and B-21. Foundations for the proposed building should not bear on or above the undocumented fill materials. Any existing fill should be removed and replaced (or improved) so foundations and floor slabs for the building bear on suitable native soils or on properly placed and compacted engineered fill extending to the suitable native soils.

- Provided the owner is willing to accept the risks associated with supporting pavements over the existing fill materials in exchange for reduced construction costs, portions of the existing fill could be left in place for support new pavements. At least 12 inches of new engineered fill should be placed directly below the pavements with this option.

- Soils with liquid limits over 45 percent were encountered in the soil exploration program and are prone to volume change with variations in moisture content. The fat clay (CH) soils encountered in the soil exploration program (both as undocumented fill materials and native soils) are high in plasticity and prone to volume change with variations in moisture content. For this reason, we recommend a 24-inch thick Low Volume Change (LVC) zone be maintained or constructed beneath grade-supported floor slabs.

- Some relatively high moisture content soils were encountered in the upper levels of some of the borings, and these soils may be exposed in excavations and cuts. These soils may become unstable when disturbed. During periods of dry weather, these soils may be stable upon initial exposure; however, these soils, if exposed, may become relatively soft and unstable under construction traffic. We recommend that the owner budget for the possibility that overexcavation and/or subgrade stabilization may be required and contractors be prepared to handle potentially unstable and/or soft conditions.

- Based on our borings and seismic refraction survey, the International Building Code (IBC) seismic site class for this site is C.

The professional opinions and recommendations presented in this report are based on evaluation of data developed by testing discrete samples obtained from widely-spaced borings. Site subsurface conditions have been inferred from available data, but actual subsurface conditions will only be revealed by excavation. So that variations in subsurface conditions which may affect the design can be addressed as they are encountered, we recommend that Terracon be retained to observe excavations and perform tests during the site preparation, earthwork and foundation construction phases of the project.

This executive summary should not be separated from or used apart from this report. This report presents fully developed recommendations and opinions based on our understanding of the project at the time the report was prepared. The report limitations are described in the **General Comments** section of this report.

Geotechnical Engineering Report

Republic Wastewater Treatment Plant Improvements
408 N. West Ave. – Northwest of Wade Street Intersection
Republic, Missouri

Terracon Project No. B5205029/B5215111

August 19, 2022

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Republic Wastewater Treatment Plant Improvements to be located at 408 N. West Ave. – Northwest of Wade Street Intersection in Republic, Missouri. In 2020, twelve (12) borings, designated B-1 through B-8, B-2A, B-4A, B-5A, and B-7A, were performed to depths of approximately 25½ to 64½ feet below the existing ground surface. In 2022, twelve (12) borings, designated B-11 through B-22, were performed to depths of approximately 18½ to 50 feet below the existing ground surface. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil (and rock) conditions
- Groundwater conditions
- Site preparation and earthwork
- Excavation considerations
- Dewatering considerations
- Demolition considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site class
- Lateral earth pressures
- Pavement design and construction

Maps showing the site and boring locations are shown in the **Site Location**, **Boring Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate pages in the **Exploration Results** section.

The **General Comments** section provides an understanding of the report limitations.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 408 N. West Ave. – Northwest of Wade Street Intersection in Republic, Missouri. The approximate coordinates of the site are: Lat.: 37.1426° N Long.: 93.2659° W (See **Site Location**)
Existing Improvements	Existing wastewater treatment facility
Current Ground Cover	Bare ground, native grasses, and asphalt pavements (access roads)
Existing Topography	A site topographic plan was not provided. Current grades at the site are relatively flat with drainage to towards Dry Branch Creek near the middle of the site.

PROJECT DESCRIPTION

Our initial understanding of the project along with associated recommendations were provided in our previous geotechnical investigation (Geotechnical Engineering Report, Republic Wastewater Treatment Plant Improvements, dated December 18, 2020, Terracon Project No. B5205029) and was discussed in the current project planning stage. A period of collaboration has transpired since the previous geotechnical investigation was completed, and our final understanding of the project is as follows:

Item	Description
Project Description	Improvements to the existing Wastewater Treatment Facility
Grading/Slopes	Terracon assumes up to 25 feet of cut and 5 feet of fill may be required to develop final grades. Terracon understands final slope angles no steeper than 3H:1V (Horizontal:Vertical) are planned.
Below-Grade Areas	Some structures are anticipated to have walls extending 22 feet below grade.
Pavements	New pavements will be constructed. We assume both rigid (concrete) , flexible (asphalt) pavement, and gravel access road sections should be considered. Anticipated traffic information for the following categories (vehicles per day) should be provided by the client: ■ Autos/light trucks ■ Light delivery and trash collection vehicles ■ Tractor-trailer trucks The pavement design period is 20 years.

Proposed Structures	**Blending:** Transfer Pump Station Valve Vault – 20’ Square – Reinforced Mat Foundation Filter Splitter Structure – 17’x12’ – Reinforced Mat Foundation Filter Building – 70’x50’ – Wall Footing with Slab-on-Grade Disinfection Building – 70’x25’ – Reinforced Mat Foundation on Perimeter Grade Beam **Membrane Bioreactor (MBR):** Influent Pump Station Vault – 22’ Square – Reinforced Mat Foundation Grit Removal and Fine Screening Building – 70’x45’ – Reinforced Mat Foundation Chemical Feed Building – 50’x35’ – Reinforced Mat Foundation on Perimeter Grade Beam Process Splitter – 30’x12’ – Reinforced Mat Foundation Process Basins – 200’x160’ – Reinforced Mat Foundation MBR Basin – 80’x40’ – Reinforced Mat Foundation MBR Building – 80’x40’ – Reinforced Mat Foundation Digester 4 – 86’ diameter – Reinforced Mat Foundation Dewatering Building – 80’x40’ – Wall Footing with Slab-on-Grade Administration Building – 125’x65’ – Wall Footing with Slab-on-Grade Electrical Building – 75’x25’ – Wall Footing with Slab-on-Grade Miscellaneous Structure for Various Equipment – Reinforced Mat Foundation
Foundation and Slab Bearing Elevations	Transfer Pump Station – 1239 feet Influent Pump Station – 1232 feet Process Basins – 1262 feet MBR Basin – 1260 feet MBR Building – 1259 feet Digester 4 – 1248 feet Slab bearing elevations of remaining structures listed in Proposed Structures are planned to be within 1 to 2 feet of existing ground surface

Maximum Loads (Provided by B&M)	**Blending:** Transfer Pump Station – 2.5 ksf bearing Filter Splitter Structure – 2.0 ksf bearing Filter Building – 6.5 klf strip Disinfection Building – 4.0 klf strip **Membrane Bioreactor (MBR):** Influent Pump Station Vault – 3.0 ksf bearing Grit Removal and Fine Screening Building – 3.5 ksf bearing Chemical Feed Building – 2.5 klf strip Process Splitter – 1.5 ksf bearing Process Basins – 2.5 ksf bearing MBR Basin – 2.0 ksf bearing MBR Building – 3.0 ksf bearing Digester 4 – 2.0 ksf bearing Dewatering Building – 80'x40' – 6.0 klf strip Administration Building – 125'x65' – 4.0 klf strip Electrical Building – 75'x25' – 4.0 klf strip Miscellaneous Structure for Various Equipment – <1.0 ksf bearing

GEOLOGIC SETTING

The project site is located in the Springfield Plateau subsection of the Ozark Highlands Physiographic Province of Missouri. This province is characterized by gently rolling to nearly level upland areas dissected by stream and river valleys, underlain primarily by carbonate rocks (limestone and dolomite).

The project site is mapped as being underlain by the limestone and dolomite of the Osagean Series carbonate rocks, dated to the Early Mississippian Geologic Period. The Osagean series in southwestern Missouri consists of the Keokuk Limestone, Burlington Limestone, Elsey Formation, Reeds Spring Formation, and Pierson Limestone, and is up to 400 feet in thickness. Due to a lack of exposed bedrock at the surface of the site, the mapped geology cannot be verified.

The Osagean Series carbonate rocks are known to form a widespread karst terrain, a landform characterized by closed depressions, sinkholes, cave entrances, sinking streams, and a highly irregular "pinnacled" bedrock/soil interface. The karst landform is the consequence of the presence of soluble bedrock.

Specifically, the project site is mapped as being underlain by the Osagean Series, see **Geologic Map**.

REVIEW OF AVAILABLE RECORDS

The following records were reviewed:

- Google Earth, Historical Aerial Photographs;
- USGS Earth Explorer, Historical Aerial Photographs, https://earthexplorer.usgs.gov/;
- USGS Topoview, Historical Topographic Maps, https://ngmdb.usgs.gov/topoview/;
- Greene County, MO, GIS Data Viewer, https://greenecountymo.gov;
- City of Springfield, MO, GIS Data Viewer, https://www.springfieldmo.gov;
- Missouri State University, Digital Library, http://digitalcollections.missouristate.edu/;
- Missouri Department of Natural Resources, GeoStrat, http://dnr.no.gov/geostrat/;

Several karst features and potential karst features were identified during our document review and review of previous Terracon projects on adjacent properties. Based on our review of the above resources, a documented sinkhole is present in the southeastern portion of the property see **Geologic Map**.

Our review of records included reviewing aerial photographs from 1936, 1959, 1964, 1968, 1970, 1978, 1979, 1990, 1997, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2013, 2015, 2017, 2019, and 2020. Additionally, our records review included reviewing USGS 7.5-minute quadrangle historical topographic maps from 1936, 1960, 1968, 1971, 1976.

Historical aerial photographs and historical topographic maps dating as far back to 1936 indicate that the subject site remained undeveloped prior to 1959, when sewage disposal structures appear directly south of project site. Documentation indicates that the site was underwent changes where parts of the site was zoned as a land fill prior to 1968. Additions to the existing wastewater treatment plan can be seen through the years up until the 2003 aerial photograph, where no changes are observed through the latest aerial photograph reviewed by Terracon in 2022.

SITE RECONAISSANCE

On October 6, 2020, Joshua Elson, R.G., of Terracon visited the property to observe surface conditions for potential karst activity. At the time of the site visit, the ground surface was predominately maintained lawn around the existing wastewater treatment plant structures. No areas of subsidence or depressions were observed at the time of the site visit. Additionally, on June 21, 2022, Ripken Dodson, E.I., of Terracon visited the property to observe surface conditions for potential karst activity. At the time of the site visit, the ground surface in the area of the proposed treatment plant addition was bare, partially graded, exposed soil. No areas of subsidence or depressions were observed at the time of the visit.

GEOPHYSICAL RESULTS

Karst Conditions

The subject site is located within karst prone bedrock material. During the exploration of Boring B-5, a sudden loss of drilling fluid and limited drilling resistance were noted from depths of approximately 25 to 32 feet below the ground surface. These conditions are associated with the presence of voids and soft clay seams in the underlying limestone and are an indication of karst activity.

Karst development in this area occurs from the dissolution of the native limestone bedrock material. Over time, groundwater can transport the surrounding soil into bedrock voids causing visible surface features such as circular depressions or areas of drainage. However, some sinkholes may not be readily visible from the surface because they are plugged or capped with a thin layer of rock. Maintaining and managing adequate storm water drainage is important within karst prone areas, as described in the **Grading and Drainage** section. The image below, provided by MDNR, depicts the development of sinkholes over time.

Image courtesy of MDNR

Though no evidence of sinkholes was noted during the 2020 and 2022 site reconnaissance visits, the development of karst features on the site is a possibility over time. The current state of the practice in geotechnical engineering does not allow for the accurate prediction of when or where sinkholes or karst-related subsidence could occur. The owner is advised that construction on this

property or essentially any other site within this area, carries with it some risk that future sinkholes may develop.

MASW Interpretations

Terracon performed Multi-Channel Analysis of Surface Waves (MASW) seismic surveys was to identify potential kart-related features to direct the subsequent geotechnical exploration. The locations of our MASW survey lines are shown on the **Geophysical Site Plan**, and a description of the MASW method is provided in the **Exploration and Testing Procedures** section of this report.

The velocity at which the surface waves propagate is related to the shear modulus of the material through which it passes; therefore, allowing us to constrain the location(s) of potentially weak, soft, or saturated subsurface conditions consistent with the presence of karst-related features. The 2D images provided on the **MASW Profiles** present the shear wave velocity, respectively, as a function of distance in the horizontal direction and depth. It should be noted that the seismic velocity characteristics of soils and rocks can be similar; thus, the transition between material types may be gradual. The occurrence of the different soil types, and their consistencies and densities encountered in the borings are consistent with the range of shear wave values shown in the table below.

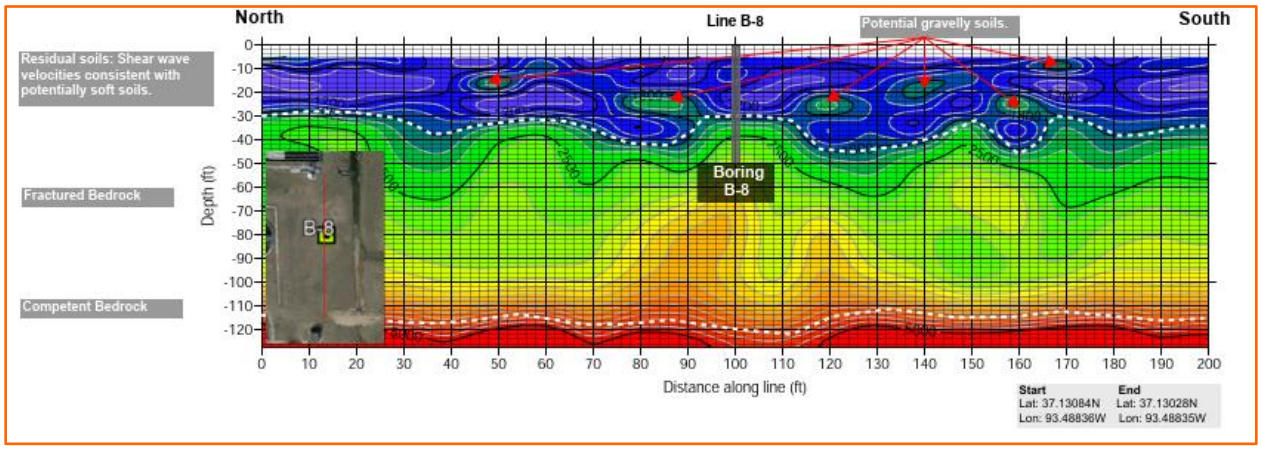
Site Class	Soil Profile	Shear Wave Velocity (ft/s)
A	Hard rock	$V_s > 5,000$
B	Medium hard rock	$3,000 < V_s \leq 5,000$
BC	Soft Rock	$2,100 < V_s \leq 3,000$
C	Very dense sand or hard clay	$1,450 < V_s \leq 2,100$
CD	Dense sand or very stiff clay	$1,000 < V_s \leq 1,450$
D	Medium dense sand or stiff clay	$700 < V_s \leq 1,000$
DE	Loose sand or medium stiff clay	$500 < V_s \leq 700$
E	Very loose sand or soft clay	$V_s \leq 500$

Based on the MASW shear wave data we identify three layers as a part of our subsurface profile:

- **Residual soils**: from the surface to depths of about 20 to 50 feet below site grade (bsg)
- **Fractured bedrock**: from about 30 to 100 feet bsg
- **Hard bedrock**: from about 80 to 100 feet bsg

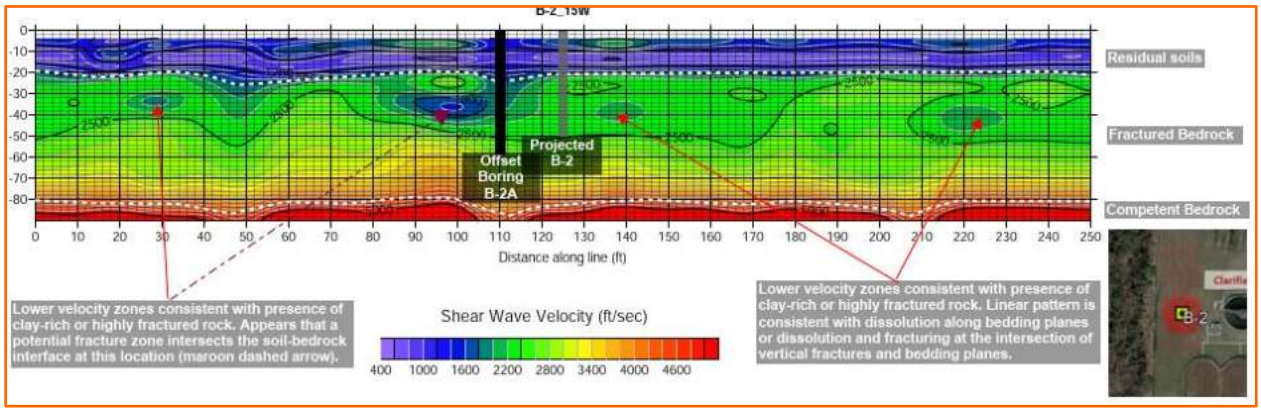
Shear wave velocities within the residual soils are characterized by shear wave velocities from less than 600 ft/s to about 1,200 ft/s consistent with the presence of soils characterized as soft to stiff. Areas of locally higher shear wave velocities relative to the surrounding materials were observed and are consistent with the presence of harder materials within the residual soil layer.

Thus, we anticipate that excavations within the residual soil layer may encounter cobbles and boulders (e.g., Line B-8 in figure below).



MASW Profile at Boring B-8 – areas with shear wave velocities greater than surrounding soils in the residual soil layer are consistent with the presence of high gravel content soils, cobbles or boulders.

Local low velocity zones (LVZs) are observed at a depth of about 40 to 50 feet within the highly to moderately weathered bedrock unit. The shear wave velocities and distribution of the LVZs are consistent with the presence of highly fractured bedrock potentially at locations where subvertical fractures intersect a weathered bedding plane. Some of these LVZs appear to extend up to the residual soil-fractured bedrock interface. It is possible that these fracture zones serve as fluid conduits and have higher clay contents than the surrounding rock mass, which would contribute to the observed lower velocities. It is important to note that the velocities of the LVZs vary from about 1,200 to 2,200 ft/s consistent with the presence of materials characterized as “very dense soil and soft rock”; therefore, our initial interpretation of the LVZs did not characterize these locations as voids. Four (4) additional borings were advanced at locations were LVZ anomalies were observed (e.g., offset Boring B-2A shown in the figure below). Our observations from these borings are consistent with our interpretation of the MASW data.



MASW Profile at Boring B-2 15W – an additional boring was offset approximately 15 feet south of boring B-2 to explore one of the LVZs located at a depth of about 30 to 40 feet and extending up to the residual soil-fractured bedrock interface.

The results of the geophysical and subsequent geotechnical exploration are consistent with some karst-related features such as variable bedrock surface topography and highly weathered fractures and bedding planes. The results are not consistent with the presence of voids, caves, etc. at locations of the proposed structures; however, construction on this property or other sites within this area, carries with it some risk that future sinkholes may develop.

A description of the subsurface materials, their occurrence across the site, and how their impact of constructability and design are presented in the following sections.

GEOTECHNICAL CHARACTERIZATION

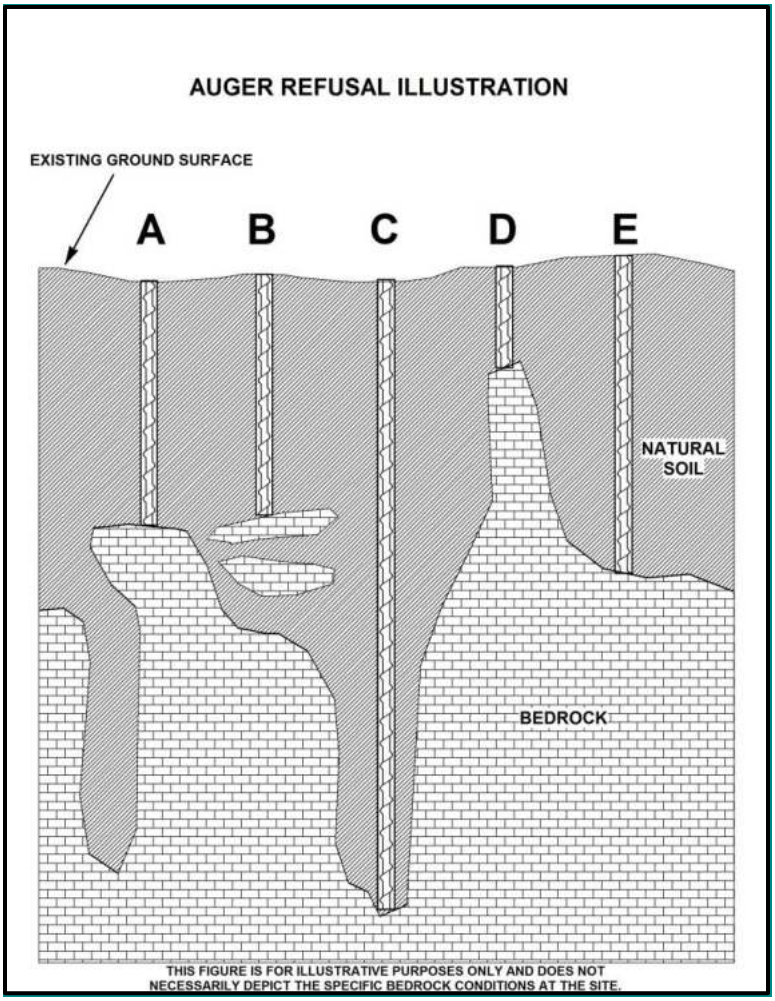
We have developed a general characterization of the subsurface conditions based upon the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical evaluation. Conditions encountered at each boring location are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Surficial Materials**	Topsoil and exposed fill materials or residual soils
2	**Fill**	Lean to fat clay (CL or CH) with varying amounts of gravel and sand or clayey gravel with varying amounts of clay and sand
3	**Residual Soils**	Lean to fat clay (CL or CH) with varying amounts of gravel and sand or gravelly soils with varying amounts of clay and sand
4	**Limestone**	Highly to slightly weathered

Auger refusal is defined as the depth below the ground surface at which a boring can no longer be advanced with the soil drilling technique being used. Auger refusal is subjective and is based upon the type of drilling equipment used, the types of augers used, and the effort exerted by the driller. Auger refusal can occur on the upper surface of discontinuous bedrock (A), slabs of unweathered rock suspended in the residual soil matrix or "floaters" (B), in widened joints that may extend well below the surrounding bedrock surface (C), on rock "pinnacles" (D) rising above

the surrounding bedrock surface, or on the upper surface of continuous bedrock (E). These possible auger refusal conditions are illustrated in the figure below. Linear interpolation of apparent bedrock elevations based upon the boring data is often used but can misrepresent actual rock removal quantities where anomalies exist, such as pinnacled rock, where rock could be shallower than that encountered in the borings. Additional borings, auger probes, test pits, or geophysical testing could be performed to obtain more specific bedrock information.



Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. In addition, delayed water levels were also obtained in some borings. The water levels observed in the boreholes are shown on the boring logs in **Exploration Results**, and are summarized below.

Boring Number	Approximate Depth to Groundwater while Drilling (feet) [1]	Approximate Depth to Groundwater after 24 hours (feet) [1]
B-2	16	12
B-8	22½	19
B-2A	14	19
B-4A	Not Encountered	21
B-7A	35	Not Encountered
B-11	35	Not Observed
B-12	22	Not Observed
B-14	20½	Not Observed
B-15	19½	Not Observed
B-17	16½	Not Observed
B-18	23	Not Observed
B-19	20	Not Observed
B-20	18½	Not Observed
B-22	23	Not Observed

1. Below ground surface

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be different than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

General

We recommend that the exposed subgrade be thoroughly evaluated after stripping of any topsoil and at the base of all cut areas, and prior to the start of any fill operations. We recommend that the Geotechnical Engineer be retained to evaluate the bearing material for the foundations and subgrade soils. Subsurface conditions, as identified by the field and laboratory testing programs, have been reviewed and evaluated with respect to the proposed project plans known to us at this time.

Anticipated Foundations

Due to the variable depth to bedrock across the site and the variance in the anticipated bearing elevation of each structure, we recommend that each structure be evaluated individually to

determine the most appropriate foundation system. Based on the anticipated bearing elevations, the anticipated maximum loads and the data that we have gathered in our exploration, we have provided a summary of the anticipated foundation system for each structure in the following table.

Planned Structure	Anticipated Maximum Load	Preliminary Bearing Elevation (feet)	Recommended Foundation Type	Recommended Bearing Material
Blending:				
Transfer Pump Station	2.5 ksf	1239	Mat Foundation and/or Drilled Shafts	Residual Clay or Competent Limestone at about elevation 1208½
Filter Splitter Structure	2.0 ksf	At Grade	Mat Foundation	Residual Clay and/or Engineered Fill
Filter Building	6.5 klf	At Grade	Strip Footings	Residual Clay and/or Engineered Fill
Disinfection Building	4.0 klf	At Grade	Strip Footings	Residual Clay and/or Engineered Fill
Membrane Bioreactor (MBR):				
Influent Pump Station Vault	3.0 ksf	1232	Mat Foundation	Residual Clay and/or Engineered Fill
Grit Removal and Fine Screening Building	3.5 ksf	At Grade	Mat Foundation bearing on ground improvement or Drilled Shafts	Competent Limestone at about elevation 1248
Chemical Feed Building	2.5 klf	At Grade	Mat Foundation on Grade Beam	Residual Clay and/or Engineered Fill
Process Splitter	1.5 ksf	At Grade	Mat Foundation	Residual Clay and/or Engineered Fill
Process Basins	2.5 ksf	1262	Mat Foundation	Residual Clay and/or Engineered Fill
MBR Basin	2.0 ksf	1260	Mat Foundation	Residual Clay and/or Engineered Fill
MBR Building	3.0 ksf	1259	Mat Foundation	Residual Clay and/or Engineered Fill
Digester 4	2.0 ksf	1253	Drilled Shafts	Competent Limestone at about elevation 1235
Dewatering Building	6.0 klf	At Grade	Strip Footings	Residual Clay and/or Engineered Fill
Administration Building	4.0 klf	At Grade	Strip Footings	Residual Clay and/or Engineered Fill
Electrical Building	4.0 klf	At Grade	Strip Footings	Residual Clay and/or Engineered Fill

Planned Structure	Anticipated Maximum Load	Preliminary Bearing Elevation (feet)	Recommended Foundation Type	Recommended Bearing Material
Miscellaneous Structure for Various Equipment	<1.0 ksf	At Grade	Strip Footings	Residual Clay and/or Engineered Fill

During the exploration of Boring B-5, a sudden loss of drilling fluid and limited drilling resistance were noted at a depth of approximately 25 to 32 feet below the ground surface. These conditions are associated with the presence of voids and soft clay seams in the underlying limestone. The extent and nature of the void cannot be determined without further investigation. With the presence of this void, Terracon recommends the mat foundation of Digester 4 be supported on drilled shaft foundations that bear beyond this depth into the competent limestone below the void and clay seam.

Demolition

Demolition of the existing structures should include removal of all above-grade and below-grade elements including floor slabs, foundation walls, and footings. Attention should be given to removing all loose or poorly compacted existing fill materials that are often located adjacent to existing and former foundation walls. All existing utilities should also be properly abandoned and/or relocated. This should include removal of all poorly compacted trench backfill extending into the proposed structure areas. In addition, care should be taken by contractors to protect all existing improvements to remain, such as pavements and utilities. Excavations created by demolition and removal of existing features should be backfilled with engineered fill that is placed and compacted as recommended in this report.

Existing Undocumented Fill

Existing undocumented fill was encountered to depths ranging from approximately 2 to 10 feet in Boring B-1, B-3 through B-7, B-4A, B-5A, B-11, B-16, B-20, and B-21. The fill could extend deeper in areas not explored. Existing undocumented fill should be observed, tested, and approved by Terracon. If indications of fill are found during the excavations, then the material should be treated as fill and the recommendations noted below should be considered. While the N-values obtained in the undocumented fill materials were generally equal to or higher than the existing native soils, no documentation or records regarding the placement of this fill were provided for our review. If records of the fill placement are available, Terracon should be provided with these documents to better assess the suitability of the existing fill.

Due to the clayey gravels at the subject site, differentiating between native materials and man placed fill in soil boring samples is difficult and, in many cases, impractical without documentation. The designation of possible fill has been given to materials that are suspected of being fill but no

definite indications of fill were noted in the sampling process. These materials should be carefully observed and inspected during excavations for indications of fill by a representative of Terracon. If indications of fill are found during the excavations, then the material should be treated as fill and the recommendations noted below should be considered.

Existing undocumented fill may contain soft or loose soil or other unsuitable materials; these conditions may not be disclosed by the widely-spaced, relatively small-diameter borings. If these conditions are present and are not discovered and addressed during construction, then larger than normal settlement resulting in cracking, differential movement, or other damage could occur in foundations, floor slabs, pavements, and utility lines supported on or above the existing fill. Typically, larger than normal settlement of floor slabs results in reflective cracking of overlying rigid floor coverings (if any), unlevel floors, and “bumps” at locations of differential movement.

Foundations and floor slabs for the new structures should not bear on or above the existing undocumented fill materials. The existing fill should be removed and replaced so that the foundations and floor slabs for the new structures bear on suitable native soils or on properly placed and compacted engineered fill extending to suitable native soils. If the fill is completely removed and replaced, it should be removed within the proposed structure footprint and extend at least 5 feet outside the building perimeter.

Provided the owner is willing to accept the risks associated with supporting pavements over the existing fill materials in exchange for reduced construction costs, portions of the existing fill could be left in place. To reduce the risk of adverse performance from higher settlement and to provide more consistent support for pavements, some portion of the existing fill should be removed and the exposed existing fill materials should be observed and tested during construction. Where unsuitable conditions are observed, the materials should be improved by scarification and recompaction or be removed and replaced with engineered fill. At least 12 inches of new engineered fill should be placed directly below the pavement sections with this option. However, even with the recommended subgrade preparation and construction testing, there is a risk to the owner that unsuitable material within or buried by the fill will not be discovered. If the owner is not willing to accept the risks of supporting pavements over existing fill materials, the existing fill should be completely removed and replaced.

Portions of the existing fill may be suitable for removal and reuse as an engineered fill material. If this material is used as an engineered fill material, it should be first evaluated by the materials testing firm to determine if it meets the requirements listed in **Material Requirements**. If the material will be used as fill it should be placed as described in **Compaction Requirements**.

Swell Potential

High plastic clays with liquid limits over 45 were noted in the Atterberg limits tests performed on selected samples. These materials are prone to volume change with seasonal fluctuations in moisture, which may lead to excessive shrinking and swelling of floor slabs and lightly-loaded structures. We recommend a low volume change (LVC) zone be constructed beneath the at-grade floor slab. Using an LVC zone as recommended in this report may not eliminate all future subgrade volume change and resultant floor slab movements. However, the procedures outlined herein should help to reduce the potential for subgrade volume change. Existing soils can be left in place and compacted if they are tested during construction and meet LVC material requirements. Details regarding this LVC zone are provided in the **Floor Slab** section.

This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and cracking in the structure could occur. The severity of cracking and other (cosmetic) damage such as uneven floor slabs will likely increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and distress may not be feasible, but it may be possible to further reduce the risk of movement if more extensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

Dewatering

Groundwater was encountered within the anticipated excavation depths at the site. The contractor should be prepared to dewater excavations for foundations and utilities that extend below the groundwater table, especially utility crossings within Dry Branch Creek. If seepage is encountered in excavations during construction, the contractor is responsible for designing, implementing, and maintaining appropriate dewatering methods to control seepage and facilitate construction. In our experience, dewatering of excavations in clay soils can typically be accomplished using sump pits and pumps. However, if seepage occurs within gravel layers or karst features are encountered excavations, a more extensive dewatering system may be required.

Soft Subgrade Potential

The subgrade soils may become unstable when disturbed. During periods of dry weather, these soils may be stable upon initial exposure, however, these soils could become relatively soft and unstable under construction traffic. Further, depending upon site conditions during construction, overexcavation or stabilization of the subgrade and/or base of overexcavations may be needed to achieve a suitable working surface. Accordingly, we recommend that the owner budget for the possibility that overexcavation and/or subgrade stabilization may be required, and contractors should be prepared to handle potentially unstable and/or soft conditions.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded, tandem-axle dump truck. The proofrolling should be observed by the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by following the recommendations in the **Subgrade Stabilization** section. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Subgrade Stabilization

Methods of subgrade improvement, as described below, could include scarification, moisture conditioning, and recompaction, and removal of unstable materials and replacement with granular fill (with or without geosynthetics). The appropriate method of improvement, if required, would be dependent on factors such as schedule, weather, the size of the area to be stabilized, and the nature of the instability. More detailed recommendations can be provided during construction as the need for subgrade stabilization occurs. Performing site grading operations during warm seasons and dry periods would help to reduce the amount of subgrade stabilization required.

If the exposed subgrade is unstable during proofrolling operations, it could be stabilized using one of the methods outlined below.

- **Scarification and Compaction** – It may be feasible to scarify, dry, and compact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soils. Stable subgrades likely would not be achievable if the thickness of the unstable soil is greater than about 1 foot, if the unstable soil is at or near groundwater levels, or if construction is performed during a period of wet or cool weather when drying is difficult.

- **Crushed Stone** – The use of crushed stone or gravel, such as MoDOT Type 5 or an approved alternate gradation of crushed limestone aggregate., is the most common procedure to improve subgrade stability. Typical undercut depths would be expected to range from about 6 to 30 inches below finished subgrade elevation with this procedure. The use of high modulus geogrid, equivalent to TENSAR BX-1100, could also be considered after underground work such as utility construction is completed. Prior to placing the geotextile or geogrid, we

recommend that all below-grade construction, such as utility line installation, be completed to avoid damaging the geosynthetic. Equipment should not be operated above the geosynthetic until one full lift of crushed stone fill is placed above it. The maximum particle size of granular material placed over the geotextile or geogrid should meet the manufacturer's specifications, and generally should not exceed 1½ inches.

Further evaluation of the need and recommendations for subgrade stabilization can be provided during construction as the geotechnical conditions are exposed.

Fill Material Types

Materials used for fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Low Volume Change (LVC) material	GM [2] or CL (LL<45 and PI<23)	All locations and elevations, except where free-draining material is required
On-site soils	CH or CL (native clay soils and existing fill soils; LL>45 and PI>23)	Pavement areas and at depths greater than 24 inches below building finished grade Existing undocumented fill should be observed, tested and approved by Terracon. Organics, rock/rubble fragments larger than 3 inches, debris, or other unsuitable materials should be removed prior to re-use of the existing undocumented fill in engineered fill sections.
Well-Graded Granular	GW [3]	Where free-draining material is required

1. Engineered fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.
2. MoDOT Type 5 or an approved alternate gradation of crushed limestone aggregate
3. Granular materials with less than 5 percent fines (material passing the #200 sieve), such as ASTM C33 Size No. 57 aggregate or similar from Section 1009 from MoDOT Standard Specifications.

Low volume change (LVC) material placed below the building floor slabs can consist of well-graded crushed stone aggregate (e.g., MoDOT Type 5). Lean clay soils with a liquid limit less than 45 and plasticity index less than 23 could also be used as LVC material, but these soils would be susceptible to softening and disturbance if they become wetted by surface water and precipitation. Soils that meet the LVC criteria were encountered in the borings, but were not encountered in an easily identifiable, discrete layer. Therefore, the use of imported LVC materials should be expected. If a granular leveling course (such as crushed stone aggregate) is used immediately below the floor slabs, this material can be considered part of the LVC zone.

Fill Compaction Requirements

Fill should meet the following compaction requirements.

Item	Description
Fill Lift Thickness[1]	9 inches in loose thickness when large, self-propelled compaction equipment is used 4 inches when small, hand-guided equipment (plate or "jumping jack" compactor) is used
Compaction Requirements[2]	At least 95 percent of the material's maximum standard Proctor dry density[3]
Water Content Range	Low plasticity cohesive: -2 percent to +2 percent of optimum[3] High plasticity cohesive: 0 to +4 percent of optimum[3] Granular: Workable moisture levels[4]

1. Reduced lift thicknesses of 4 to 6 inches are recommended in confined areas (e.g., utility trenches, foundation excavations, and foundation backfill) and when hand-operated compaction equipment is used.
2. We recommend that engineered fill be tested for moisture content and compaction during placement. If 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. As stated within ASTM D 698, this procedure is intended for soils with 30 percent or less material larger than ¾ inch. Accordingly, we recommend full time proofroll observation be performed instead of moisture density testing for materials containing more than 30 percent aggregate retained on the ¾-inch sieve.
3. As determined by the standard Proctor test (ASTM D 698)
4. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

Utility Trench and Duct Bank Backfill

All trench excavations and excavations for concrete duct banks should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches and duct banks are backfilled with relatively clean granular material, they should be capped with at least 18 inches of clay fill to reduce the infiltration and conveyance of surface water through the trench backfill.

Utility trenches are common sources of water infiltration and migration. All utility trenches that penetrate beneath structures should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the structure. We recommend constructing an effective "trench plug" that extends at least 5 feet out from the face of the structure exterior. The plug material should consist of clay compacted as recommended in **Earthwork**. The clay fill should be placed to completely surround the utility line and be compacted in accordance with

recommendations in this report. Alternatively, flowable fill could be used to construct the trench plug.

Grading and Drainage

During construction, grades should be developed to direct surface water flow away from or around the site. Exposed subgrades should be sloped to provide positive drainage so that saturation of subgrades is avoided. Surface water should not be permitted to accumulate on the site. Final surrounding grades should promote rapid surface drainage away from the structures. Accumulation of water adjacent to the structure could contribute to significant moisture increases in the subgrade soils and subsequent softening/settlement or expansion/heave.

After construction of the structures and pavements have been completed, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structures should also be periodically inspected and adjusted as necessary, as part of the structure's maintenance program.

Earthwork and Excavation Considerations

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proofrolling, placement and compaction of controlled compacted fills, backfilling of excavations into completed subgrades, and just prior to construction of foundations, slabs, and pavements.

Care should be taken to avoid disturbance of prepared subgrades. Unstable subgrade conditions can develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. If unstable subgrade conditions develop, stabilization measures will need to be employed. Construction traffic over the completed subgrade should be avoided to the extent practical. If the subgrade becomes frozen, desiccated, saturated, or disturbed, the affected materials should be removed or these materials should be scarified, moisture conditioned, and compacted prior to slab construction.

The OSHA Occupational Safety and Health Standards-Excavations classify soils into three basic types (Type A, B, or C). Depending upon the soil type, OSHA requirements for excavation slopes range from ¾ H to 1V (horizontal to vertical) for Type A soils, 1H to 1V for Type B soils, and 1½H to 1V for Type C soils. OSHA allows up to vertical excavations in stable rock masses. OSHA dictates that any excavation extending to a depth of more than 20 feet shall be designed by a registered professional engineer. Based upon the subsurface conditions encountered at the boring locations, the overlying soils classify as Type C soil according to OSHA regulations. OSHA recommends a maximum slope inclination of 1½ horizontal to 1 vertical for excavation in these soils. In addition, whenever a lower strength material underlies a higher strength material, the lower strength material must be utilized for trench design.

In lieu of trench slopes as defined by OSHA, trench shoring or a shield (trench boxes) may be utilized to reduce overall excavation widths. The contractor or the specialty subcontractor should be responsible for the design of the temporary shoring. These designs should be performed in accordance with applicable regulatory requirements.

Care should be taken during excavation to protect the structural integrity of any existing structures, pavements, or adjacent underground utilities that are to remain in-place. The settlement tolerances of adjacent structures or improvements should be considered when determining the excavation methods. Depending upon factors such as the depth of excavation, the location of the existing improvements, groundwater and soils conditions, temporary sheeting, shoring, and underpinning may be required. Particular caution should be exercised if excavations are performed near existing utility lines. Existing backfill for utility lines is often poorly compacted and the limits of the old excavation form a ready failure surface. The OSHA trench safety guidelines for adequate side slopes based on soil types may not apply in these situations. Existing underground utilities should be shored and braced as required to maintain their integrity and appropriately designed trench boxes or sheeting and bracing should be used to provide for worker safety.

All vehicles, equipment and soil piles should be kept a sufficient lateral distance from the crest of the trench slope to maintain safe working conditions. Vehicles, equipment and soil piles located adjacent to trenches could significantly influence the stability of the slopes as outlined by the OSHA regulations. A more detailed stability analysis would be required for these conditions. Additionally, vibrations from heavy traffic, or similar sources can influence slope stability. The exposed slope faces should be protected from the elements. Surface water should be diverted away from all excavations. The length of open trench should be held to a minimum. Trench excavation, pipe laying, and backfilling should be completed as quickly as possible to minimize the amount of time that excavations are left open.

Construction Observation and Testing

The earthwork efforts should be observed and tested by a representative of the Geotechnical Engineer. Observation and testing should include documentation of removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unacceptable conditions are encountered, the Geotechnical Engineer should be contacted to recommend mitigation options.

SHALLOW FOUNDATIONS

The following section provides design parameters for shallow spread footing foundations and reinforced concrete mat foundations.

Spread Footing Foundation Design Parameters

The following design parameters are applicable for design of shallow strip footing foundations for the proposed Filter, Disinfection, Electrical, Dewatering and Administration Buildings, and other ancillary structures for various equipment planned.

Description	Value
Maximum net allowable bearing pressure [1,2,3]	**Bearing on residual clay and/or engineered fill** 2,000 psf
Minimum embedment below finished grade for frost protection [4]	30 inches
Minimum footing widths	Isolated footings: 30 inches Continuous footings: 16 inches
Estimated total settlement [5]	1 inch or less
Estimated differential settlement [5]	1/2 to 2/3 of the total settlement over a horizontal distance of 50 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. This pressure assumes that any soft soils or other unsuitable materials, including existing undocumented fill, if encountered, will be undercut and replaced with engineered fill.
2. The allowable bearing pressure can be increased by 1/3 for transient loading conditions.
3. A factor of safety of 3 has been applied to this value.
4. This embedment depth is recommended for footings beneath unheated areas to provide frost protection and to reduce the effects of seasonal moisture variations in the foundation bearing soils.
5. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of engineered fill below the footings, and the quality of the earthwork operations and footing construction.

Mat Foundation Design Parameters

Based on the conditions encountered at the borings, we understand the foundations for Filter Splitter Structure, Influent and Transfer Pump Station, Chemical Feed Building, Process Splitter and Basins, and MBR Building and Basins will be supported on mat foundations. The mat foundations at these locations can bear on medium stiff to stiff residual clay or engineered fill at the planned depth.

Description	Value
Maximum net allowable bearing pressure [1,2,3]	2,000 psf
Modulus of subgrade reaction (for design of mat foundations) [4]	100 pounds per square inch per inch of deflection (psi/in or pci)
Estimated total settlement [5]	¾ inch within 3 months after full load is applied

Description	Value
Estimated differential settlement [5]	½ inch over a horizontal distance of 10 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation.
2. The allowable bearing pressure can be increased by 1/3 for transient loading conditions.
3. A factor of safety of 3 has been applied to these values.
4. The recommended modulus value is based on a 12-inch square plate. The modulus value used in design should be adjusted based on the actual size of the floor slab according to the Naval Facilities Engineering Design Manual 7.2, Page 7.2-155, Table 4 equation: $K_b = K_v \left(\frac{b+1}{2b}\right)^2$ where K_v is the modulus value based on a 12-inch square plate, b is the width of the slab and K_b is the design modulus value.
5. The foundation settlement will depend upon the variations within the structural loading conditions, the quality of the lean concrete placed, and foundation construction.

Foundations that will be subjected to lateral loads should be embedded sufficiently to resist these loads. Horizontal loads acting on foundations cast directly against undisturbed soils or backfilled with engineered fill may be resisted by a combination of passive pressure on the sides of the footing and sliding friction at the base of the foundation. An ultimate coefficient of sliding friction of 0.3 may be assigned to the base of the foundations bearing on residual clay or engineered fill. Passive resistance may be calculated using an equivalent fluid unit weight of 290 pounds per cubic foot (pcf) for cohesive backfill and 360 pcf for granular backfill. Appropriate safety factors should be applied to the ultimate friction and equivalent fluid unit weight values provided.

Ground Improvement Utilizing Aggregate Piers/Stone Columns

The Grit Removal and Fine Screen Building may be supported on a mat foundation designed to the above recommendations if underlying soil modifications utilizing rammed/vibratory aggregate piers/columns are utilized to support the anticipated loads at this site. The use of this type of soil modification can also increase the allowable bearing capacity of the existing soil. The ground improvement system can often be designed for a specified bearing capacity. Maximum obtainable bearing capacities are site-specific and may vary between 3,000 psf to 8,000 psf.

There are two main systems of this type of soil modification, one using a ramming action to compact the soil and one utilizing a vibrating system. These systems typically consist of 18- to 30-inch diameter drilled holes that are filled in lifts of well-graded aggregate that is densified by either ramming or vibration to form very stiff, high-density aggregate piers/columns. The compacted aggregate piers/columns produce high lateral stresses within the surrounding soil matrix, thereby stiffening the reinforced composite soil/aggregate mass. This results in significant strengthening and stiffening of the foundation bearing layer to support footings within the required settlement tolerances.

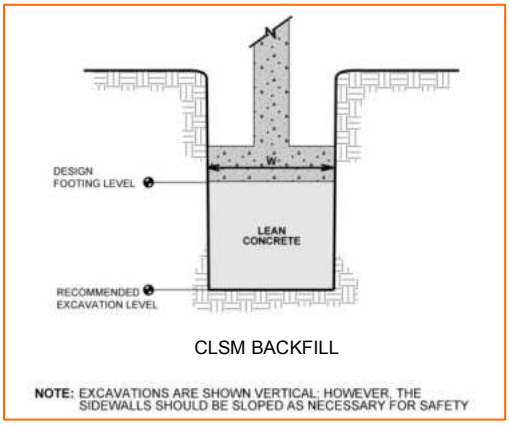
Aggregate pier foundation elements are a design-build system that are designed and installed by a specialty foundation contractor. Therefore, the subsurface exploration information contained in this report should be provided to the foundation contractors for detailed analysis and design and

cost information. The foundation contractor selected for doing the installation should be contact prior to the start of excavations, as these elements are often installed from the existing ground surface. The client should be prepared with a desired targeted bearing capacity to discuss with the foundation contractor. The allowable net bearing capacity following installation of aggregate piers will be provided by the designer.

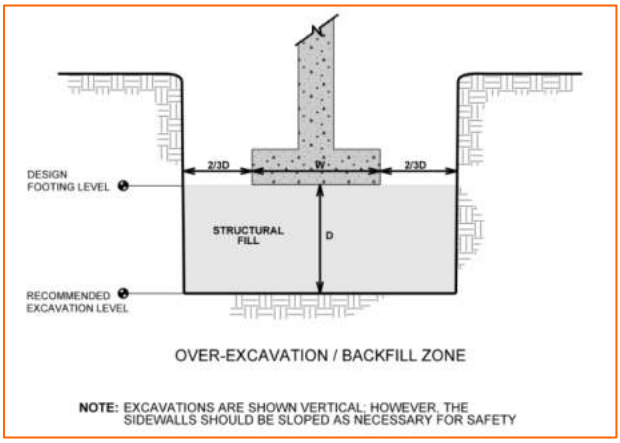
Shallow Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be observed and tested by a representative Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed. Placement of a lean concrete or controlled low-strength material (CLSM) mud mat over the bearing soils should be considered if the excavations must remain open for an extended period of time.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



Over-excavation for structural fill placement below spread footing foundations should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation with suitable fill materials, as recommended in the **Earthwork** section.



DEEP FOUNDATIONS

Subsurface voids, and soft, compressible clay seams were encountered in the vicinity of the proposed Transfer Pump Station and Digester 4. Drilled shaft foundations bearing below these voids and clay seams can be considered to support these structures. Additionally, if a mat foundation underlain by ground improvement of the proposed Grit Removal and Fine Screen Building is not a suitable option, drilled shafts bearing within competent limestone can be considered.

Drilled Shaft Foundation Design Parameters

Based on the conditions encountered at our boring locations, drilled shaft foundations at the proposed Transfer Pump Station, Digester 4, Grit Removal and Fine Screen Building should bear within competent limestone. Competent limestone was encountered at the approximate elevations shown in the following table.

Structure	Approximate Elevation of Competent Limestone (feet) [1,2]	Allowable End Bearing Pressure (Limestone), (ksf) [3]	Allowable Skin Friction Uplift (Limestone) (ksf) [3, 4]
Transfer Pump Station	1208½	60	8
Digester 4	1235	60	8
Grit Removal and Fine Screen Building	1248	60	8

1. The structural engineer should refer to the appended boring logs and exploration plan to evaluate the drilled shaft capacities based on the structural loading, shaft diameter, and embedment depth. The contract documents should include provisions to adjust the drilled shaft bearing elevations based on the rock conditions encountered and Terracon's field observations during construction, rather than setting a strict tip elevation for each shaft.
2. Drilled shafts should extend a minimum of 6 inches into competent limestone.

3. A factor of safety of 2 has been applied to these values.
4. Skin friction should be ignored in the overburden soils.

Drilled shafts for this project should have a minimum diameter of 3 feet. Provided the drilled shafts are designed and constructed in accordance with recommendations presented in this report, we estimate total settlement of the drilled shafts would be ¼ inch or less. Differential settlement between adjacent columns would be less than half the total settlement. These settlement estimates do not include elastic compression of the drilled shaft under axial loading. Settlement estimates for drilled shafts are dependent on the shaft diameter, and these settlement estimates are valid for shaft diameters ranging from 3 to 5 feet. Terracon should be notified if larger-diameter shafts are planned.

Drilled Shaft Foundation Construction Considerations

The base of all drilled shaft excavations should be free of water and loose material prior to placement of concrete. Core samples of the bedrock were obtained in B-4 and B-4A at the Transfer Pump Station and B-5 and B-5A at Digester 4, and these boreholes extended about 10 feet into the bedrock. We recommend foundation inspection holes be performed at each drilled shaft location. Each inspection hole should extend to a depth of 10 feet or twice the diameter of the rock socket below the bottom of the shaft, whichever is greater, to evaluate the bearing material below the shaft and integrity of the rock socket.

Drilled shaft excavations should be observed by a Terracon representative to evaluate that suitable bearing materials have been reached and that the excavations have been cleaned sufficiently prior to placement of concrete. If the shaft bottom cannot be visually inspected and probed/sounded from ground surface, other methods (such as a downhole camera) could be used to inspect the shaft bottom.

Conventional excavating and drilling equipment should be able to penetrate the soil. Coring may be required to advance the shaft excavations through weathered limestone and 6 inches into competent limestone.

While removing the casing from a shaft excavation during concrete placement, the concrete inside the casing should be maintained at a sufficient level to prevent intrusion of overburden materials into the excavation and resist any earth pressures outside the casing during the entire casing removal procedure. We recommend the concrete mixture for drilled shafts be designed to have a slump in the range of 5 to 7 inches to facilitate casing removal and reduce the possibility of concrete arching.

SEISMIC CONSIDERATIONS

Terracon conducted a seismic refraction survey for the purpose of providing information relative to the Seismic Site Class per International Building Code (IBC) 2018 using the average shear-wave velocity in the top 100 feet of the subsurface profile.

A seismic refraction system consisting of one SeismicSource DAQLink III seismographs and 24 geophones was utilized to derive subsurface seismic velocity information. Linear arrays of 24 geophones were placed as indicated on the figure below and the following type of seismic data was recorded:

- *Refraction microtremors* produced by ambient seismic noise are recorded. The data was then processed using a wavefield-transformation data-processing technique and an interactive Rayleigh-wave dispersion-modeling tool. The refraction microtremor exploits aspects of spectral analysis of surface waves (SASW) and multi-channel analysis of surface waves (MASW) to derive a shear wave (s-wave) profile and an average shear-wave velocity along the array for a corresponding depth.

The IBC requires structural design to be in accordance with the appropriate site class definition for soil profile type. Based upon the Site Class Definitions in ASCE 7-22, Chapter 20, Table 20.2-1, and the **average shear wave velocity of 2,300 ft/s** derived from our seismic survey data, as indicated in the **Shear-Wave Velocity** appendix, Terracon recommends a Class BC seismic site classification for design.

The average shear-wave velocity analysis and recommendations presented in this report are based upon the data obtained from the seismic refraction system performed at the indicated location and on the indicated date. This analysis does not reflect variations that may occur across the site, or variations that may occur throughout the year, such as groundwater fluctuations. The refraction microtremor method is an approximate method, and one of many methods that can be used to determine shear-wave velocities.

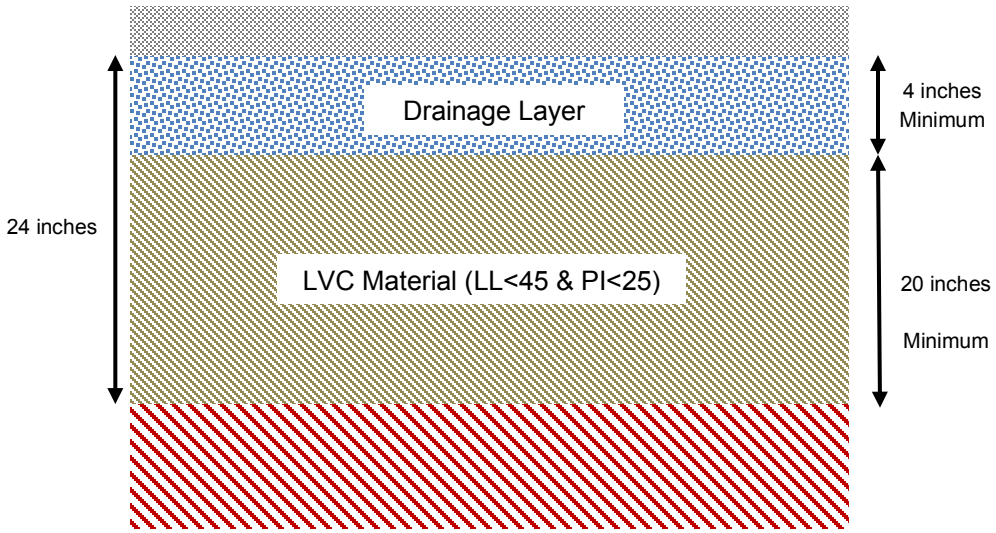
Description	Value
2018 International Building Code Site Class (IBC) [1]	BC
Site Latitude	37.1305° N
Site Longitude	93.4884° W
Risk Category	III
S_{DS} Spectral Acceleration for a Short Period [2]	0.18 g
S_{D1} Spectral Acceleration for a 1-Second Period [2]	0.085 g
F_a Site Coefficient – Table 1613.3.3(1)	1.3
F_v Site Coefficient – Table 1613.3.3(2)	1.5

1. Seismic site classification in general accordance with *ASCE 7-22, Minimum Design Loads for Buildings and Other Structures*.
2. These values were obtained using online seismic design maps and tools provided by the USGS (http://earthquake.usgs.gov/hazards/designmaps/).

FLOOR SLABS

Grade-supported floor slabs should be supported on a minimum of 24 inches of low volume change (LVC) material. LVC fill should be placed and compacted as recommended in section **Earthwork**.

Concrete Slab-on-Grade



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Floor Slab Design Parameters

Item	Description
Floor slab support [1, 2]	A minimum 24-inch thick low volume change (LVC) material
Modulus of subgrade reaction	100 pounds per square inch per inch (psi/in) for point loading conditions
Granular course beneath slab [3, 4, 5]	Minimum 4 inches
Capillary break layer thickness [4, 5]	Minimum 4 inches

1. The recommended modulus value is based on a 12-inch square plate. The modulus value used in design should be adjusted based on the actual size of the floor slab according to the Naval Facilities Engineering Design Manual 7.2, Page 7.2-155, Table 4 equation: $K_b = K_v \left(\frac{b+1}{2b}\right)^2$ where K_v is the modulus value based on a 12-inch square plate, b is the width of the slab and K_b is the design modulus value.
2. Well graded crushed stone (e.g., MoDOT Type 5 aggregate) or open-graded crushed stone (e.g., ASTM C33, Size No. 57 aggregate) can be used as the leveling course.
3. These granular materials may be considered part of the LVC zone.

Joints should be constructed in slabs at regular intervals as recommended by the American Concrete Institute (ACI) to help control the location of cracks. Joints or any cracks in the slab that develop should be sealed with a waterproof, non-extruding compressible compound.

Typically, some increase in the slab subgrade moisture content will occur because of gradual accumulation of capillary moisture, which would otherwise evaporate if the slab had not been constructed. The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Floor Slab Construction Considerations

If LVC materials consist of clay, the subgrade should be maintained in a relatively moist condition until the slab is constructed. If the subgrade becomes desiccated prior to construction of the slab, the affected material should be removed or the materials should be scarified, moistened, and compacted. Upon completion of grading operations in the construction area, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the slab. A 4-inch thick CLSM mud-mat could be utilized to protect the subgrade during construction.

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall etc. As a result, the slab subgrade soils may not be suitable for placement of the granular course and/or concrete at the time of building construction, and corrective action may be required.

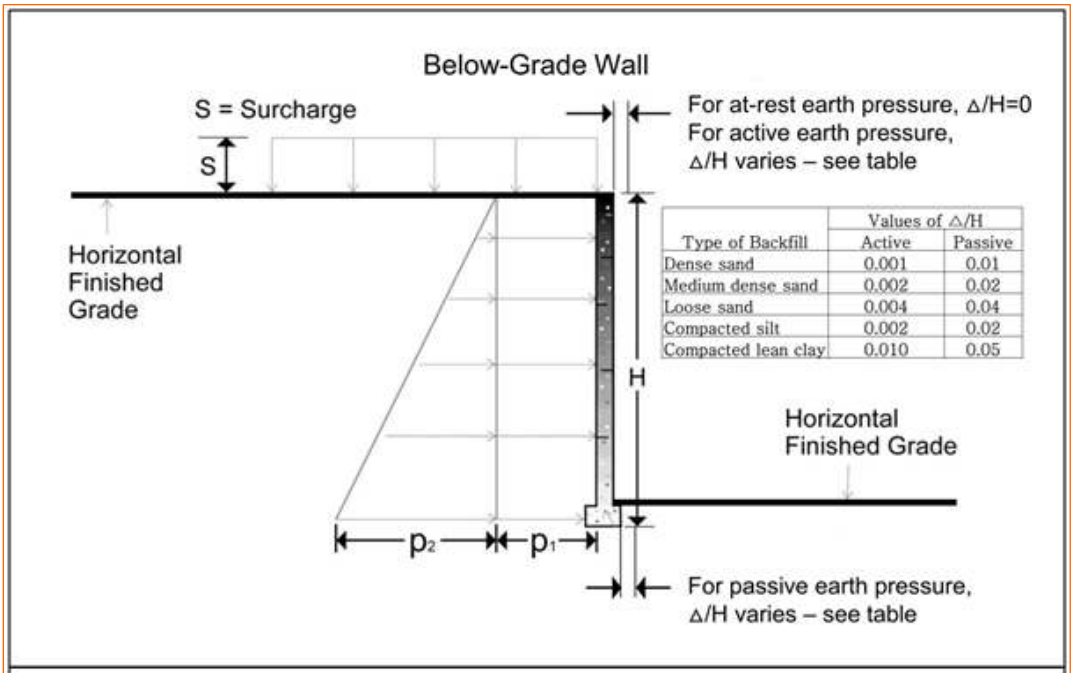
Terracon should evaluate the condition of the slab subgrades immediately prior to placement of the granular leveling course and construction of the slabs. Particular attention should be paid to areas containing backfilled trenches and high traffic areas that were previously disturbed during construction. Where unsuitable conditions are located within the slab subgrade soils, the subgrade should be improved by removing and replacing the affected material with properly compacted fill.

LATERAL EARTH PRESSURES

Lateral Earth Pressure Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions

are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for walls that are restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Type of Backfill	Values of Δ/H Active	Passive
Dense sand	0.001	0.01
Medium dense sand	0.002	0.02
Loose sand	0.004	0.04
Compacted silt	0.002	0.02
Compacted lean clay	0.010	0.05

Table from Movements Required to Reach Active or Passive Earth Pressure Conditions (Clough and Duncan, 1991)

Lateral Earth Pressure Design Parameters				
Earth Pressure Condition [1]	**Coefficient for Backfill Type** [2]	**Surcharge Pressure** [3, 4, 5] **p_1 (psf)**	**Effective Fluid Pressures (psf)** [2, 4, 5]	
			Drained [6]	**Undrained** [6]
Active (Ka)	Granular - 0.31 Fine Grained - 0.41	(0.31)S (0.41)S	(40)H (50)H	(80)H (85)H
At-Rest (Ko)	Granular - 0.47 Fine Grained - 0.58	0.47)S (0.58)S	(55)H (70)H	(90)H (95)H
Passive (Kp)	Granular - 3.25 Fine Grained - 2.46	--- ---	(390)H (295)H	(250)H (205)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 95% of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf
3. Uniform surcharge, where S is surcharge pressure
4. Loading from heavy compaction equipment is not included.

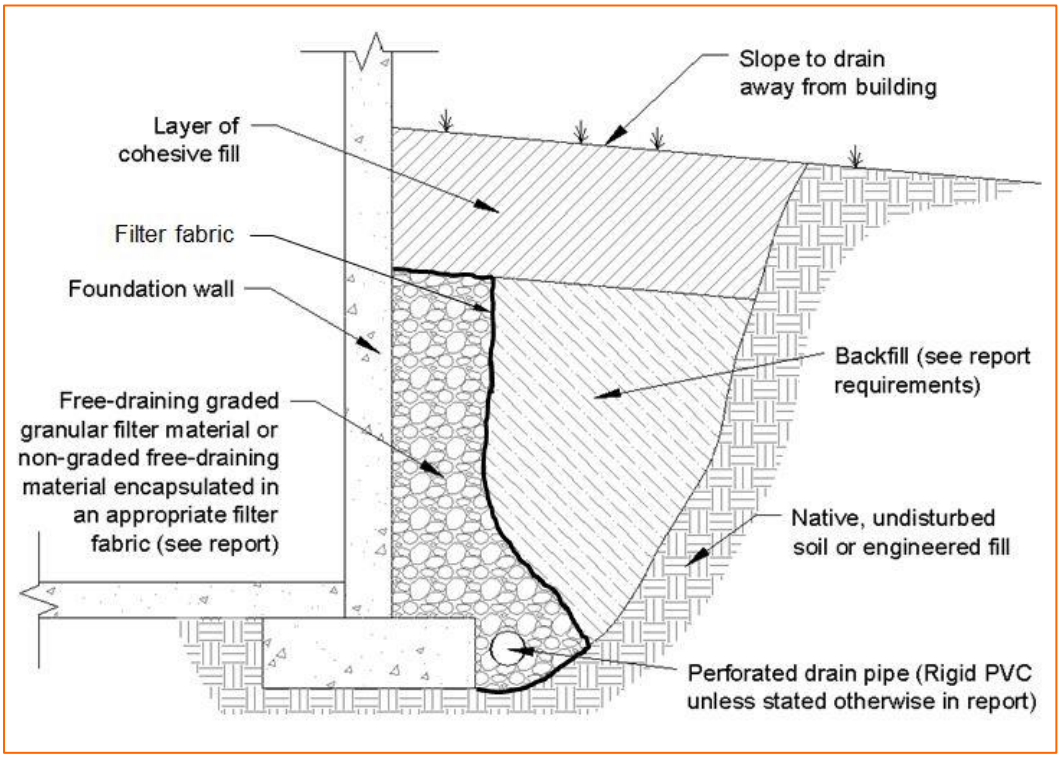
Lateral Earth Pressure Design Parameters				
Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3, 4, 5] p_1 (psf)	Effective Fluid Pressures (psf) [2, 4, 5]	
			Drained [6]	Undrained [6]

5. No safety factor is included in these values.
6. To achieve "Drained" conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. "Undrained" conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active and at-rest cases and 60 degrees from the vertical for the passive case.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

PAVEMENTS

Pavement subgrades are expected to consist of on-site native clay soils. The pavement subgrades should be proofrolled as recommended in **Earthwork**. If soft or otherwise unsuitable areas are observed, additional over-excavation and replacement will be needed.

Grading and paving are commonly performed by separate contractors and there is often a time lapse between the end of grading operations and the commencement of paving. Subgrades prepared early in the construction process may become disturbed by construction traffic. Non-uniform subgrades often result in poor pavement performance and local failures relatively soon after pavements are constructed. Depending on the paving equipment used by the contractor, measures may be required to improve subgrade strength to greater depths for support of heavily loaded concrete/asphalt trucks.

We recommend the moisture content and density of the subgrade be evaluated and the pavement subgrades be proofrolled (using a loaded tandem-axle dump truck with a minimum gross weight of 20 tons or similarly loaded rubber-tire equipment) within two days prior to commencement of

actual paving operations. Areas not in compliance with the required ranges of moisture or density should be scarified, moisture conditioned, and compacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills. The subgrade should be in its finished form at the time of the final review.

Opinions of Minimum Pavement Thickness

Pavement thickness depends upon many factors including but not limited to:

- applied wheel/axle loads and number of repetitions
- subgrade and pavement material characteristics
- climate conditions
- site and pavement drainage

Specific information regarding anticipated vehicle types, axle loads, and traffic volumes was not provided at the time of this report. The "Light Duty" pavement section considers 4-tire, 2-axle personal vehicle traffic (cars, vans, pickups and SUVs) only. The "Medium Duty" pavement section considers personal vehicle traffic along with a maximum of ten trucks per week, consisting of panel delivery trucks, trash collection trucks, or legally loaded semi-tractor trailers (53-foot trailers). Our recommendations for asphaltic cement concrete (ACC) pavement and Portland cement concrete (PCC) pavement sections are outlined in the following table.

Pavement Type	Light Duty	Medium Duty
Gravel Access Roads	8 inches aggregate (MoDOT Type 5 or similar)	12 inches aggregate (MoDOT Type 5 or similar)
ACC	2 inches ACC surface 4 inches ACC base 6 inches aggregate base (MoDOT Type 5 or similar)	2 inches ACC surface 6 inches ACC base 6 inches aggregate base (MoDOT Type 5 or similar)
PCC	5 inches PCC 4 inches open graded rock (ASTM C33 Size No. 57 aggregate or similar from Section 1009 from MoDOT Standard Specifications)	7 inches PCC 4 inches open graded rock (ASTM C33 Size No. 57 aggregate or similar from Section 1009 from MoDOT Standard Specifications)

PCC pavements will perform better than ACC in areas where short radii turning and braking are expected (i.e., entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to heavy static loads (i.e., dumpster pads).

Construction traffic on the pavements was not considered in developing our opinions of minimum pavement thickness. If the pavements will be subject to construction equipment/vehicles, the pavement sections should be revised to consider the additional loading.

Pavements and subgrades will be subject to freeze-thaw cycles and seasonal fluctuations in moisture content. Pavement thickness design methods are intended to provide adequate thickness of structural materials over a particular subgrade such that wheel loads are reduced to a level that the subgrade can support. The subgrade support parameters for pavement thickness design do not account for shrink/swell movements of a subgrade constructed of expansive clay soils. Therefore, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade.

The pavement sections provided above consider that the subgrade soils will not experience significant increases in moisture content. Paved areas should be sloped to provide rapid drainage of surface water and to drain water away from the pavement edges. Pavements should be designed so water does not accumulate on or adjacent to the pavement, since this could saturate and soften the subgrade soils and subsequently accelerate pavement deterioration.

Periodic maintenance of the pavements will be required. Cracks should be sealed, and areas exhibiting distress should be repaired promptly to help prevent further deterioration. Even with periodic maintenance, some movement and related cracking may still occur and repairs may be required.

CORROSIVITY

The table below lists the results of laboratory soluble sulfate, sulfides, soluble chloride, Red-Ox, total salts, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary

Boring	Sample Depth (feet)	Soil Description	Soluble Sulfate (mg/kg)	Soluble Chloride (mg/kg)	Sulfides (mg/kg)	Red-Ox (mV)	Total Salts (mg/kg)	Electrical Resistivity (Ω-cm)	pH
B-2A	6 to 8	Lean Clay (CL)	20	35	ND [1]	+693	101	6,499	6.69
B-4A	13 to 15	Lean Clay (CL)	86	45	ND [1]	+690	493	3,395	7.09
B-11	0 to 5	Lean Clay (CL)	103	<17	0.099	Not Tested	163	1,432	6.82

Corrosivity Test Results Summary									
Boring	**Sample Depth (feet)**	**Soil Description**	**Soluble Sulfate (mg/kg)**	**Soluble Chloride (mg/kg)**	**Sulfides (mg/kg)**	**Red-Ox (mV)**	**Total Salts (mg/kg)**	**Electrical Resistivity (Ω-cm)**	**pH**
B-14	5 to 10	Fat Clay (CH)	22	25	0.083	Not Tested	55	2,470	6.21

1. ND = Not Detected

The 10-point system evaluation of corrosive potential for ductile iron pipe is used to determine the corrosivity of the soil samples and is included in **Figures**. The evaluation procedure is based on five tests on a sample of soil. Each test result is assigned a point value according to its contributions to corrosivity. The points for all five areas are totaled and if the sum is 10 or more, the soil is considered corrosive to ductile iron pipe, in which case corrosion protective measures will be required. Based on the sum of averaged points for all five areas, the soils tested do not exceed the 10-point system, so the site soils would not be considered corrosive environment to buried ductile iron pipe.

In our experience, alkali-silica reactivity (ASR) in concrete aggregates is uncommon in Southwest Missouri; however, it is a possibility that ASR could occur in concrete in the project area under the certain circumstances. We recommend the contractor and concrete supplier consider the potential impacts of ASR in the concrete mix design.

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 19.3.1.1 of ACI 318 and indicate that ASTM Type I/II portland cement should be suitable for concrete on and below grade for the length of the project. Concrete should be designed in accordance with the provisions of ACI 318. For specific recommendations regarding soil corrosivity, we recommend a corrosion specialist be consulted.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations may occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Support of floor slabs and pavements over existing fill is discussed in this report. However, even with the recommended construction testing, there is a risk that unsuitable materials within or buried by the fill will not be discovered. This risk cannot be eliminated without removing the fill, but it can be reduced by thorough exploration and testing.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation costs. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation costs. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, cost estimating, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

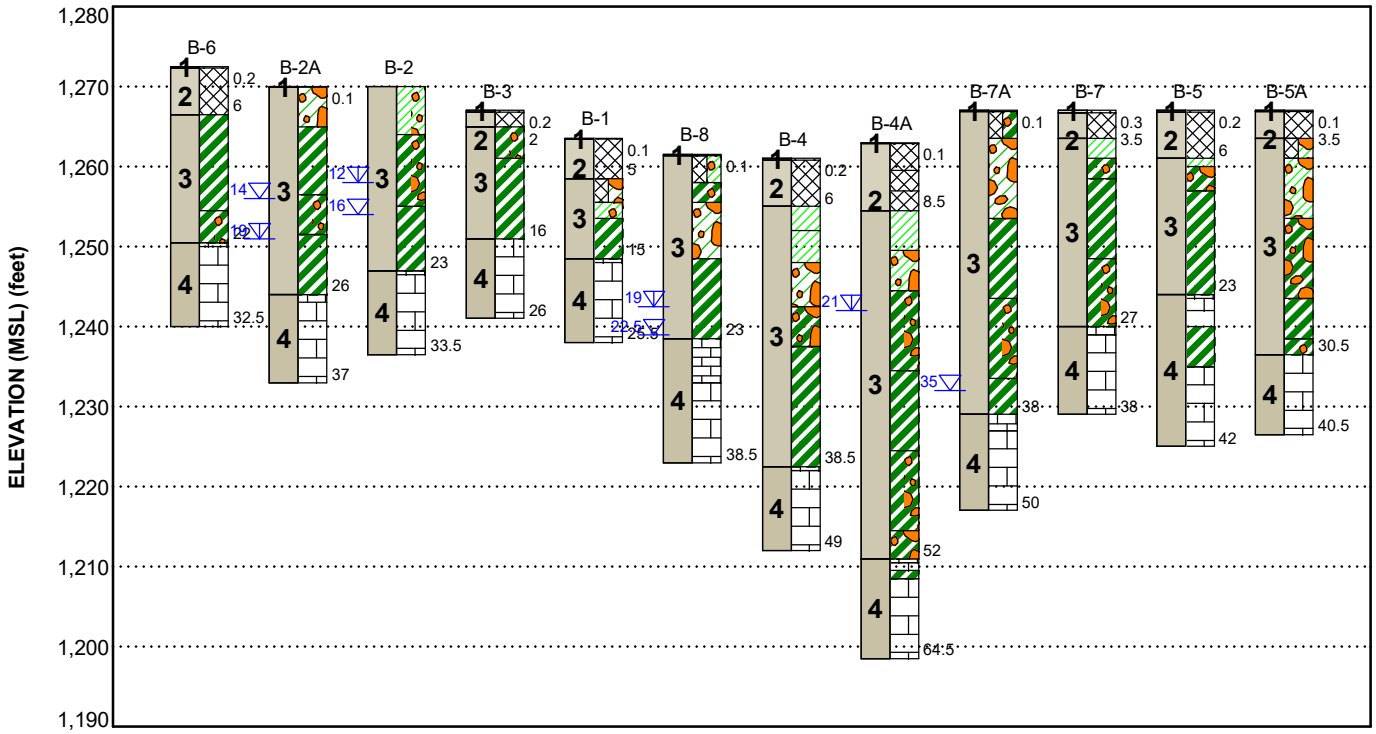
FIGURES

Contents:

GeoModels (2020 & 2022)

GEOMODEL

Republic WWTP ■ Republic, Missouri
Terracon Project No. B5205029



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Surficial Materials**	Topsoil and exposed fill materials or residual soils
2	**Fill**	Lean to fat clay (CL or CH) with varying amounts of gravel and sand or clayey gravel with varying amounts of clay and sand
3	**Residual Soils**	Lean to fat clay (CL or CH) with varying amounts of gravel and sand or gravelly soils with varying amounts of clay and sand
4	**Limestone**	Highly to slightly weathered

LEGEND

- Topsoil
- Fill
- Clayey Gravel
- Lean Clay with Gravel
- Fat Clay
- Highly Weathered Limestone
- Limestone
- Fat Clay with Gravel
- Lean Clay
- Gravelly Fat Clay
- Gravelly Lean Clay

▽ First Water Observation
▽ Second Water Observation

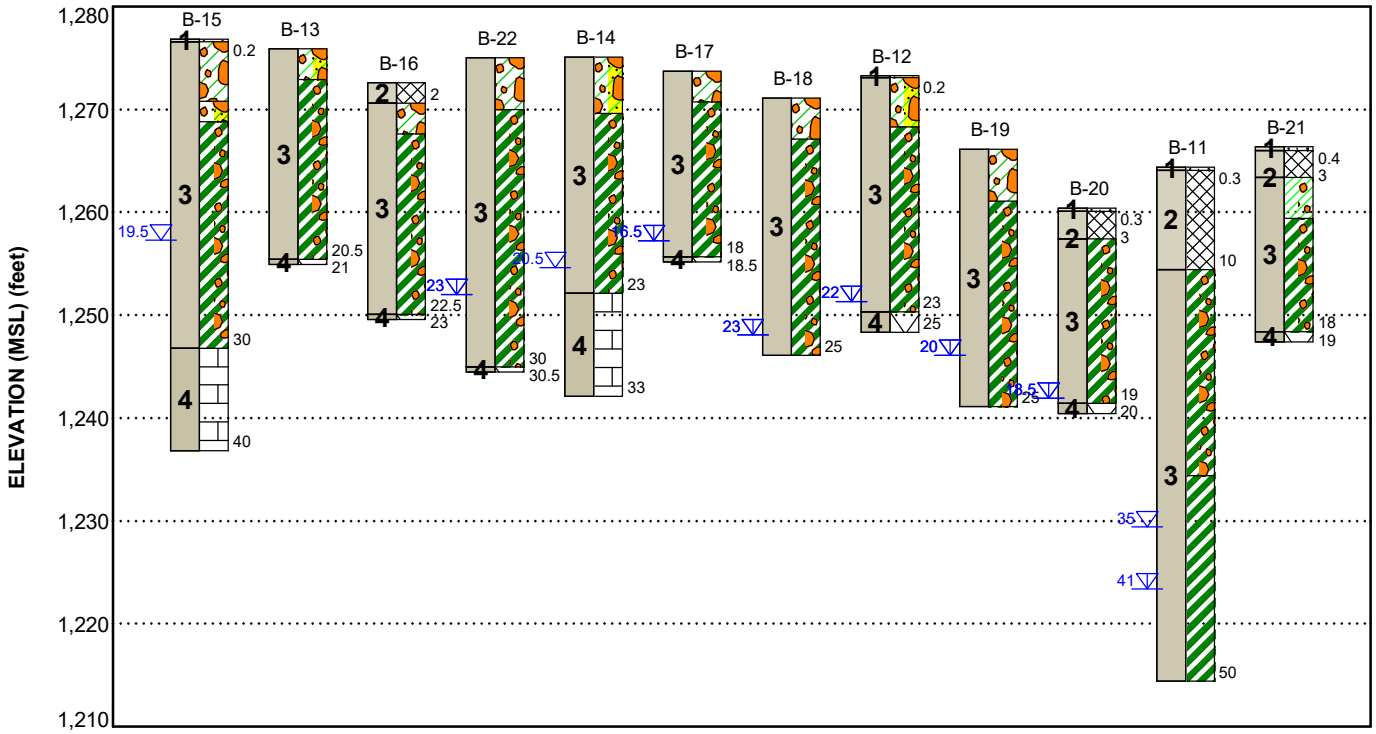
Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

GEOMODEL

Republic, MO WWTP Expansion - Additional Borings ■ Republic, MO
Terracon Project No. B5215111

Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Surficial Materials**	Topsoil and exposed fill materials or residual soils
2	**Fill**	Lean to fat clay (CL or CH) with varying amounts of gravel and sand or clayey gravel with varying amounts of clay and sand
3	**Residual Soils**	Lean to fat clay (CL or CH) with varying amounts of gravel and sand or gravelly soils with varying amounts of clay and sand
4	**Limestone**	Highly to slightly weathered

LEGEND

- Topsoil
- Fill
- Fat Clay with Gravel
- Fat Clay
- Clayey Gravel with Sand
- Weathered Rock
- Limestone
- Clayey Gravel
- Poorly-graded Gravel with Clay and Sand
- Lean Clay with Gravel

▽ First Water Observation
▽ Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

SOIL TEST EVALUATION

Ductile Iron Pipe Research Association (DIPRA)

	Range	Points
Resistivity (ohm/cm) (Based on single probe at pipe depth or water saturated Miller soil box)	< 1500 ≥1500-1800 >1800-2100 >2100-2500 >2500-3000 > 3000	10 8 5 2 1 0
pH	0.0-2.0 2.0-4.0 4.0-6.5 6.5-8.5 > 8.5	5 3 0 0* 3
Redox	> 100 mV 50-100 mV 0-50 mV Negative mV	0 3.5 4 5
Sulfides	Positive Trace Negative	3.5 2 0
Moisture	Poor drainage, continuously wet Fair drainage, generally moist Good drainage, generally dry	2 1 0

* If sulfides are present and low or negative redox results are obtained, 3 points shall be given to this range.

Interpretation

Corrosive conditions to ductile iron pipe if ten (10) points or more.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Geophysical Field Exploration

Terracon performed Multi-Channel Analysis of Surface Waves (MASW) seismic surveys at the locations shown on the **Geophysical Site Plan**. A Geometrics Geode seismograph and a land-streamer consisting of a linear array of twenty-four, 4.5Hz geophones was used to collect multi-channel analysis of surface waves (MASW) data to measure the shear wave velocity of the subsurface materials.

MASW was performed by collecting surface waves created by a seismic source consisting of a Propelled Energy Generator (PEG) equipped with an 80lb weight dropped and accelerated from a height of about 17 inches onto a steel impact plate. The data was processed using dispersion analysis software that extracts the fundamental-mode dispersion curves. Using a roll-along setup and subsets of geophones, many 1D profiles are created along an array and then combined to yield a 2D profile. These 2D profiles were examined for locations indicating abrupt changes in shear wave velocities, which may indicate subsurface voids, sinkholes, or abrupt material changes.

Geotechnical Field Exploration

Number of Borings [1]	Boring Depth (feet) [2, 3]	Planned Location
B-1	25½	Near electrical building, bower pad (formerly planned Anoxic basin)
B-2 and B-2A	33½ and 37	Generator building (formerly planned Clarifier 4)
B-3	25	Disinfection building (formerly planned Chemical feed building)
B-4 and B-4A	49.2 and 64.3	Transfer pump station
B-5 and B-5A	42 and 40½	Digester 4
B-6	32.3	Generaly location (formerly planned Aeration basin)
B-7 and B-7A	38 and 50	General location (formerly planned Admin/dewatering building)
B-8	38.5	General location
B-11	50	Influent pump station
B-12	25	Grit removal and fine screen building

Number of Borings [1]	Boring Depth (feet) [2, 3]	Planned Location
B-13	21	Process splitter
B-14	33½	Process basin
B-15	40	Process basin
B-16	23	Membrane bioreactor building and tank
B-17	18½	Chemical feed building
B-18	25	Electrical building
B-19	25	Administration building
B-20	20	Filter building and filter splitter structure
B-21	19	Dewatering building
B-22	30½	Process basin

1. Boring designation B-9 and B-10 were not utilized as part of the 2020 and 2022 geotechincal field exploration
2. Below ground surface
3. Borings B-13, B-16, B-17, B-20 encountered auger refusal on a possible cobble, boulder, or bedrock prior to their planned termination depth. All other borings extended to their planned depths.

Boring Layout and Elevations: The boring layout was performed by Terracon. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±20 feet). Approximate elevations for the 2020 borings were obtained by surveyor's level and rod and are rounded to the nearest ½-foot. Elevations for the 2020 borings are referenced to a temporary benchmark indicated on the **Boring Location and Exploration Plan**. Surface elevations for the 2022 borings were surveyed by Allgeier, Martin and Associates, Inc.

Subsurface Exploration Procedures: The borings were advanced with ATV-mounted rotary drill rigs using continuous flight, solid-stem augers. Samples were obtained from the borings as noted in **Exploration Results**. The thin-walled tube sampling was performed with a thin-walled, seamless steel tube with a sharp cutting edge that was pushed hydraulically into the soil to obtain a relatively undisturbed sample. The split-barrel sampling procedure was performed using a standard 2-inch outer diameter, split-barrel sampling spoon that was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The automatic hammer used in our 2020 and 2022 field explorations had hammer efficiencies of 92.5 and 82%, respectively. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at their respective test depths. Water levels were observed and recorded during drilling and sampling and after 24 hours when practical. For safety purposes, all borings were backfilled with bentonite chips and grout after their completion.

Auger refusal materials were explored with rock coring procedures at select location. An NQ2 rock core barrel was utilized to perform the rock cores at all borings except Boring B-13, B-16, B-17, and B-20. Water was used as a drilling fluid for cooling the rock bit and the spent water was discharged on site. Due to the use of water for rock coring, groundwater observations may have been affected and may not accurately portray the actual groundwater elevation at these locations.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

Classification of the soil samples was performed in general accordance with the Unified Soil Classification System (USCS) based on the material's texture and plasticity. The project engineer reviewed the field data and assigned laboratory tests to better understand the engineering properties of the various soil and rock strata.

- Water (Moisture) Content of Soil and Rock by Mass
- Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- Particle-Size Analysis of Soils
- Dry Unit Weight of Soils
- Unconfined Compressive Strength of Cohesive Soil
- Unconfined Compressive Strength of Rock
- Chemical Analysis: pH, Sulfates, Sulfide, Chloride, Electrical Resistivity, Total Salts, Redox Potential

Boring log rock classification was determined using the Description of Rock Properties and locally accepted practices for engineering purposes. Petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Boring Location Plan
Exploration Plan
Geologic Map

BORING LOCATION PLAN

Republic Wastewater Treatment Plant Improvements ■ Republic, Missouri
August 19, 2022 ■ Terracon Project No. B5205029/B5215111

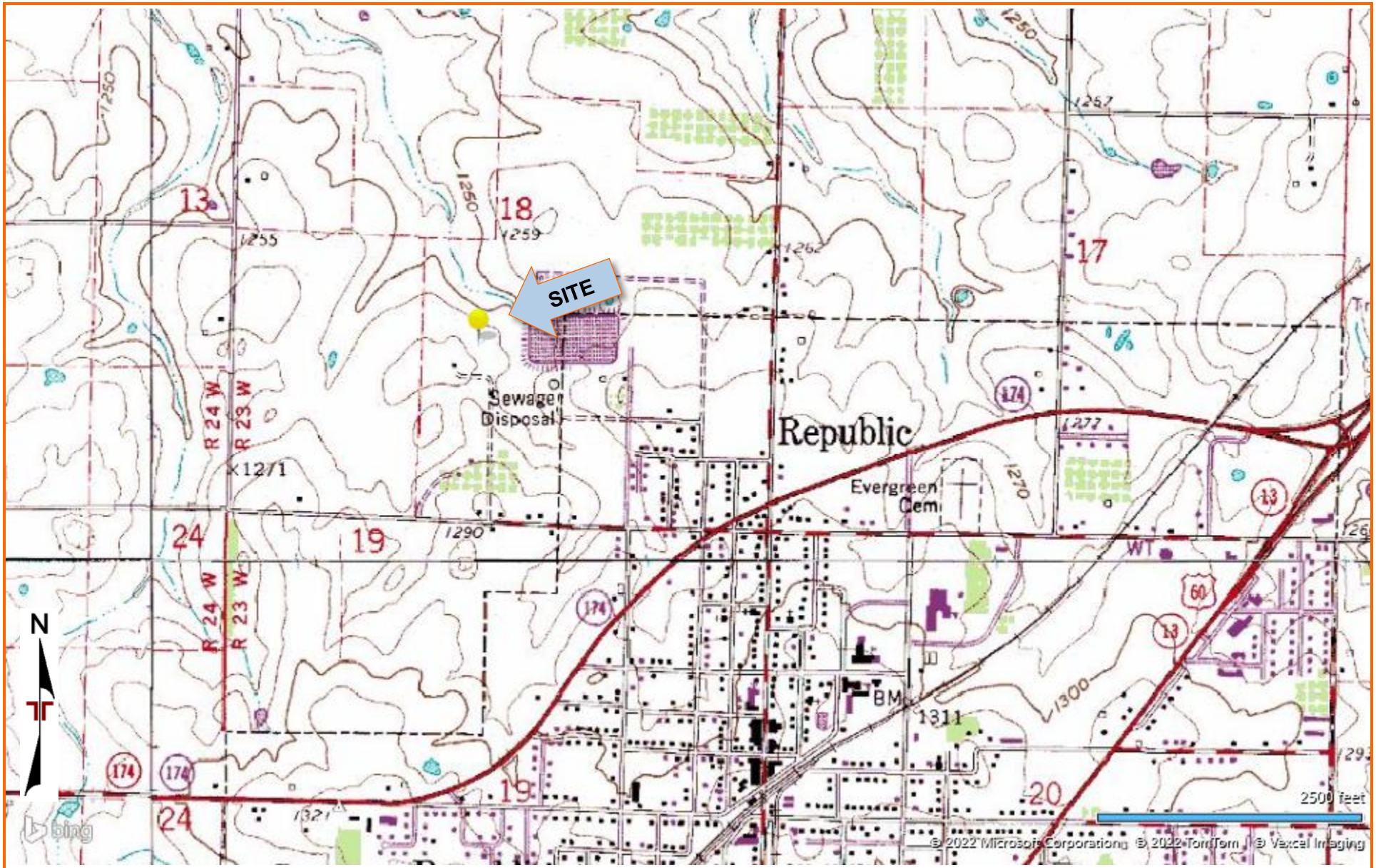


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

GEOPHYSICAL SITE PLAN

Republic Wastewater Treatment Plant Improvements ■ Republic, Missouri
August 19, 2022 ■ Terracon Project No. B5205029/B5215111

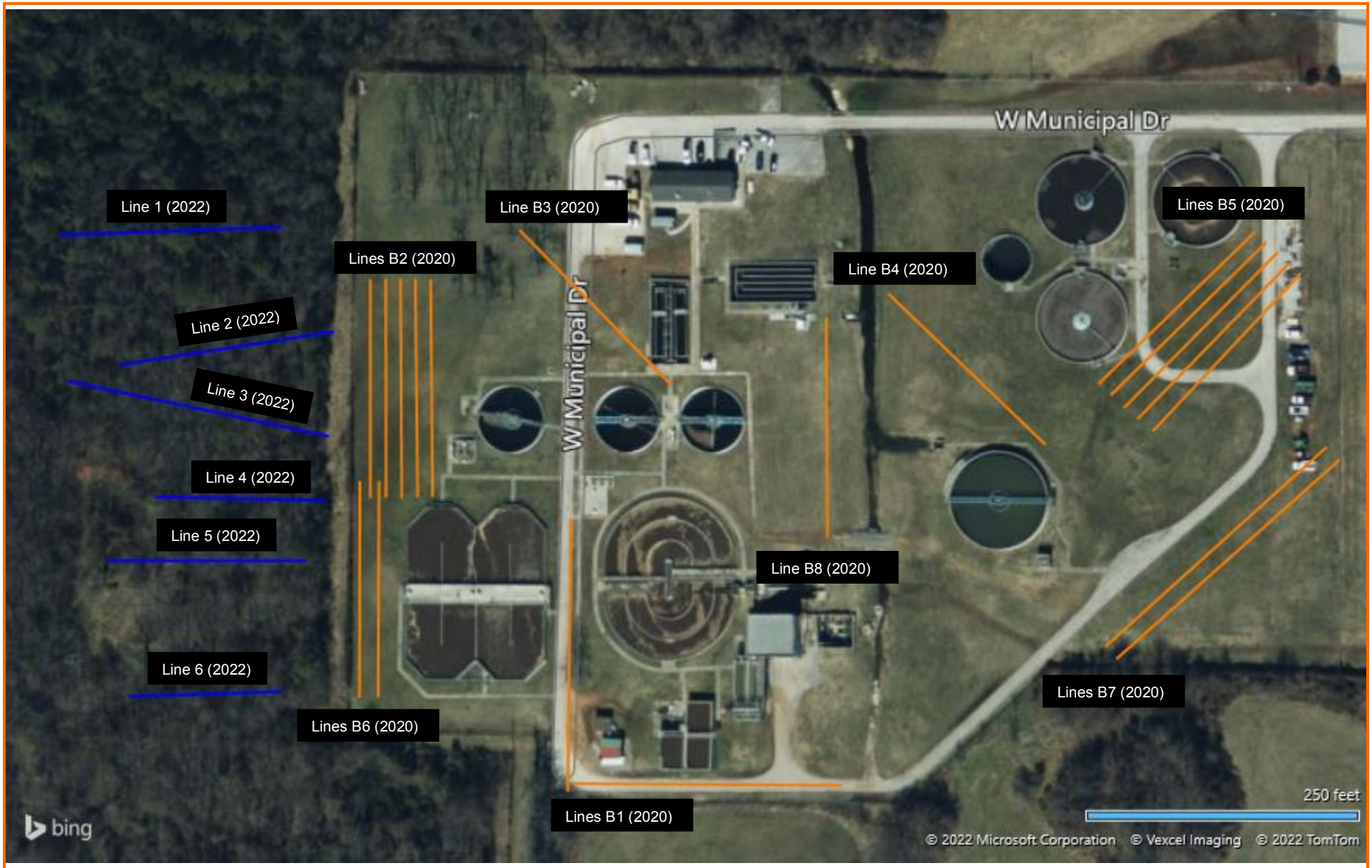


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

BORING LOCATION PLAN

Republic Wastewater Treatment Plant Improvements ■ Republic, Missouri
August 19, 2022 ■ Terracon Project No. B5205029/B5215111

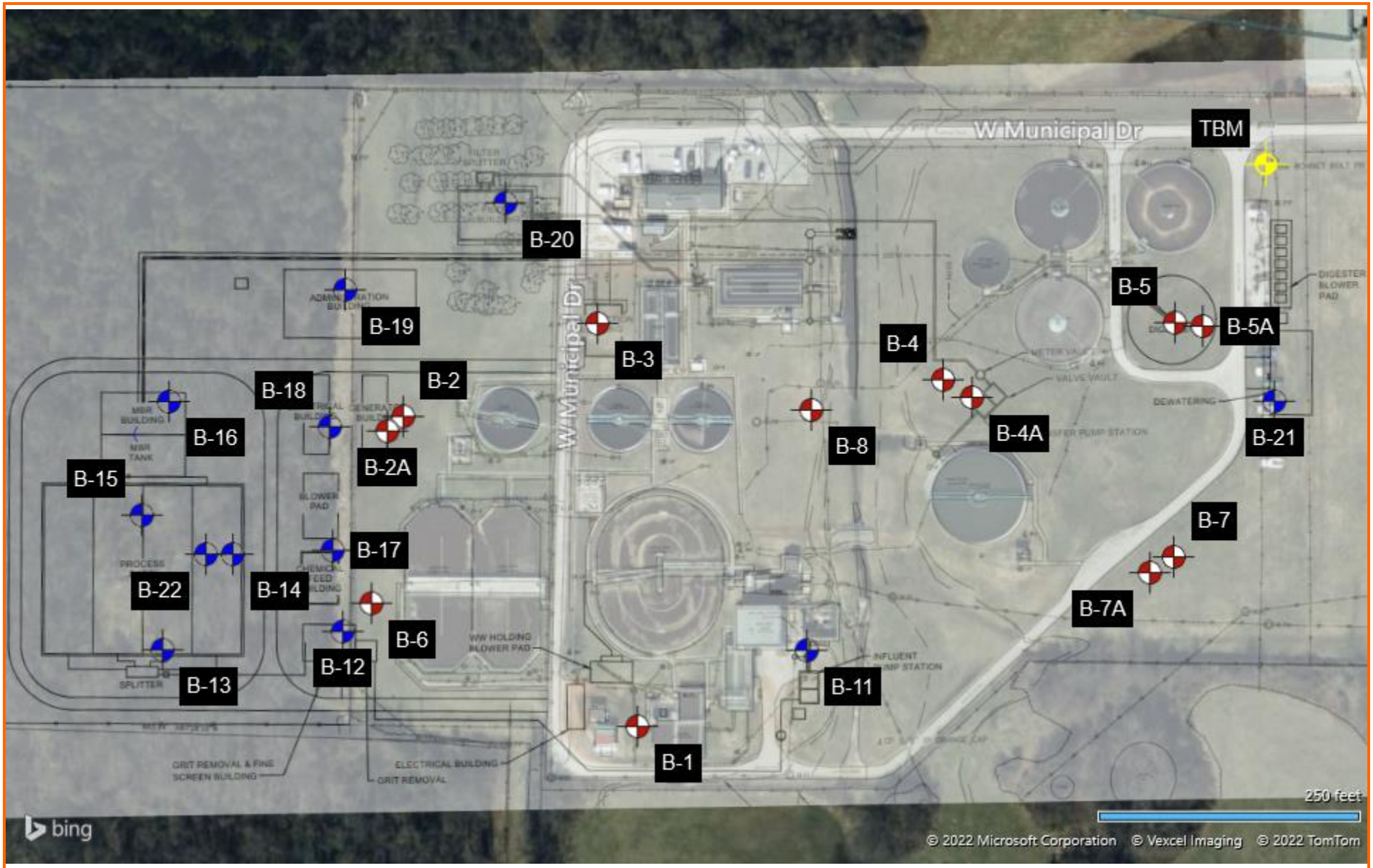


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

GEOLOGIC MAP

Republic Wastewater Treatment Plant Improvements ■ Republic, Missouri
August 19, 2022 ■ Terracon Project No. B5205029/B5215111

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

GEOLOGIC MAP

Republic Wastewater Treatment Plant Improvements ■ Republic, Missouri
August 19, 2022 ■ Terracon Project No. B5205029/B5215111

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Logs (2020 & 2022)
Atterberg Limits (2020 & 2022)
Grain Size Distribution (2020 & 2022)
Moisture Density Relationships (2020)
Chemical Testing Results (2020 & 2022)
Unconfined Compressive Strength – Rock (2020 & 2022)
Rock Core Photographs (2020 & 2022)
MASW Profiles (2020 & 2022)
Shear Wave Velocity Profile

BORING LOG NO. B-1

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1297° Longitude: -93.4889°

Approximate Surface Elev.: 1263.5 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.1	1263.4+/-													
2			**TOPSOIL**													
			FILL - LEAN CLAY WITH SAND (CL), trace gravel, red and brown				8	5-5-3 N=8			1.5 (HP)		20.3			
							3	5-5-4 N=9			1.25 (HP)		16.8			
		5.0	1258.5+/-	5												
			CLAYEY GRAVEL (GC), red, (Possible Fill)				1	2-5-2 N=7			1.0 (HP)		31.9			
		8.0	1255.5+/-													
3			**LEAN CLAY WITH GRAVEL (CL)**, stiff				6	4-5-8 N=13			0.5 (HP)		16.7		33-20-13	
		10.0	1253.5+/-	10												
			FAT CLAY (CH), trace gravel, red, stiff													
							4				0.5 (HP)		57.3			
		15.0	1248.5+/-													
		15.5	1248+/-	15			2	50/2"					9.8			
4			**HIGHLY WEATHERED LIMESTONE**, gray													
			LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock						100	100						7,160
				20					100	100						9,700
		25.5	1238+/-	25					100	100						
			Boring Terminated at 25.5 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-22-2020 | Boring Completed: 10-22-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-2

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1305° Longitude: -93.4897°

Approximate Surface Elev.: 1270 (Ft.) +/-

MODEL LAYER	DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
3	0.0	1270+/-	**LEAN CLAY WITH GRAVEL (CL)**, with sand, red and brown, very stiff to hard				4	50			1.75 (HP)		10.8			
				5			8	5-8-12 N=20			3.0 (HP)		24.8			
							12	8-6-5 N=11			3.0 (HP)		37.1		75-41-34	
				10			6	6-14-11 N=25			0.75 (HP)		34.3			
	6.0	1264+/-	**FAT CLAY WITH GRAVEL (CH)**, red, stiff to very stiff													
							24				0.75 (HP)	840	54.7	40		
	15.0	1255+/-	**FAT CLAY (CH)**, trace gravel, red, medium stiff	15												
				20			18	6-3-2 N=5			0.75 (HP)		45.5			
	23.0	1247+/-														
4	23.5	1246.5+/-	**HIGHLY WEATHERED LIMESTONE**, gray				0	50/0"	100	100						7,940
			LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock	25					100	93						
				30					100	88						7,080
	33.5	1236.5+/-	***Boring Terminated at 33.5 Feet***													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

After 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-23-2020 | Boring Completed: 10-23-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-3

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1308° Longitude: -93.4891°

Approximate Surface Elev.: 1267 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.2	1266.8+/-													
2		2.0	1265+/-				10	9-13-12 N=25			4.5 (HP)		31.2			
			FILL - CLAYEY GRAVEL (GC), red													
			FAT CLAY WITH GRAVEL (CH), dark brown, hard	5			6	19-18-8 N=26			2.5 (HP)		15.9			
		6.0	1261+/-													
3			**FAT CLAY (CH)**, trace gravel and sand, red, stiff				8	9-19-13 N=32			2.25 (HP)		35.0			
				10			4				2.0 (HP)		41.3			
				15			16	3-5-9 N=14			0.75 (HP)		57.9			
		16.0	1251+/-													
4			**LIMESTONE**, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock	20					100	96						9,460
									100	97						5,570
		26.0	1241+/-	25					100	100						

Boring Terminated at 26 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-28-2020 | Boring Completed: 10-28-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-4

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan
Latitude: 37.1306° Longitude: -93.4879°
Approximate Surface Elev.: 1261 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.2	1260.8+/-	**TOPSOIL**													
2				**FILL - CLAYEY GRAVEL (GC)**, red				5	10-12-12 N=24			4.0 (HP)		15.2			
								4	10-13-20 N=33			4.75 (HP)		14.4			
		6.0	1255+/-	**LEAN CLAY (CL)**, trace gravel, dark brown, hard	5			13	4-3-4 N=7			1.25 (HP)		22.9			
		9.0	1252+/-	**LEAN CLAY (CL)**, trace gravel, brownish red, stiff				14	4-6-7 N=13			3.0 (HP)		21.0		41-21-20	
		13.0	1248+/-	**CLAYEY GRAVEL (GC)**, red, medium dense	10			6	10-13-15 N=28			2.0 (HP)		20.0			
		18.5	1242.5+/-	**GRAVELLY FAT CLAY (CH)**, red	15			8	19-18-12 N=30			N/A		22.1			
3		23.5	1237.5+/-	**FAT CLAY (CH)**, trace gravel, red	20			18	0-1-2 N=3			1.0 (HP)		57.6			
								18	3-2-7 N=9			0.25 (HP)		71.1			
					25			18	4-3-5 N=8			N/A		41.3			
					30			18	0-2-3 N=5			N/A		69.9			
		38.5	1222.5+/-		35												
		39.0	1222+/-	**HIGHLY WEATHERED LIMESTONE**, gray	40			0	50/0"	100	88	N/A					
4				**LIMESTONE**, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock	45					100	92						5,860
		49.0	1212+/-							100	95						7,130
				Boring Terminated at 49 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-21-2020 | Boring Completed: 10-21-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-5

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1308° Longitude: -93.4872°

Approximate Surface Elev.: 1267 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.2	1266.8+/-													
			TOPSOIL													
2			**FILL - FAT CLAY WITH GRAVEL (CH)**, red				6	8-12-6 N=18			3.0 (HP)		25.2			
							5	7-6-5 N=11			4.5 (HP)		21.9			
		6.0	1261+/-	5												
		7.0	1260+/-				9	6-12-12 N=24			2.0 (HP)		15.3		33-15-18	
			LEAN CLAY (CL), trace gravel, brown, stiff													
		10.0	1257+/-				6	10-12-7 N=19			2.0 (HP)		25.8			
3			**GRAVELLY FAT CLAY (CH)**, red, very stiff	10												
			FAT CLAY (CH), trace gravel, red, stiff				20					360	54.3	41		
				15												
							8	10-6-3 N=9			1.25 (HP)		30.7			
		23.0	1244+/-	20												
		23.5	1243.5+/-				0	50/0"	100	44	N/A					
			HIGHLY WEATHERED LIMESTONE, gray													
		25.0	1242+/-	25												
			LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock						0	0						
		27.0	1240+/-													
			VOID	30												
		32.0	1235+/-						65	53						7,300
4			**CLAY SEAM**													
			LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock	35					100	92						8,380
		42.0	1225+/-	40					100	100						
			Boring Terminated at 42 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-20-2020 | Boring Completed: 10-20-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-6

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1300° Longitude: -93.4898°

Approximate Surface Elev.: 1272.5 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.2	1272.3+/-													
			TOPSOIL													
2			**FILL - FAT CLAY WITH GRAVEL (CH)**, red				8	11-17-5 N=22			4.5 (HP)		15.8			
				5			10	8-13-16 N=29			4.5 (HP)		22.3			
		6.0	1266.5+/-				18	4-4-5 N=9			2.5 (HP)		45.2			
3			**FAT CLAY (CH)**, trace gravel, red, stiff	10			18	5-5-6 N=11			3.25 (HP)		51.0			
				15			20					760	41.6	52		
		18.0	1254.5+/-													
			FAT CLAY WITH GRAVEL (CH), red, stiff	20			14	4-4-5 N=9			1.0 (HP)		38.4			
		22.0	1250.5+/-													
		22.5	1250+/-													
4			**HIGHLY WEATHERED LIMESTONE**, gray	25					100	100						
			LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock						100	100						7,640
		32.5	1240+/-	30					100	74						8,380
			Boring Terminated at 32.5 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-23-2020 | Boring Completed: 10-23-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-7

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1302° Longitude: -93.4872°

Approximate Surface Elev.: 1267 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.3	1266.7+/-													
2			**TOPSOIL**													
		3.5	**FILL - FAT CLAY WITH GRAVEL (CH)**, red 1263.5+/-				8	6-4-10 N=14			4.5 (HP)		17.5		45-22-23	
		6.0	**LEAN CLAY (CL)**, trace gravel, brown, very stiff 1261+/-	5			7	4-10-8 N=18			2.0 (HP)		20.6			
		8.5	**FAT CLAY WITH GRAVEL (CH)**, red, hard 1258.5+/-				11	9-6-24 N=30			2.25 (HP)		23.5			
3			**FAT CLAY (CH)**, trace gravel, red, stiff	10			16	5-5-5 N=10			2.25 (HP)		47.4		97-44-53	
				15			15	3-5-9 N=14			2.0 (HP)		46.8			
		18.5	1248.5+/-													
			FAT CLAY WITH GRAVEL (CH), red, medium stiff to stiff	20			9	5-4-5 N=9			2.75 (HP)		46.7			
				25			8	3-3-4 N=7			0.5 (HP)		21.9			
		27.0	1240+/-													
4		28.0	**HIGHLY WEATHERED LIMESTONE**, gray 1239+/-	30					100	80						10,120
			LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock						100	95						
				35					100	100						8,020
		38.0	1229+/-													
			Boring Terminated at 38 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-19-2020 | Boring Completed: 10-20-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-8

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1305° Longitude: -93.4884°

Approximate Surface Elev.: 1261.5 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.1	1261.4+/-	**TOPSOIL**													
		3.5	1258+/-	**LEAN CLAY WITH GRAVEL (CL)**, brown, stiff, (Possible Fill)				0	12-16-19 N=35			1.0 (HP)		26.9			
		6.0	1255.5+/-	**FAT CLAY WITH GRAVEL (CH)**, red, very stiff to hard	5			6	4-6-12 N=18			4.0 (HP)		20.8			
3		13.0	1248.5+/-	**CLAYEY GRAVEL (GC)**, red, medium dense to dense				8	22-32-10 N=42			12.25 (HP)		20.5			
					10			2	9-10-7 N=17			1.25 (HP)		24.2			
		23.0	1238.5+/-	**FAT CLAY (CH)**, trace gravel, red, medium stiff to stiff	15			20				N/A	1920	46.2	44		
					20			12	2-3-4 N=7			1.0 (HP)		47.4			
		28.5	1233+/-	**HIGHLY WEATHERED LIMESTONE**, gray, with occasional clay seams	25			10	2-20-9 N=29			N/A		47.8			
4		38.5	1223+/-	**LIMESTONE**, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock	30			0	50/0"	100	95	N/A					8,130
					35					100	97						8,280
				Boring Terminated at 38.5 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

After 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-21-2020 | Boring Completed: 10-22-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-2A

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1305° Longitude: -93.4897°

Approximate Surface Elev.: 1270 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.1	1269.9+/-													
			TOPSOIL													
			CLAYEY GRAVEL (GC), brown, very stiff to hard				8	23-19-12 N=31			3.0 (HP)		16.6			
		5.0	1265+/-				4	13-9-16 N=25			N/A		18.4			
			FAT CLAY (CH), trace gravel, red, stiff	5			16				N/A	1560	48.6	44		
							18	5-4-5 N=9			3.25 (HP)		36.9			
3		13.5	1256.5+/-	10												
			FAT CLAY WITH GRAVEL (CH), red, very stiff				14	13-16-9 N=25			1.75 (HP)		34.3			
		18.5	1251.5+/-	15												
			FAT CLAY (CH), trace gravel, red, soft				10	0-0-1 N=1			N/A		70.1		89-37-52	
				20												
							10				N/A	120	79.3	29		
		26.0	1244+/-	25												
4		27.0	1243+/-						100	83						8,750
			HIGHLY WEATHERED LIMESTONE, gray, with occasional clay seams	30												
			LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock						100	100						
				35												
		37.0	1233+/-						100	96						7,320
			Boring Terminated at 37 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

After 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-30-2020 | Boring Completed: 10-30-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-4A

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1306° Longitude: -93.4878°

Approximate Surface Elev.: 1263 (Ft.) +/-

MODEL LAYER	DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
1	0.1	1262.9+/-	**TOPSOIL**									
	3.5	1259.5+/-	**FILL - FAT CLAY WITH GRAVEL (CH)**, red and brown			6	4-4-4 N=8	1.0 (HP)		22.2		
	6.0	1257+/-	**FILL - FAT CLAY WITH GRAVEL (CH)**, red	5		6	5-10-11 N=21	1.75 (HP)		18.2		
2	8.5	1254.5+/-	**FILL - GRAVELLY FAT CLAY (CH)**, red			6	8-6-3 N=9	N/A		20.0		
	13.5	1249.5+/-	**LEAN CLAY (CL)**, trace gravel, dark brown, medium stiff	10		10	4-4-4 N=8	1.5 (HP)		21.9		39-20-19
	18.5	1244.5+/-	**GRAVELLY LEAN CLAY (CL)**, brown, medium stiff	15		20		N/A	1900	24.3	64	
			FAT CLAY WITH GRAVEL (CH), red, medium stiff	20	▽	18	2-3-3 N=6	0.75 (HP)		22.4		
				25		18	3-3-2 N=5	1.0 (HP)		28.2		48-21-27
	28.5	1234.5+/-										
3			**FAT CLAY (CH)**, trace gravel, red brown, stiff to very stiff	30		12	3-6-7 N=13	1.25 (HP)		25.5		
			Red below 33.5 feet	35		13	13-14-9 N=23	0.5 (HP)		24.7		
	38.5	1224.5+/-										
			FAT CLAY WITH GRAVEL (CH), red, stiff	40		10	7-7-7 N=14	1.0 (HP)		24.4		
				45		11	5-6-6 N=12	2.5 (HP)		27.2		
	48.5	1214.5+/-										
			GRAVELLY FAT CLAY (CH), red, stiff	50		10	11-7-7 N=14	N/A		33.7		
	52.0	1211+/-										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

▽ *After 24 hours*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-30-2020 | Boring Completed: 10-30-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-4A

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1306° Longitude: -93.4878°

Approximate Surface Elev.: 1263 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
4		52.5	1210.5+/-													
		53.5	1209.5+/-													
		54.5	1208.5+/-						79	31						
				55												
									100	63						11,170
				60												
									100	100						6,900
		64.5	1198.5+/-													

HIGHLY WEATHERED LIMESTONE, gray, -with occasional clay seams

LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock

CLAY SEAM

LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock

Boring Terminated at 64.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

After 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 10-30-2020 | Boring Completed: 10-30-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-5A

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1308° Longitude: -93.4871°

Approximate Surface Elev.: 1267 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.1	1266.9+/-													
2			**TOPSOIL**													
			FILL - FAT CLAY WITH GRAVEL (CL), brown			X	6	12-7-4 N=11					26.7			
		3.5	1263.5+/-													
			GRAVELLY LEAN CLAY (CL), brown, stiff to very stiff, (Possible Fill)			X	10	6-11-10 N=21					20.8			
		6.0	1261+/-	5												
			GRAVELLY LEAN CLAY (CL), red and brown, stiff to very stiff			X	12	10-7-6 N=13					16.8			
						X	15	9-14-13 N=27					25.4		45-19-26	
				10												
		13.5	1253.5+/-													
3			**GRAVELLY FAT CLAY (CH)**, red, medium stiff to stiff			■	18					390	60.2	43		
				15												
						X	8	5-3-5 N=8					32.9			
		23.5	1243.5+/-	20												
			FAT CLAY (CH), trace gravel, red			X	18	0-1-1 N=2					73.8			
		28.5	1238.5+/-	25												
		30.5	**FAT CLAY WITH GRAVEL (CH)**, red, soft to medium stiff 1236.5+/-			X	10	18-5-3 N=8					73.3			
4			**LIMESTONE**, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock	30		▮			100	97						8,330
				35		▮			100	97						6,500
		40.5	1226.5+/-	40												
			Boring Terminated at 40.5 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

Not oberseved while drilling

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 11-02-2020 | Boring Completed: 11-02-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-7A

PROJECT: Republic WWTP

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

LOCATION See Exploration Plan

Latitude: 37.1301° Longitude: -93.4872°

Approximate Surface Elev.: 1267 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	REC%	RQD%	LABORATORY HP (psf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.1	1266.9+/-	**TOPSOIL**													
		3.5	1263.5+/-	**FAT CLAY WITH GRAVEL (CH)**, red, medium stiff, (Possible Fill)				8	3-4-3 N=7					33.2			
				CLAYEY GRAVEL (GC), red, very stiff to hard	5			0	8-14-9 N=23								
								10	14-19-13 N=32					19.5			
					10			10	22-19-16 N=35					17.8			
		13.5	1253.5+/-														
3				**FAT CLAY (CH)**, trace gravel, red, medium stiff to very stiff	15			14	3-3-3 N=6					53.9			
					20			12	2-10-11 N=21					48.5			
		23.5	1243.5+/-														
				FAT CLAY WITH GRAVEL (CH), red, very stiff	25			10	8-9-7 N=16					37.1			
					30			13	8-11-9 N=20					58.3			
		33.5	1233.5+/-														
				FAT CLAY (CH), trace gravel, red, soft	35	▽		18	6-2-2 N=4					41.4			
		38.0	1229+/-														
4		40.0	1227+/-	**HIGHLY WEATHERED LIMESTONE**, gray, -with occasional clay seams	40			6	28-50/1"					47.3			
				LIMESTONE, gray, coarse-grained, sound, thick bedding, slightly weathered, strong rock						100	84						6,920
					45					100	75						3,390
		50.0	1217+/-		50					100	100						
				Boring Terminated at 50 Feet													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers to refsual followed with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were measured in the field using an engineer's level and grade rod.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Not observed after 24 hours

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 11-02-2020 | Boring Completed: 11-02-2020

Drill Rig: CME 750X | Driller: DH

Project No.: B5205029

BORING LOG NO. B-11

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1299° Longitude: -93.4884°

Approximate Surface Elev.: 1264.4 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.3	1264.1+/-											
			TOPSOIL											
			FILL - GRAVELLY LEAN CLAY (CL), brown				8	5-5-4 N=9			1.5 (HP)	15.5		
2							4	2-3-4 N=7			0.5 (HP)	23.0		
				5			10	4-8-7 N=15			1.5 (HP)	35.2		
		10.0	1254.4+/-				8	16-10-6 N=16			3.0 (HP)	20.1		
			FAT CLAY WITH GRAVEL (CH), red, medium stiff to very stiff	10										
							18	1-3-5 N=8			2.0 (HP)	25.4	52-16-36	
				15										
							14	13-16-11 N=27			1.0 (HP)	23.4		
				20										
							13	7-15-12 N=27			2.5 (HP)	30.4		
				25										
3		30.0	1234.4+/-				18	8-4-7 N=11			1.0 (HP)	50.6		
			FAT CLAY (CH), red and tan, very soft to stiff	30										
					▽		15	7-11-5 N=16			0.5 (HP)	66.8		
				35										
					▽		9	7-5-6 N=11			N/A	111.2		
				40										
							8	1-0-0 N=0			0.5 (HP)	48.1		
				45										
		50.0	1214.4+/-				2	0-1-2 N=3			3.5 (HP)	22.4		
			Boring Terminated at 50 Feet	50										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-24-2022 | Boring Completed: 06-24-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-12

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1300° Longitude: -93.4899°

Approximate Surface Elev.: 1273.3 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.2	1273.1+/-											
			TOPSOIL											
			CLAYEY GRAVEL WITH SAND (GC), brown, medium dense				9	4-6-6 N=12			N/A	16.0		
		5.0	1268.3+/-	5			10	6-16-6 N=22			3.5 (HP)	24.1		
3			**FAT CLAY WITH GRAVEL (CH)**, red, medium stiff to very stiff				18	4-5-5 N=10			2.5 (HP)	49.1		
				10			14	7-8-8 N=16			2.5 (HP)	49.7		
				15			8	2-3-4 N=7			0.5 (HP)	47.0		
				20	▽		18	3-5-2 N=7			0.5 (HP)	67.8		
		23.0	1250.3+/-											
4			**WEATHERED LIMESTONE**											
		25.0	1248.3+/-	25			18	3-22-24 N=46			N/A	25.1		
			Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While sampling*

▽ *At completion of drilling*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-21-2022 | Boring Completed: 06-21-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-13

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1299° Longitude: -93.4905°

Approximate Surface Elev.: 1275.9 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
3			**CLAYEY GRAVEL WITH SAND (GC)**, brown, medium dense				3	5-12-12 N=24			N/A	9.2		
		3.0	1272.9+/-											
			FAT CLAY WITH GRAVEL (CH), red, stiff to very stiff	5			8	6-20-9 N=29			2.0 (HP)	30.2		
							6	9-14-7 N=21			2.5 (HP)	38.7		
				10			10	7-7-7 N=14			3.5 (HP)	36.6		
				15			13	2-20-9 N=29			2.5 (HP)	49.6		
		20.5	1255.4+/-											
4		21.0	**WEATHERED LIMESTONE** 1254.9+/-	20			9	3-5-10 N=15			2.0 (HP)	54.5		
			Auger Refusal at 21 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:
Auger refusal on possible cobbles, boulder, or bedrock.

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-22-2022	Boring Completed: 06-22-2022
Drill Rig: CME 750X	Driller: DH
Project No.: B5215111	

BORING LOG NO. B-14

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1302° Longitude: -93.4902°

Approximate Surface Elev.: 1275.1 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
3		0.0	1275.1+/-											
			CLAYEY GRAVEL WITH SAND (GC), brown, medium dense				10	6-8-11 N=19			1.0 (HP)	20.1		
							7	22-16-5 N=21			0.5 (HP)	18.1		
		5.5	1269.6+/-	5										
			FAT CLAY WITH GRAVEL (CH), red, stiff to hard				12	20-21-14 N=35			3.5 (HP)	49.2		
							18	8-7-9 N=16			1.5 (HP)	57.7		
				10										
							8	3-5-5 N=10			1.0 (HP)	48.3		
				15										
					▽		12	5-7-7 N=14			1.5 (HP)	52.3		
				20										
4			**LIMESTONE**, fine to medium-grained, slightly fractured, slightly weathered				60		100	95				3710
				25										
							57		95	78				12510
				30										
		33.0	1242.1+/-											
			Boring Terminated at 33 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-22-2022 | Boring Completed: 06-22-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-15

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1303° Longitude: -93.4905°

Approximate Surface Elev.: 1276.8 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.2	1276.6+/-											
			TOPSOIL											
			CLAYEY GRAVEL (GC), brown, medium dense to dense				10	6-6-6 N=12			2.5 (HP)	19.0		
							9	32-19-12 N=31			2.0 (HP)	22.3		
		6.0	1270.8+/-	5										
			POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC), brown, medium dense				11	12-10-8 N=18			1.0 (HP)	16.2	36-15-21	
		8.0	1268.8+/-											
			FAT CLAY WITH GRAVEL (CH), red, very soft to stiff	10			12	10-6-6 N=12			2.5 (HP)	43.2		
3														
				15			12	3-2-3 N=5			1.0 (HP)	35.8		
				20	▽		10	2-2-3 N=5			0.5 (HP)	58.7		
				25			18	2-1-1 N=2			0.5 (HP)	63.2		
		30.0	1246.8+/-	30										
4			**LIMESTONE**, grey, slightly fractured, slightly weathered				60		100	87				11280
				35			60		100	92				9730
		40.0	1236.8+/-	40										
			Boring Terminated at 40 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers with NQ2 core barrel

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While sampling*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-22-2022 | Boring Completed: 06-22-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-16

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1306° Longitude: -93.4905°

Approximate Surface Elev.: 1272.6 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
2		0.0												
		FILL - GRAVELLY LEAN CLAY (CL)												
		2.0	1270.6+/-											
3		**CLAYEY GRAVEL (GC)**, brown, medium dense												
		5.0	1267.6+/-											
		FAT CLAY WITH GRAVEL (CH), red, stiff to hard		5			7	4-7-11 N=18			1.0 (HP)	20.5		
							10	18-18-8 N=26			3.0 (HP)	35.3		
							10	7-6-7 N=13			2.5 (HP)	38.2	77-27-50	
				10			17	8-9-33 N=42			2.5 (HP)	50.1		
				15			18	7-11-7 N=18			2.5 (HP)	52.0		
				20			18	10-6-8 N=14			2.0 (HP)	53.0		
		22.5	1250.1+/-											
4		23.0	1249.6+/-											
		WEATHERED LIMESTONE												
		Auger Refusal at 23 Feet												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:
Auger refusal on possible cobbles, boulder, or bedrock.

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-22-2022	Boring Completed: 06-22-2022
Drill Rig: CME 750X	Driller: DH
Project No.: B5215111	

BORING LOG NO. B-17

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1302° Longitude: -93.4899°

Approximate Surface Elev.: 1273.7 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
3		0.0	1273.7+/-											
			CLAYEY GRAVEL (GC), brown, medium dense				12	7-13-7 N=20			1.0 (HP)	19.3		
		3.0	1270.7+/-											
			FAT CLAY WITH GRAVEL (CH), red, medium stiff to hard	5			13	5-5-6 N=11			2.5 (HP)	41.6		
							18	4-6-6 N=12			2.0 (HP)	48.0		
				10			18	6-16-15 N=31			3.5 (HP)	47.4		
				15	▽		7	4-3-5 N=8			1.0 (HP)	69.1		
		18.0	1255.7+/-											
4		18.5	1255.2+/-											
			WEATHERED LIMESTONE											
			Auger Refusal at 18.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:
Auger refusal on possible cobbles, boulder, or bedrock.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-21-2022 | Boring Completed: 06-21-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-18

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1305° Longitude: -93.4899°

Approximate Surface Elev.: 1271.1 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
3														
			CLAYEY GRAVEL (GC), brown, dense											
		4.0	1267.1+/-											
			FAT CLAY WITH GRAVEL (CH), red, medium stiff to very stiff	5			12	8-14-20 N=34			2.5 (HP)	18.3	29-19-10	
							16	6-6-11 N=17			2.5 (HP)	36.3		
							5	9-16-8 N=24			3.0 (HP)	19.1		
				10			12	5-10-7 N=17			2.5 (HP)	46.8		
				15			14	7-8-5 N=13			4.0 (HP)	49.8		
				20			9	3-2-3 N=5			1.5 (HP)	58.0		
		25.0	1246.1+/-	25			18	3-3-3 N=6			0.5 (HP)	57.5		
			Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

While sampling

At completion of drilling

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-21-2022 | Boring Completed: 06-21-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-19

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1309° Longitude: -93.4899°

Approximate Surface Elev.: 1266.1 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
3		0.0	1266.1+/-											
		CLAYEY GRAVEL (GC), brown, medium dense to dense												
							12	20-28-22 N=50			N/A	19.6		
		5.0	1261.1+/-	5			16	7-11-9 N=20			2.5 (HP)	37.2		
		FAT CLAY WITH GRAVEL (CH), red, medium stiff to very stiff												
							9	12-6-9 N=15			2.5 (HP)	41.7		
				10			10	6-12-9 N=21			3.0 (HP)	47.5		
							5	3-4-5 N=9			1.0 (HP)	45.8		
				15										
					▽		7	4-5-3 N=8			N/A			
				20										
		25.0	1241.1+/-				16	1-0-8 N=8			1.0 (HP)	88.1		
		Boring Terminated at 25 Feet		25										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-21-2022 | Boring Completed: 06-21-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-20

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1311° Longitude: -93.4894°

Approximate Surface Elev.: 1260.4 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.3	1260.1+/-											
2		**TOPSOIL**												
		3.0	1257.4+/-											
		FAT CLAY WITH GRAVEL (CH), red, very soft to very stiff												
				5			6	9-12-10 N=22			N/A	18.8		
							8	9-15-13 N=28			3.5 (HP)	26.2		
							8	8-10-10 N=20			1.5 (HP)	28.2		
3				10			4	6-6-5 N=11			1.5 (HP)	27.7		
				15			9	2-1-0 N=1			N/A	71.3		
		19.0	1241.4+/-		▽									
4		20.0	**WEATHERED LIMESTONE** 1240.4+/-	20			15	5-5-50/4"			N/A	55.3		
		Auger Refusal at 20 Feet												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:
Auger refusal on possible cobbles, boulder, or bedrock.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-24-2022 | Boring Completed: 06-24-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-21

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1306° Longitude: -93.4868°

Approximate Surface Elev.: 1266.4 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
1		0.0												
2		0.4	1266+/-											
		TOPSOIL												
		FILL - GRAVELLY LEAN CLAY (CL)					10	4-4-2 N=6			1.5 (HP)	26.5		
		3.0	1263.4+/-											
		LEAN CLAY WITH GRAVEL (CL)					15	9-14-5 N=19			1.5 (HP)	20.9	41-18-23	
				5										
							10	4-5-5 N=10			3.5 (HP)	48.6		
		7.0	1259.4+/-											
3		**FAT CLAY WITH GRAVEL (CH)**, red, stiff to very stiff					8	7-7-8 N=15			2.0 (HP)	50.4		
				10										
							18	3-4-9 N=13			1.5 (HP)	52.7		
				15										
		18.0	1248.4+/-											
4		19.0	1247.4+/-				3	50/4"			N/A	16.3		
		WEATHERED LIMESTONE												
		Boring Terminated at 19 Feet												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:
Auger refusal on possible cobbles, boulder, or bedrock.

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4765 W Junction St
Springfield, MO

Boring Started: 06-24-2022 | Boring Completed: 06-24-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

BORING LOG NO. B-22

PROJECT: Republic, MO WWTP Expansion - Additional Borings

CLIENT: Burns & McDonnell Engineering Company Inc Kansas City, MO

SITE: Near 408 N. West Ave. Republic, MO

LOCATION See Exploration Plan

Latitude: 37.1302° Longitude: -93.4903°

Approximate Surface Elev.: 1275.0 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	REC (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	Strength (psi)
3			**CLAYEY GRAVEL (GC)**, brown, dense											
		5.0	1270+/-	5			9	6-18-18 N=36			2.0 (HP)	29.3		
			FAT CLAY WITH GRAVEL (CH), red, very soft to hard				7	15-19-20 N=39			N/A	18.0		
							12	21-29-9 N=38			2.5 (HP)	35.6		
				10			18	5-8-7 N=15			3.0 (HP)	47.1		
				15			15	2-3-4 N=7			1.5 (HP)	53.7		
				20			18	4-3-3 N=6			1.5 (HP)	64.7		
				25			18	0-0-0 N=0			N/A	92.8		
		30.0	1245+/-											
4		30.5	**WEATHERED LIMESTONE** 1244.5+/-	30			18	0-0-50 N=50			N/A	88.3		
			Boring Terminated at 30.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" center flight augers

Abandonment Method:
Boring backfilled with bentonite chips/grout upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:
Auger refusal on possible cobbles, boulder, or bedrock.

WATER LEVEL OBSERVATIONS

While drilling

At completion of drilling

Terracon
4765 W Junction St
Springfield, MO

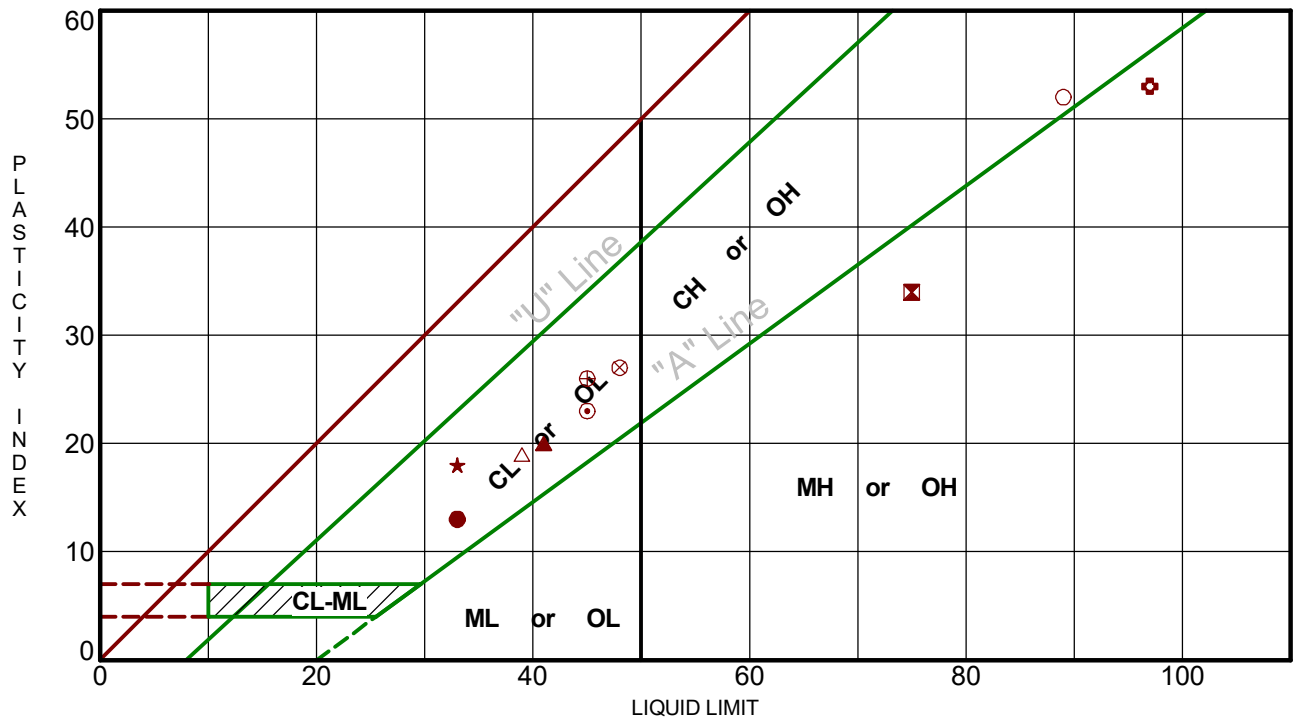
Boring Started: 06-24-2022 | Boring Completed: 06-24-2022

Drill Rig: CME 750X | Driller: DH

Project No.: B5215111

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-1	8.5 - 10	33	20	13			
⊠	B-2	6 - 7.5	75	41	34			
▲	B-4	8.5 - 10	41	21	20			
★	B-5	6 - 7.5	33	15	18			
⊙	B-7	1 - 2.5	45	22	23			
✿	B-7	8.5 - 10	97	44	53			
○	B-2A	18.5 - 20	89	37	52			
△	B-4A	8.5 - 10	39	20	19			
⊗	B-4A	23.5 - 25	48	21	27			
⊕	B-5A	8.5 - 10	45	19	26			

PROJECT: Republic WWTP

PROJECT NUMBER: B5205029

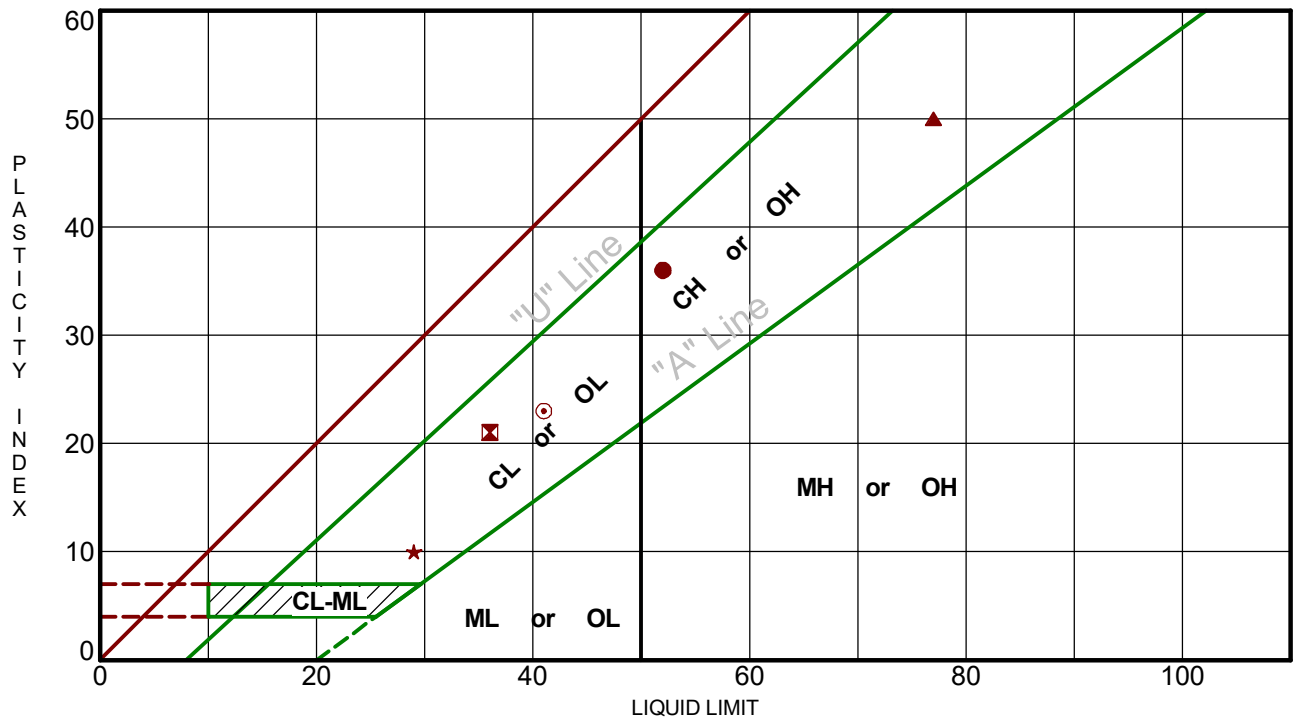
SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

Terracon
4765 W Junction St
Springfield, MO

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-11	13.5 - 15	52	16	36			
⊠	B-15	6 - 7.5	36	15	21	6.1	GP-GC	POORLY GRADED GRAVEL with CLAY and SAND
▲	B-16	6 - 7.5	77	27	50			
★	B-18	1 - 2.5	29	19	10			
⊙	B-21	3.5 - 5	41	18	23			

PROJECT: Republic, MO WWTP Expansion - Additional Borings

SITE: Near 408 N. West Ave. Republic, MO

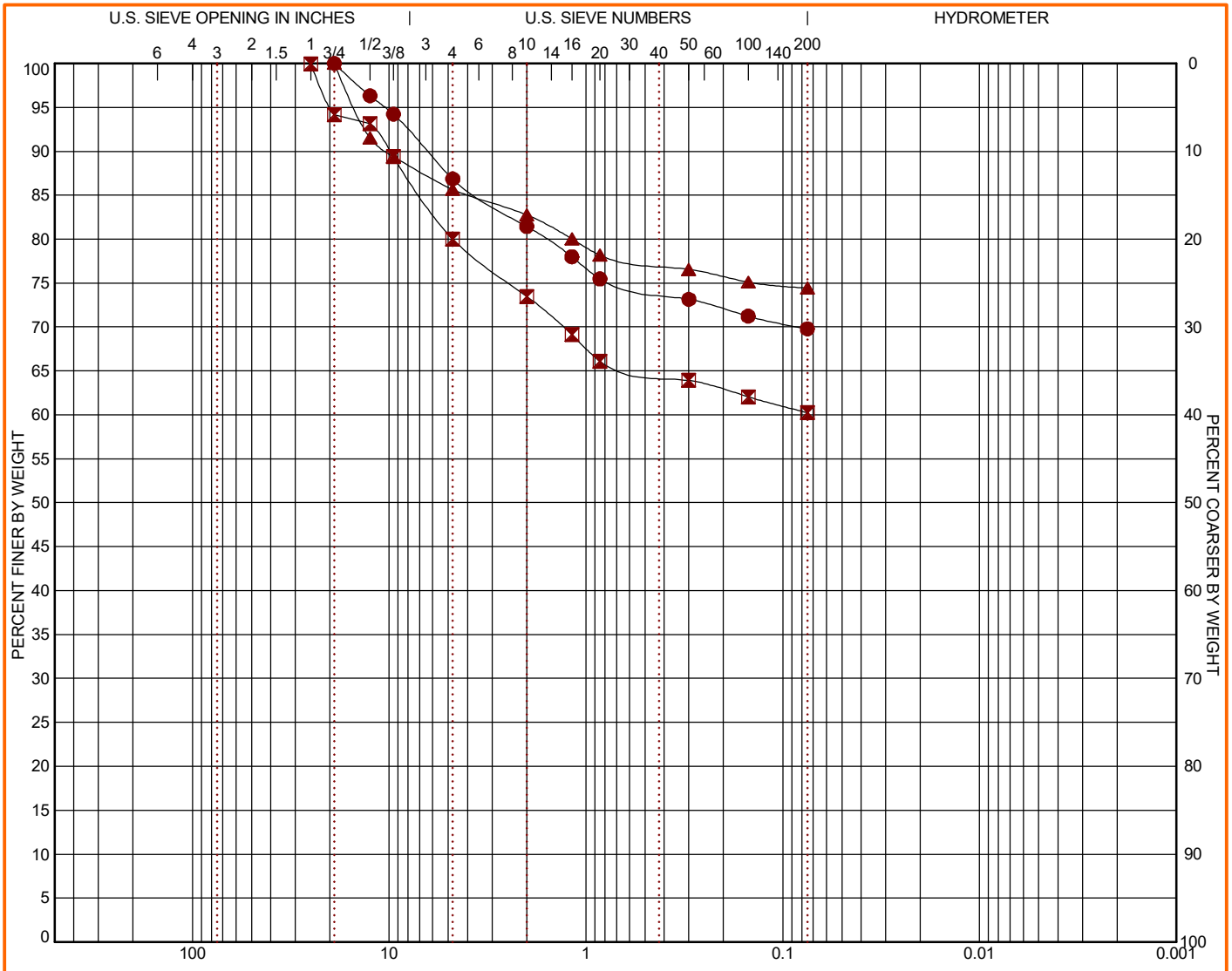
Terracon
4765 W Junction St
Springfield, MO

PROJECT NUMBER: B5215111

CLIENT: Burns & McDonnell Engineering Company Inc
Kansas City, MO

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-1	1 - 2.5	0.0	13.1	17.1		69.8		
⊠	B-2	3.5 - 5		19.9	19.8		60.3		
▲	B-3	8 - 9	0.0	14.4	11.2		74.4		

GRAIN SIZE	●	⊠	▲
D_{60}			
D_{30}			
D_{10}			

COEFFICIENTS	●	⊠	▲
C_C			
C_U			

● Sieve	● % Finer	⊠ Sieve	⊠ % Finer	▲ Sieve	▲ % Finer
3/4"	100.0	1"	99.94	3/4"	100.0
1/2"	96.32	3/4"	94.13	1/2"	91.51
3/8"	94.22	1/2"	93.17	3/8"	89.37
#4	86.85	3/8"	89.4	#4	85.65
#8	81.44	#4	80.02	#8	82.76
#16	77.99	#8	73.48	#16	80.03
#30	75.48	#16	69.12	#30	78.17
#100	73.14	#30	66.11	#100	76.56
#200	71.23	#100	63.9	#200	75.11
	69.79	#200	62.06		74.43
			60.26		

SOIL DESCRIPTION	
●	
⊠	
▲	

REMARKS	
●	
⊠	
▲	

PROJECT: Republic WWTP

PROJECT NUMBER: B5205029

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

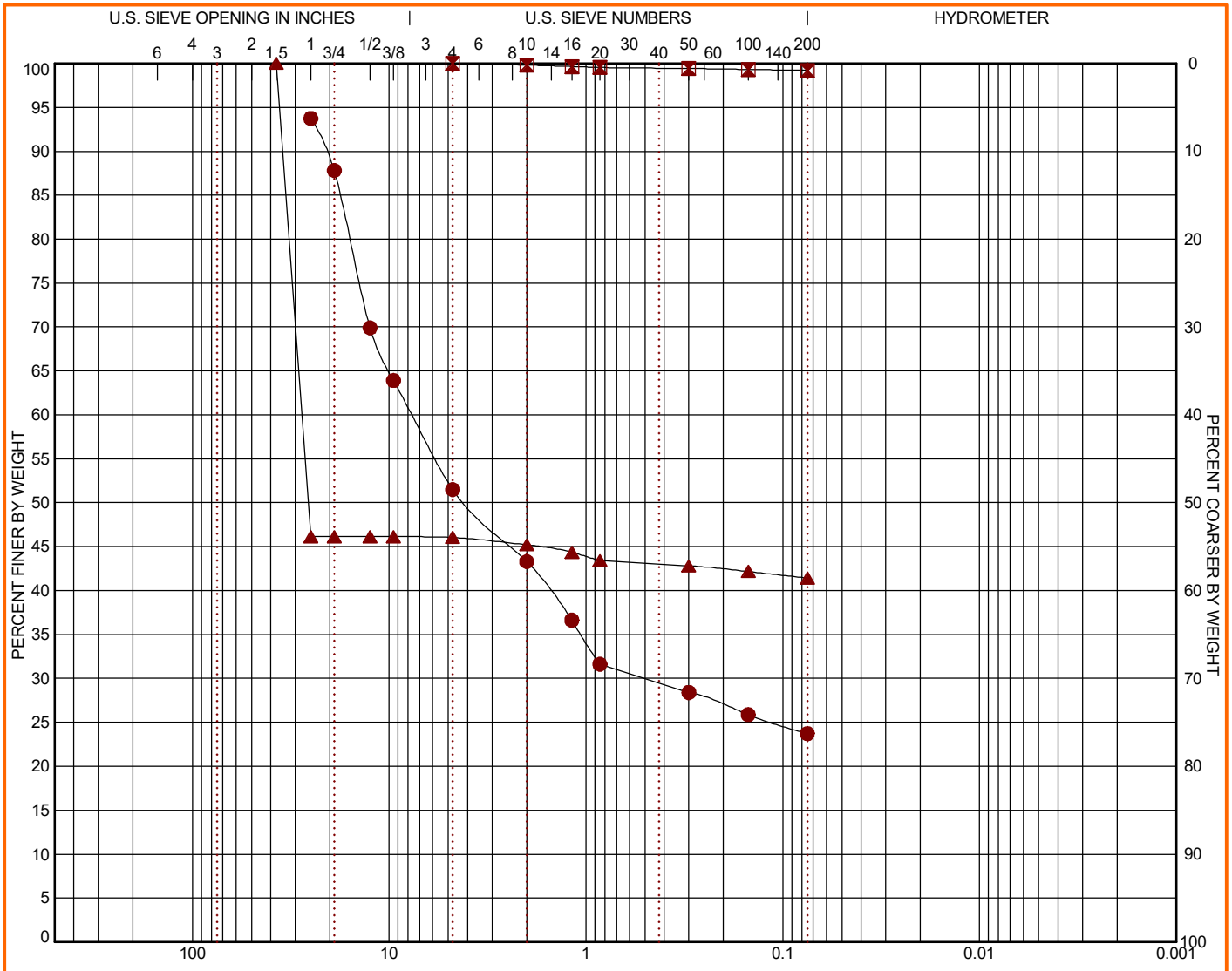
Terracon
4765 W Junction St
Springfield, MO

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 KF B5205029 REPUBLIC WASTEWAT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/22

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-4	18.5 - 20		42.2	27.8		23.7		
⊠	B-6	8.5 - 10	0.0	0.0	0.8		99.2		
▲	B-8	8.5 - 10	0.0	54.0	4.6		41.4		

GRAIN SIZE	●	⊠	▲
D_{60}	7.636		27.748
D_{30}	0.504		
D_{10}			

COEFFICIENTS	●	⊠	▲
C_C			
C_U			

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
1"	93.74	#4	100.0	1"	46.15
3/4"	87.81	#8	99.81	3/4"	46.15
1/2"	69.9	#16	99.64	1/2"	46.15
3/8"	63.91	#30	99.55	3/8"	46.15
#4	51.5	#100	99.42	#4	46.05
#8	43.3	#200	99.31	#8	45.21
#16	36.63		99.2	#16	44.37
#30	31.62			#30	43.43
#100	28.4			#100	42.8
#200	25.88			#200	42.17
	23.72				41.44
					100.0

SOIL DESCRIPTION	
●	
⊠	
▲	

REMARKS	
●	
⊠	
▲	

PROJECT: Republic WWTP

PROJECT NUMBER: B5205029

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

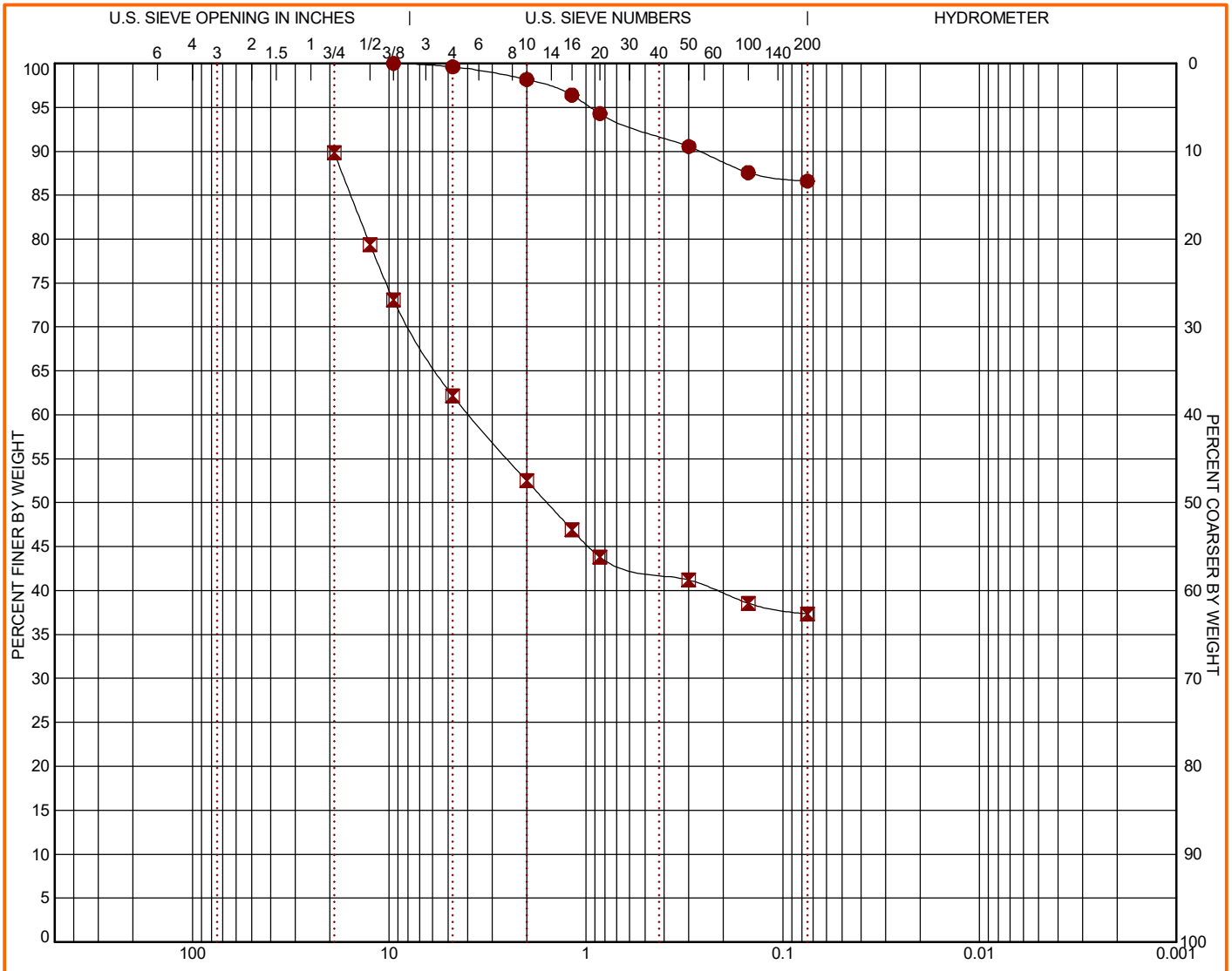
Terracon
4765 W Junction St
Springfield, MO

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 KF B5205029 REPUBLIC WASTEWAT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/22

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-4A	13 - 15	0.0	0.4	13.0		86.6		
⊠	B-5A	6 - 7.5		27.6	24.8		37.3		

GRAIN SIZE	●	⊠	
D_{60}		3.91	
D_{30}			
D_{10}			

COEFFICIENTS	●	⊠	
C_C			
C_U			

●		⊠			
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	99.61	3/4"	89.81		
#8	98.17	1/2"	79.39		
#16	96.4	3/8"	73.07		
#30	94.28	#4	62.18		
#100	90.54	#8	52.49		
#200	87.57	#16	46.93		
	86.61	#30	43.81		
	100.0	#100	41.2		
		#200	38.56		
			37.33		

SOIL DESCRIPTION	
●	
⊠	

REMARKS	
●	
⊠	

PROJECT: Republic WWTP

PROJECT NUMBER: B5205029

SITE: N. West Ave. NW of Wade St. Intersection
Republic, Missouri

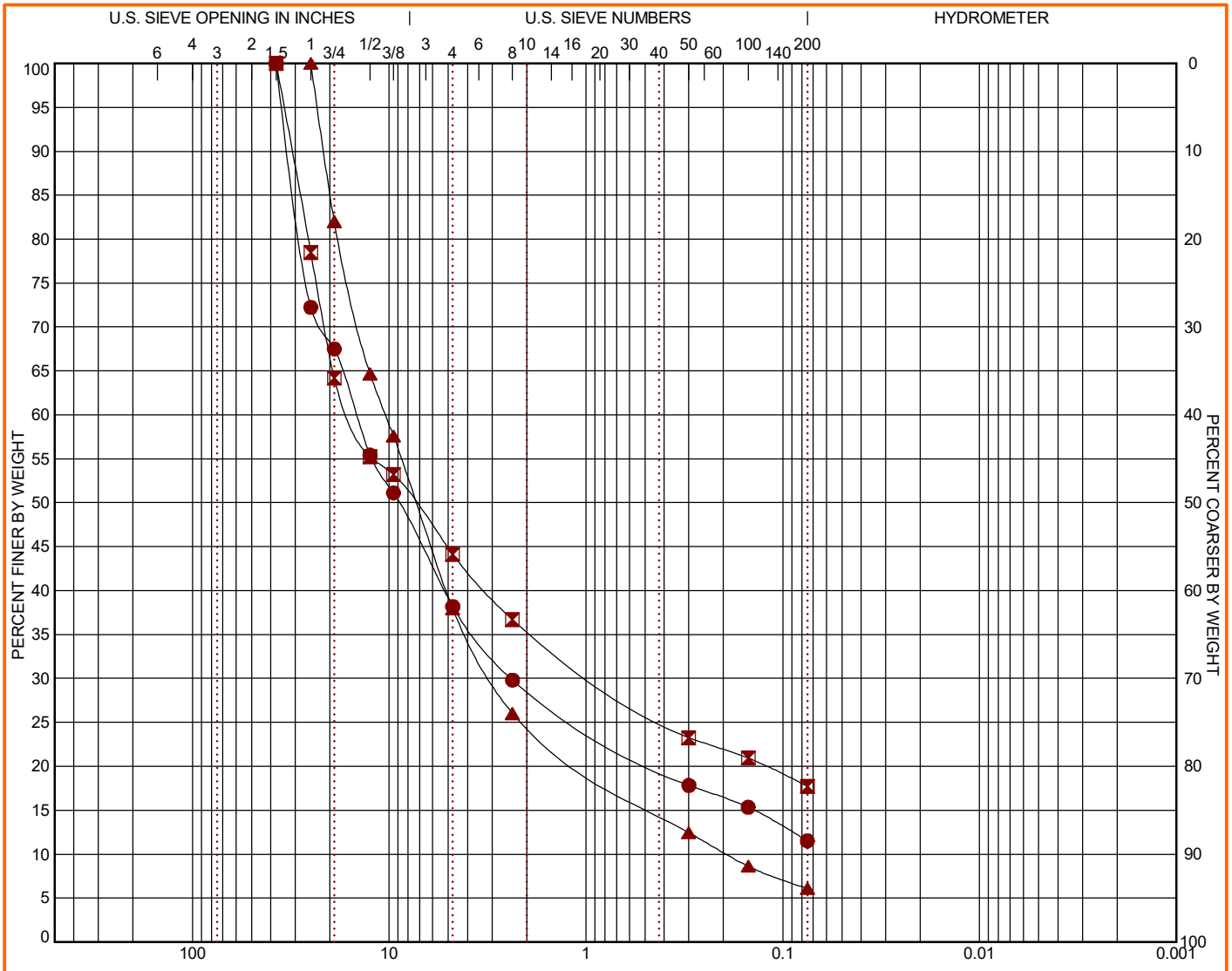
Terracon
4765 W Junction St
Springfield, MO

CLIENT: Burns & McDonnell Engineering Co.
Kansas City, Missouri

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 KF B5205029 REPUBLIC WASTEWAT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/22

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-12	1 - 2.5	0.0	61.8	26.7		11.5		
⊠	B-14	3.5 - 5	0.0	55.8	26.4		17.7		
▲	B-15	6 - 7.5	0.0	62.1	31.8		6.1		GP-GC

GRAIN SIZE	●	⊠	▲
D_{60}	14.651	15.605	10.43
D_{30}	2.398	0.844	2.982
D_{10}			0.192

COEFFICIENTS	●	⊠	▲
C_C	6.88		4.43
C_U	256.63		54.21

●		⊠		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
1 1/2"	100.0	1 1/2"	100.0	1"	100.0
1"	72.23	1"	78.45	3/4"	82.02
3/4"	67.5	3/4"	64.22	1/2"	64.67
1/2"	55.42	1/2"	55.25	3/8"	57.59
3/8"	51.12	3/8"	53.21	#4	37.91
#4	38.19	#4	44.15	#8	26.02
#8	29.81	#8	36.69	#100	12.44
#100	17.82	#100	23.27	#200	8.63
#200	15.34	#200	20.94		6.1
	11.51		17.72		

SOIL DESCRIPTION	
●	
⊠	
▲	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)

REMARKS	
●	
⊠	
▲	

PROJECT: Republic, MO WWTP Expansion - Additional Borings

SITE: Near 408 N. West Ave. Republic, MO

Terracon
4765 W Junction St
Springfield, MO

PROJECT NUMBER: B5215111

CLIENT: Burns & McDonnell Engineering Company Inc
Kansas City, MO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 B5215111 REPUBLIC, MO WWTP.GPJ TERRACON_DATATEMPLATE.GDT 7/21/22

LABORATORY COMPACTION CHARACTERISTICS OF SOIL REPORT

Report Number: B5205029.0001
Service Date: 10/26/20
Report Date: 10/28/20

Terracon
4765 W Junction St
Springfield, MO 65802-1013
417-864-5100

Client

Burns & McDonnell CAS LLC
Attn: Jeff Barnard
9400 Ward Parkway
Kansas City, MO 64114

Project

Republic Wastewater Treatment Plant Additions
N. West Ave. NW of Wade St. Intersection
Republic, MO

Project Number: B5205029

Material Information

Source of Material: Bulk Sample B-1
Proposed Use:

Sample Information

Sample Date: 10/28/20
Sampled By:
Sample Location: B-1 1 to 5 Feet

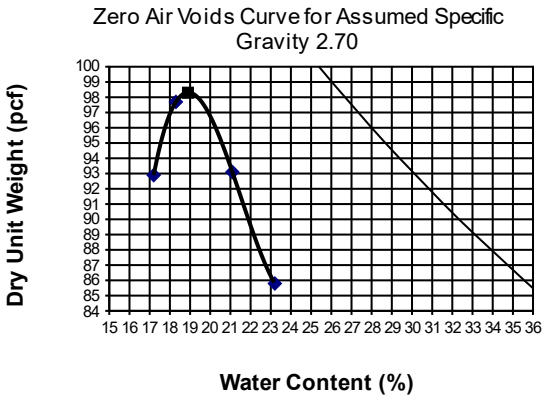
Sample Description: Brown Gravelly Clay

Laboratory Test Data

Test Procedure: ASTM D698
Test Method: Method C
Sample Preparation: Wet
Rammer Type: Manual
Maximum Dry Unit Weight (pcf): 98.3
Optimum Water Content (%): 18.9

	Result	Specifications
Liquid Limit:	46	
Plastic Limit:	21	
Plasticity Index:	25	
In-Place Moisture (%):		
Passing 3/4" (%):	8.7	

USCS: CL



Comments:

Services: Proctor values

Terracon Rep.: Austin Payne
Reported To:
Contractor:
Report Distribution:

(1) Burns & McDonnell CAS LLC, Jeff Barnard

Reviewed By: _____

Joshua Elson
Senior Staff Geologist

Test Methods: ASTM D698

LABORATORY COMPACTION CHARACTERISTICS OF SOIL REPORT

Report Number: B5205029.0002
Service Date: 10/26/20
Report Date: 10/28/20

Terracon
4765 W Junction St
Springfield, MO 65802-1013
417-864-5100

Client

Burns & McDonnell CAS LLC
Attn: Jeff Barnard
9400 Ward Parkway
Kansas City, MO 64114

Project

Republic Wastewater Treatment Plant Additions
N. West Ave. NW of Wade St. Intersection
Republic, MO

Project Number: B5205029

Material Information

Source of Material: Bulk Sample B-2
Proposed Use:

Sample Information

Sample Date: 10/23/20 **Sample Time:** 800
Sampled By: Joshua Elson
Sample Location: Boring B-2 - 1 to 5 Feet

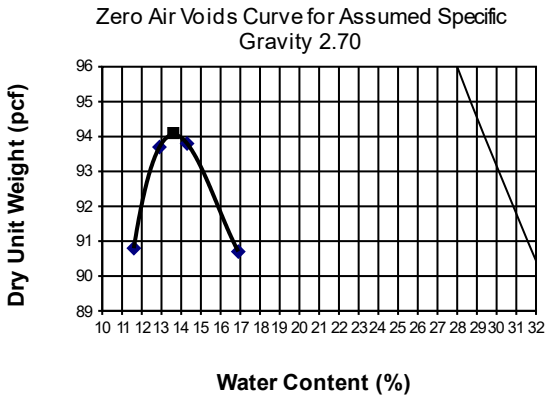
Sample Description: Brown Gravelly Clay

Laboratory Test Data

Test Procedure: ASTM D698
Test Method: Method C
Sample Preparation: Wet
Rammer Type: Manual
Maximum Dry Unit Weight (pcf): **94.1**
Optimum Water Content (%): **13.6**

	Result	Specifications
Liquid Limit:	36	
Plastic Limit:	23	
Plasticity Index:	13	
In-Place Moisture (%):		
Passing 3/4" (%):	10.7	

USCS: CL



Comments:

Services: Proctor values

Terracon Rep.: Austin Payne
Reported To:
Contractor:

Report Distribution:

(1) Burns & McDonnell CAS LLC, Jeff Barnard

Reviewed By: _____

Joshua Elson
Senior Staff Geologist

Test Methods: ASTM D698

LABORATORY COMPACTION CHARACTERISTICS OF SOIL REPORT

Report Number: B5205029.0003
Service Date: 10/26/20
Report Date: 10/28/20

Terracon
4765 W Junction St
Springfield, MO 65802-1013
417-864-5100

Client

Burns & McDonnell CAS LLC
Attn: Jeff Barnard
9400 Ward Parkway
Kansas City, MO 64114

Project

Republic Wastewater Treatment Plant Additions
N. West Ave. NW of Wade St. Intersection
Republic, MO

Project Number: B5205029

Material Information

Source of Material: Bulk Sample B-5
Proposed Use:

Sample Information

Sample Date: 10/23/20 **Sample Time:** 800
Sampled By: Joshua Elson
Sample Location: Boring B-5 - 3 to 5 Feet

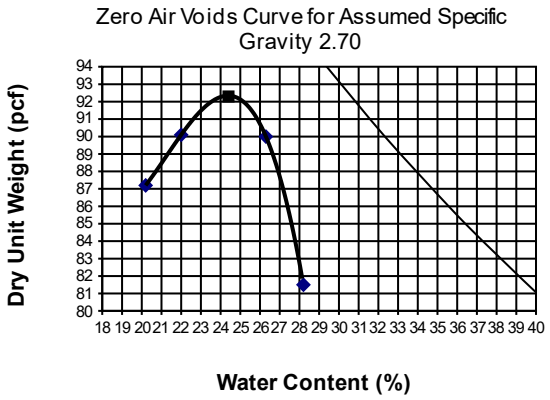
Sample Description: Brown Gravelly Clay

Laboratory Test Data

Test Procedure: ASTM D698
Test Method: Method C
Sample Preparation: Wet
Rammer Type: Manual
Maximum Dry Unit Weight (pcf): 92.3
Optimum Water Content (%): 24.4

	Result	Specifications
Liquid Limit:	52	
Plastic Limit:	25	
Plasticity Index:	27	
In-Place Moisture (%):		
Passing 3/4" (%):	13.9	

USCS: CH



Comments:

Services: Proctor values

Terracon Rep.: Austin Payne
Reported To:
Contractor:

Report Distribution:

(1) Burns & McDonnell CAS LLC, Jeff Barnard

Reviewed By: _____

Joshua Elson
Senior Staff Geologist

Test Methods: ASTM D698

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Terracon GeoReport

Client
Burns & McDonnell CAS LLC

Project
Republic Wastewater Treatment Plant Additions

Sample Submitted By: Terracon (B5) **Date Received:** 12/2/2020 **Lab No.: 20-1250**

Results of Corrosion Analysis

Sample Number	--	--
Sample Location	B-2A	B-4A
Sample Depth (ft.)	6.0-8.0	13.0-15.0
pH Analysis, ASTM G 51	6.69	7.09
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	20	86
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil
Chlorides, ASTM D 512, (mg/kg)	35	45
Red-Ox, ASTM G 200, (mV)	+693	+690
Total Salts, AWWA 2540, (mg/kg)	101	493
Resistivity (Saturated), ASTM G 57, (ohm-cm)	6499	3395

Analyzed By: Trisha Campo
Chemist

MMET, Inc • 316 N Airport Rd • Strafford, MO 65757
tel: 417-736-6016 • fax: 417-736-6018 • toll: 877-581-MMET
Email mmet@mmetinc.com Est. 1997

MMET LABORATORY

LABORATORY REPORT

Report Number: M261105
Lab Number: 221506

Report Date: 7/20/2022

Customer: Terracon
4765 W. Junction Street
Springfield, MO 65802
Phone 417-864-5100
Fax 417-864-0871
Cell 417-773-2500 Ripken.Dodson@terracon.com
Email Joshua.Elson@terracon.com Nic.Arens@terracon.com
Purchase Order No. David.Williams@terracon.com

Project Manager: David A. Williams, PE Project Eng.
Project Name: Republic WWTP
Project Location: B5215111
Sample Matrix: Soil
Sampled By: Drill Crew
Sample ID: B-11 (Cumulative)
Date Sampled:
Date Received 6/29/2022

Paramter	Method	Results	Units	Date of Analysis	Analyst
Sulfate	AASHTO T290-91	103	mg/Kg	7/20/2022	WAM
Sulfide	SM 4500-S D	0.099	mg/Kg	7/20/2022	WAM
Chloride	AASHTO T291	< 17	mg/Kg	7/20/2022	WAM
pH 1:2	EPA 9045C / AASHTO T289-91	6.82	SU	7/20/2022	WAM
Electrical Conductivity 1:2	SM 2510	327	µS	7/20/2022	WAM
TDS		163	ppm	7/20/2022	WAM
Salt		0.17	ppt	7/20/2022	WAM
Minimum Lab Soil Resistivity	AASHTO T288-91	1,432	Ω cm	7/20/2022	WAM

Report Approved by:

Wayne A. Middleton, Pres., Lab Dir.

MMET, Inc • 316 N Airport Rd • Strafford, MO 65757
tel: 417-736-6016 • fax: 417-736-6018 • toll: 877-581-MMET
Email mmet@mmetinc.com Est. 1997

MMET LABORATORY

LABORATORY REPORT

Report Number:	M261105	**Report Date:**	7/20/2022
Lab Number:	221507		

Customer:	Terracon			**Project Manager:**	David A. Williams, PE Project Eng.
	4765 W. Junction Street			**Project Name:**	Republic WWTP
	Springfield, MO 65802			**Project Location:**	B5215111
Phone	417-864-5100			**Sample Matrix:**	Soil
Fax	417-864-0871			**Sampled By:**	Drill Crew
Cell	417-773-2500	Ripken.Dodson@terracon.com		**Sample ID:**	B-14 (5-10')
Email	Joshua.Elson@terracon.com	Nic.Arens@terracon.com		**Date Sampled:**	
Purchase Order No.		David.Williams@terracon.com		**Date Received**	6/29/2022

Paramter	Method	Results	Units	Date of Analysis	Analyst
Sulfate	AASHTO T290-91	22	mg/Kg	7/20/2022	WAM
Sulfide	SM 4500-S D	0.083	mg/Kg	7/20/2022	WAM
Chloride	AASHTO T291	25	mg/Kg	7/20/2022	WAM
pH 1:2	EPA 9045C / AASHTO T289-91	6.21	SU	7/20/2022	WAM
Electrical Conductivity 1:2	SM 2510	111	µS	7/20/2022	WAM
TDS		55	ppm	7/20/2022	WAM
Salt		0.06	ppt	7/20/2022	WAM
Minimum Lab Soil Resistivity	AASHTO T288-91	2,470	Ω cm	7/20/2022	WAM

Report Approved by:

Wayne A. Middleton, Pres., Lab Dir.

Unconfined Compressive Strength of Intact Rock Core Specimens

Project Name: Republic WWTP

Project No.: B5205029/B5215111

Client: Burns & McDonnell Engineering Co.

Date: 7/25/2022

Tested By: KSH

Reviewed By: JDE

Boring	Depth (feet)	Recovery (%)	RQD (%)	Strength (psi)	Type of Rock
B-1	16.5	100	100	**7,160**	Limestone
B-1	23.0	100	100	**9,700**	Limestone
B-2	24.0	100	100	**7,940**	Limestone
B-2	30.5	100	88	**7,080**	Limestone
B-3	17.0	100	96	**9,460**	Limestone
B-3	23.0	100	97	**5,570**	Limestone
B-4	41.5	100	92	**5,860**	Limestone
B-4	47.6	100	95	**7,130**	Limestone
B-5	32.0	65	53	**7,300**	Limestone
B-5	36.0	100	92	**8,390**	Limestone
B-6	25.5	100	100	**7,640**	Limestone
B-6	31.8	100	74	**8,380**	Limestone
B-7	29.0	100	80	**10,120**	Limestone
B-7	35.2	100	100	**8,020**	Limestone

Unconfined Compressive Strength of Intact Rock Core Specimens

Project Name: Republic WWTP

Project No.: B5205029/B5215111

Client: Burns & McDonnell Engineering Co.

Test Date: 7/25/2022

Tested by: KSH

Reviewed By: JDE

Terracon

Laboratory Data Sheet

Boring	Depth (feet)	Recovery (%)	RQD (%)	Strength (psi)	Type of Rock
B-8	29.0	100	95	**8,130**	Limestone
B-8	37.0	100	97	**8,280**	Limestone
B-2A	28.5	100	83	**8,750**	Limestone
B-2A	33.5	100	96	**7,320**	Limestone
B-4A	57.0	100	63	**11,170**	Limestone
B-4A	63.2	100	100	**6,900**	Limestone
B-5A	33.0	100	97	**8,330**	Limestone
B-5A	40.5	100	97	**6,500**	Limestone
B-7A	41.3	100	84	**6,920**	Limestone
B-7A	46.5	100	75	**3,390**	Limestone

Unconfined Compressive Strength of Intact Rock Core Specimens

Project Name: Republic WWTP

Project No.: B5205029/B5215111

Client: Burns & McDonnell Engineering Co.

Test Date: 7/25/2022

Tested by: AAP

Reviewed By: DAW

Terracon

Laboratory Data Sheet

Boring	Depth (feet)	Recovery (%)	RQD (%)	Strength (psi)	Type of Rock
B-14	24.5	100	95	**3,710**	Limestone
B-14	29.5	95	78	**12,510**	Limestone
B-15	31.5	100	87	**11,280**	Limestone
B-15	36.5	100	92	**9,730**	Limestone

Boring B-1

Depth: 15.5’ to 25.5’

0 0.5 1.0 1.5 2.0

Scale In Feet

Boring B-2

Depth: 23.5’ to 33.5’

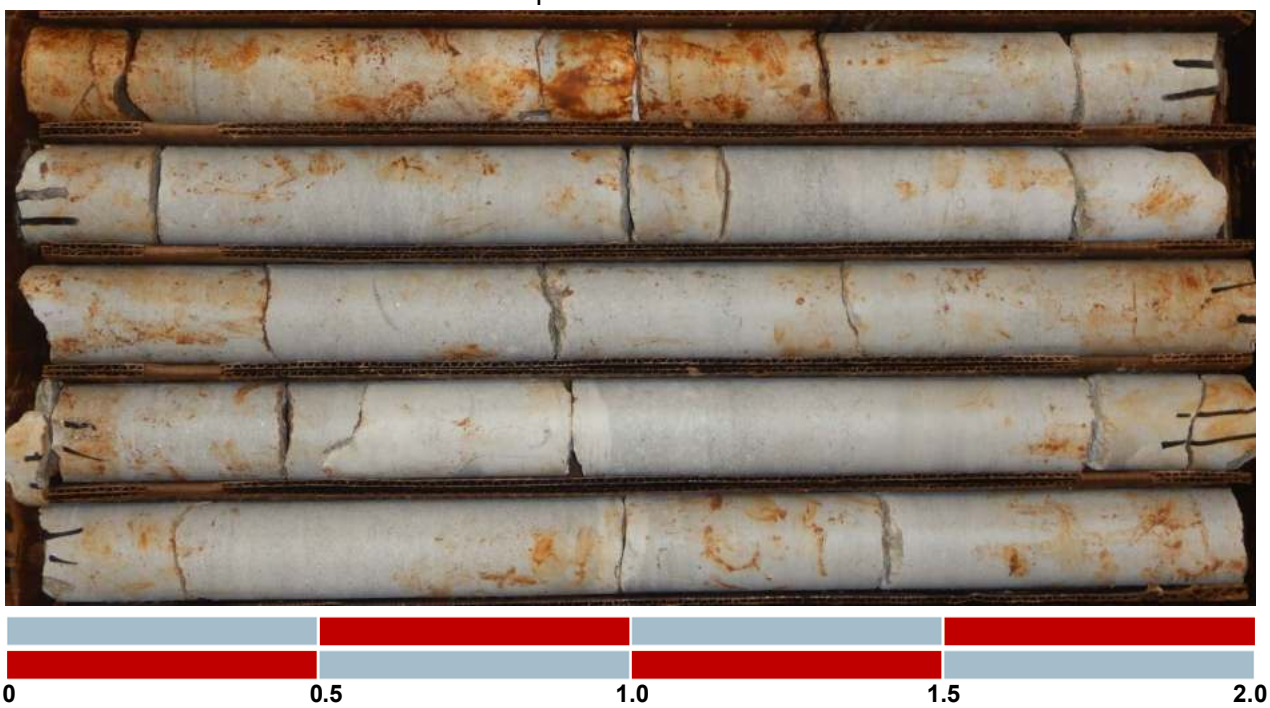
0 0.5 1.0 1.5 2.0

Scale In Feet

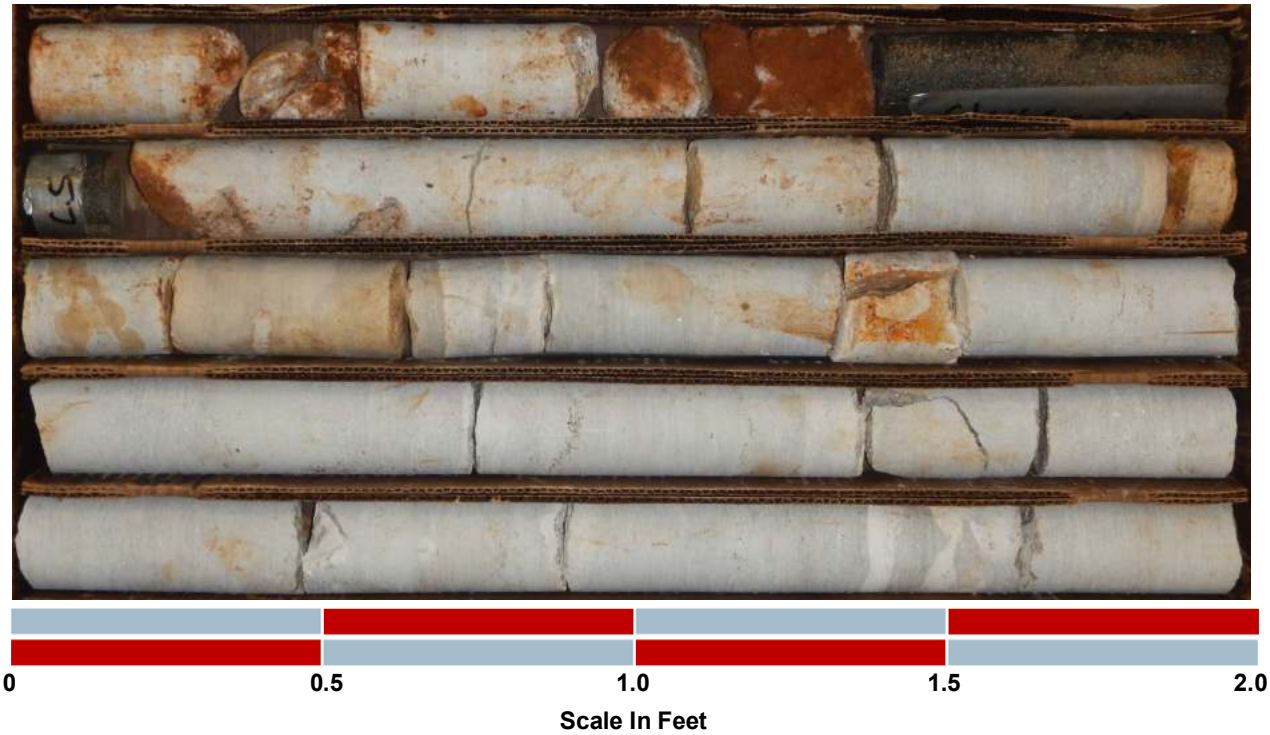
Boring B-2A
Depth: 27.0’ to 37.0’

Boring B-3
Depth: 15.8’ to 25.8’

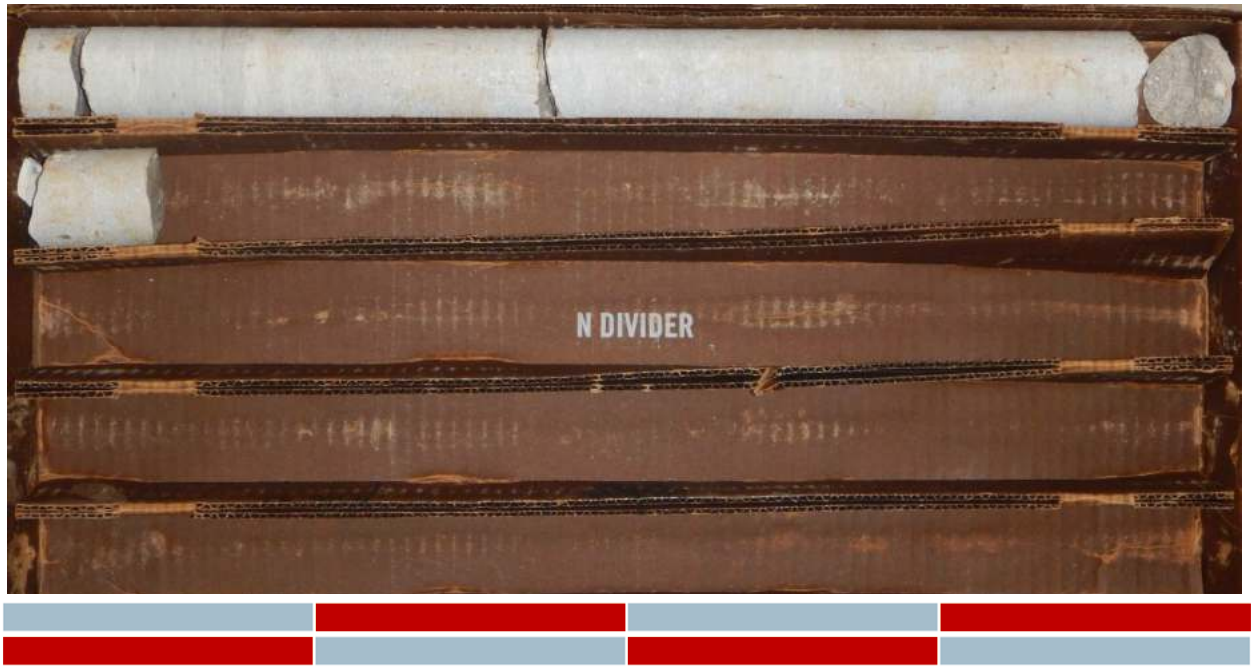
Boring B-4
Depth: 39.2’ to 49.2’



Boring B-4A
Depth: 52.0’ to 62.0’



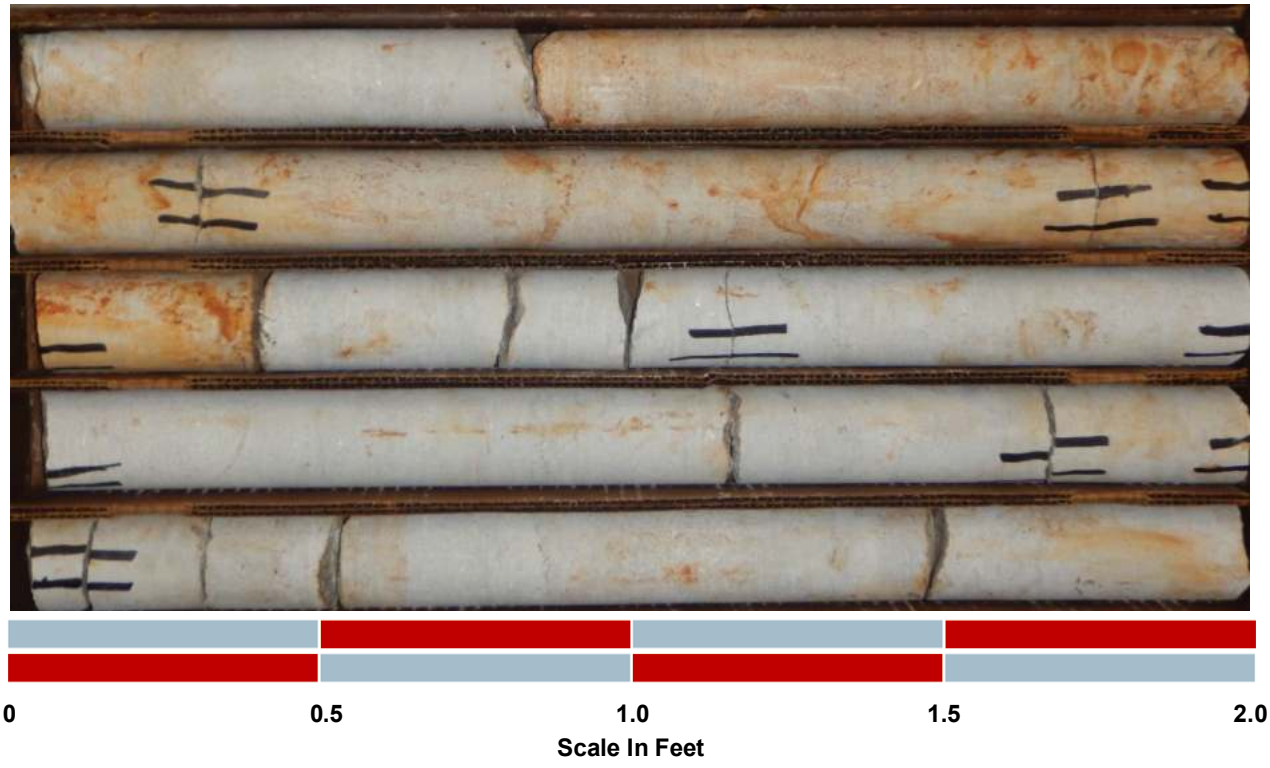
Boring B-4A
Depth: 62.0’ to 64.3



Boring B-5
Depth: 23.5’ to 33.5’

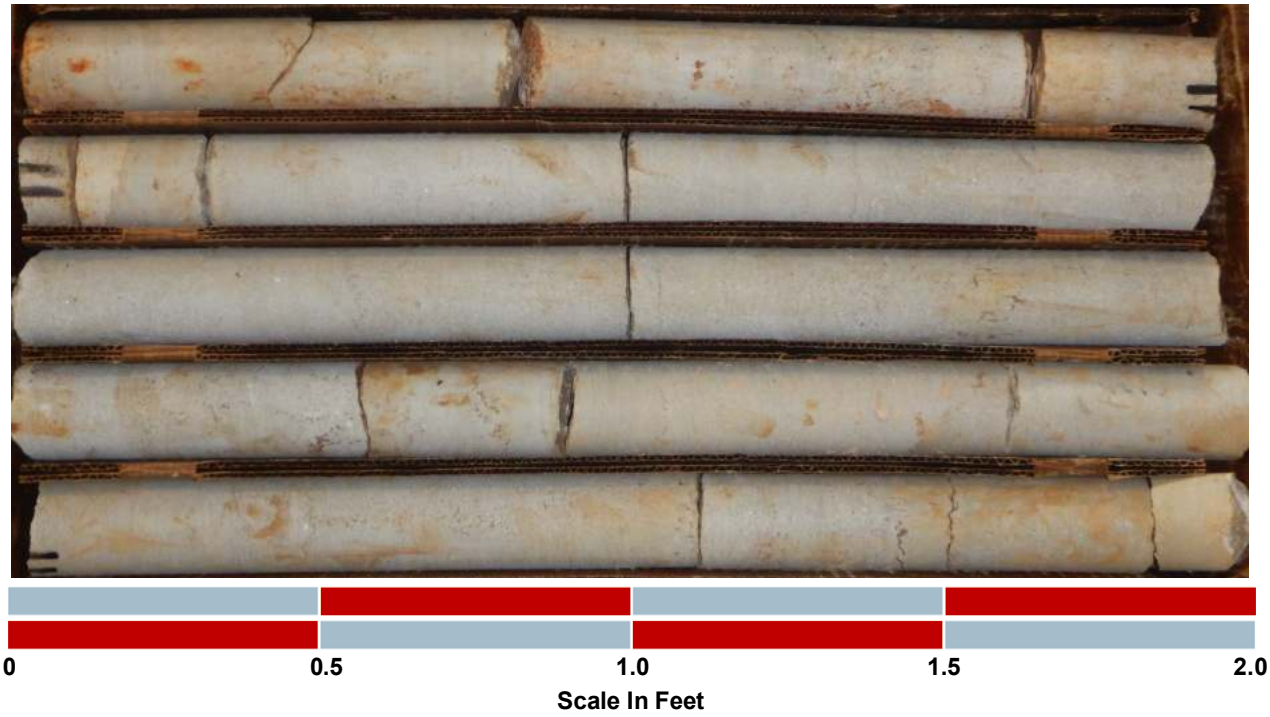
Boring B-5
Depth: 33.5’ to 42.0’

Boring B-5A
Depth: 30.5’ to 40.5’



Boring B-6
Depth: 22.3’ to 32.3’

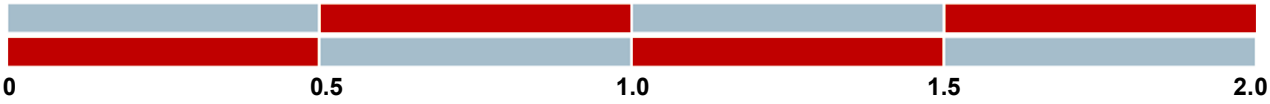
Boring B-7
Depth: 28.0’ to 38.0’



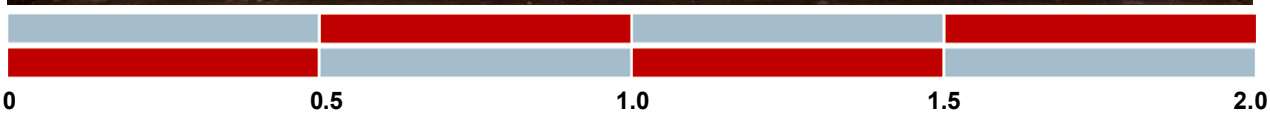
Boring B-7A
Depth: 40.0’ to 50.0’

Boring B-8
Depth: 28.5’ to 38.5’

Boring B-14
Depth: 23.0’ to 33.0’



Boring B-15
Depth: 30.0’ to 40.0’

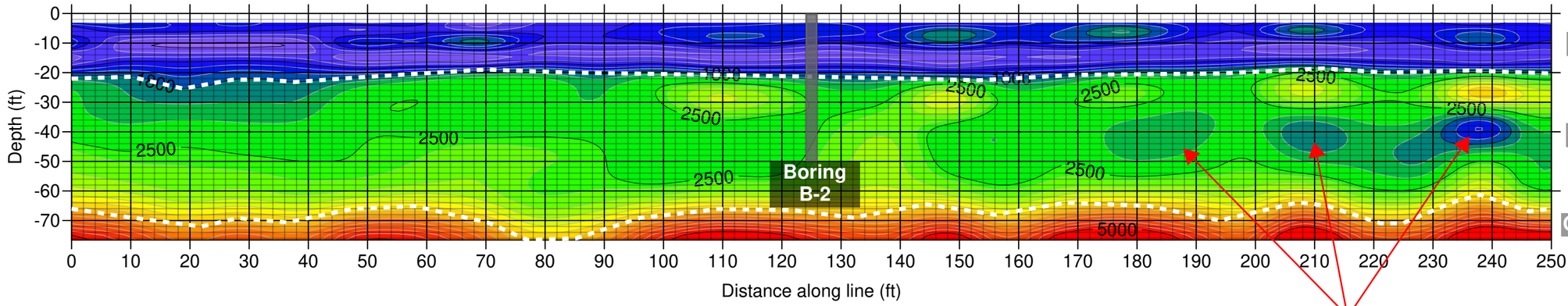


South **North**

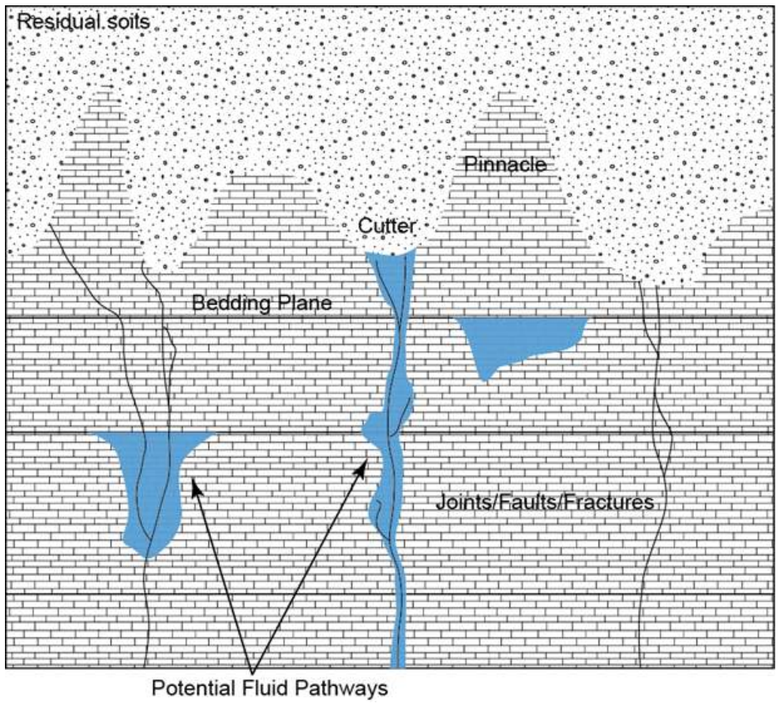
Start
Lat: 37.13022 N
Lon: 93.78971 W

End
Lat: 37.13087 N
Lon: 93.48954 W

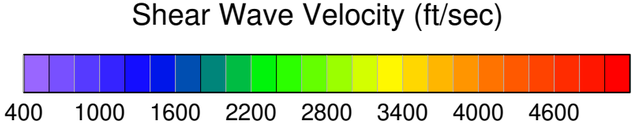
Line B-2_C



Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Linear pattern is consistent with dissolution along bedding planes or dissolution and fracturing at the intersection of vertical fractures and bedding planes.



Shear Wave Velocity (ft/sec)



Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5,000$
Rock	$2,500 < V_s \leq 5,000$
Very dense soil and soft rock	$1,200 < V_s \leq 2,500$
Stiff soil	$600 < V_s \leq 1,200$
Soft soil	$V_s < 600$

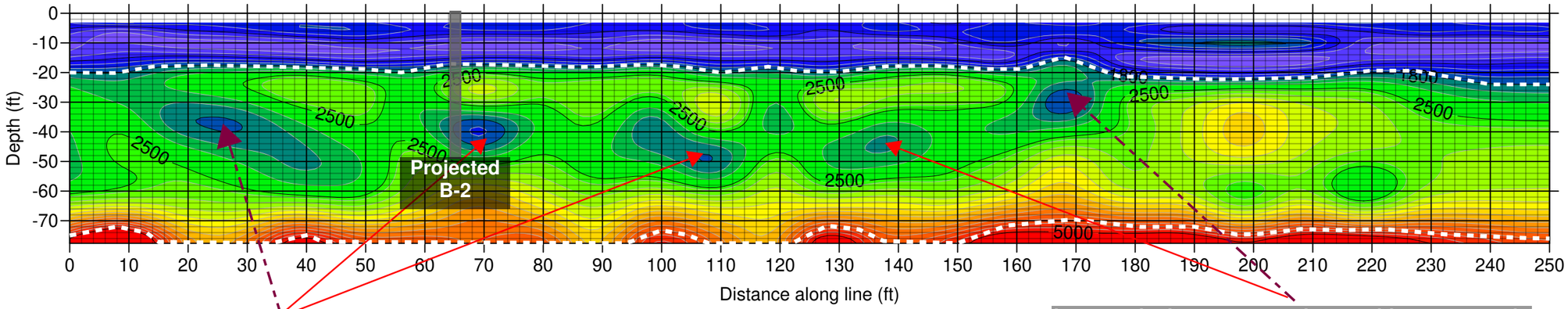
Legend	Notes	MASW Profile - Line B-2_C
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 8, 2020 Terracon

South **North**

B-2_15E

Start
Lat: 37.13048 N
Lon: 93.48958 W

End
Lat: 37.13118 N
Lon: 93.48953W



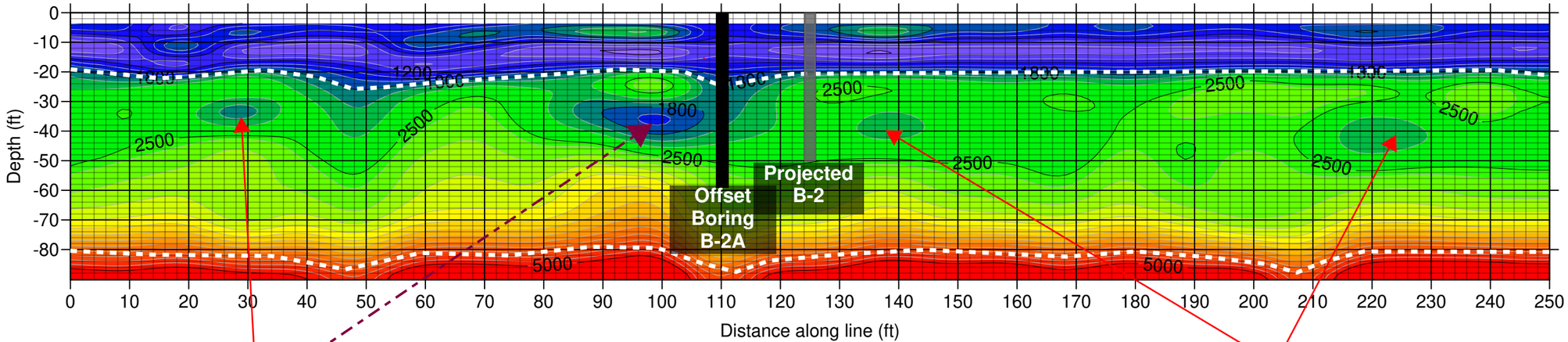
Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Appears that a potential fracture zone intersects the soil-bedrock interface at this location (maroon dashed arrow).

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Appears that a potential fracture zone intersects the soil-bedrock interface at this location (maroon dashed arrow).

B-2_15W

Start
Lat: 37.13024 N
Lon: 93.48969 W

End
Lat: 37.13090 N
Lon: 93.48963 W



Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Appears that a potential fracture zone intersects the soil-bedrock interface at this location (maroon dashed arrow).

Shear Wave Velocity (ft/sec)

400 1000 1600 2200 2800 3400 4000 4600

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Linear pattern is consistent with dissolution along bedding planes or dissolution and fracturing at the intersection of vertical fractures and bedding planes.

Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5{,}000$
Rock	$2{,}500 < V_s \leq 5{,}000$
Very dense soil and soft rock	$1{,}200 < V_s \leq 2{,}500$
Stiff soil	$600 < V_s \leq 1{,}200$
Soft soil	$V_s < 600$

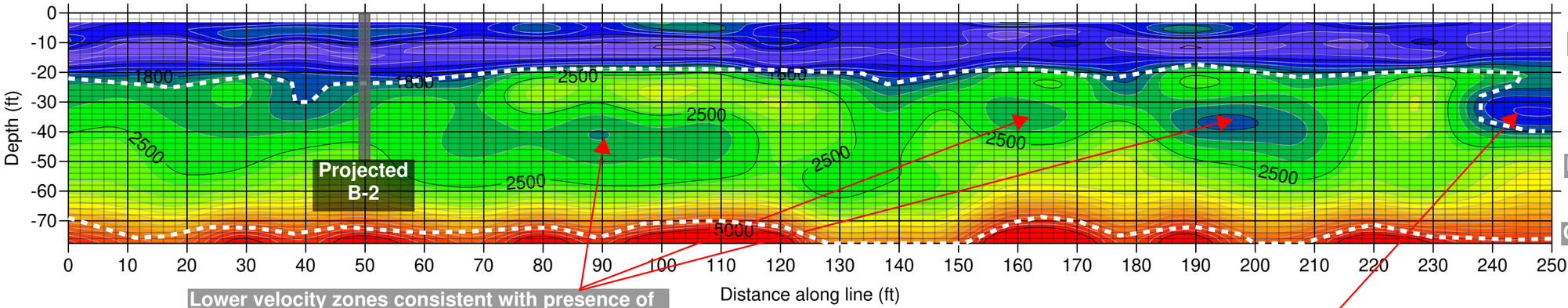
Legend	Notes	MASW Profiles - B-2_15E & B-2_15W
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 8, 2020 Terracon

South **North**

Line B-2_30E

Start
Lat: 37.13050 N
Lon: 93.48954 W

End
Lat: 37.13118 N
Lon: 93.48947W



Residual soils

Fractured Bedrock

Competent Bedrock

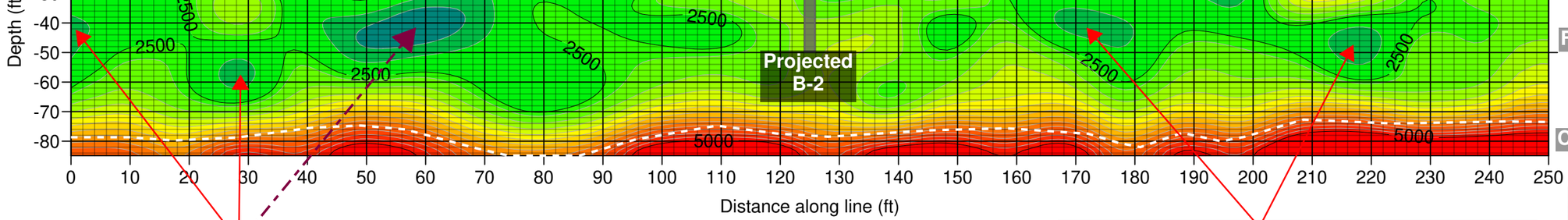
Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Linear pattern is consistent with dissolution along bedding planes or dissolution and fracturing at the intersection of vertical fractures and bedding planes.

Apparent change in relief of about 10 feet for the soil-bedrock interface at the north end of the line.

Line B-2_30W

Start
Lat: 37.13020 N
Lon: 93.48975 W

End
Lat: 37.13090 N
Lon: 93.48975 W



Residual soils

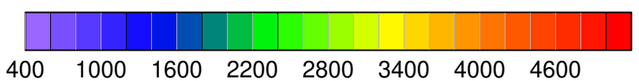
Fractured Bedrock

Competent Bedrock

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Appears that a potential fracture zone intersects the soil-bedrock interface at this location (maroon dashed arrow).

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Linear pattern is consistent with dissolution along bedding planes or dissolution and fracturing at the intersection of vertical fractures and bedding planes.

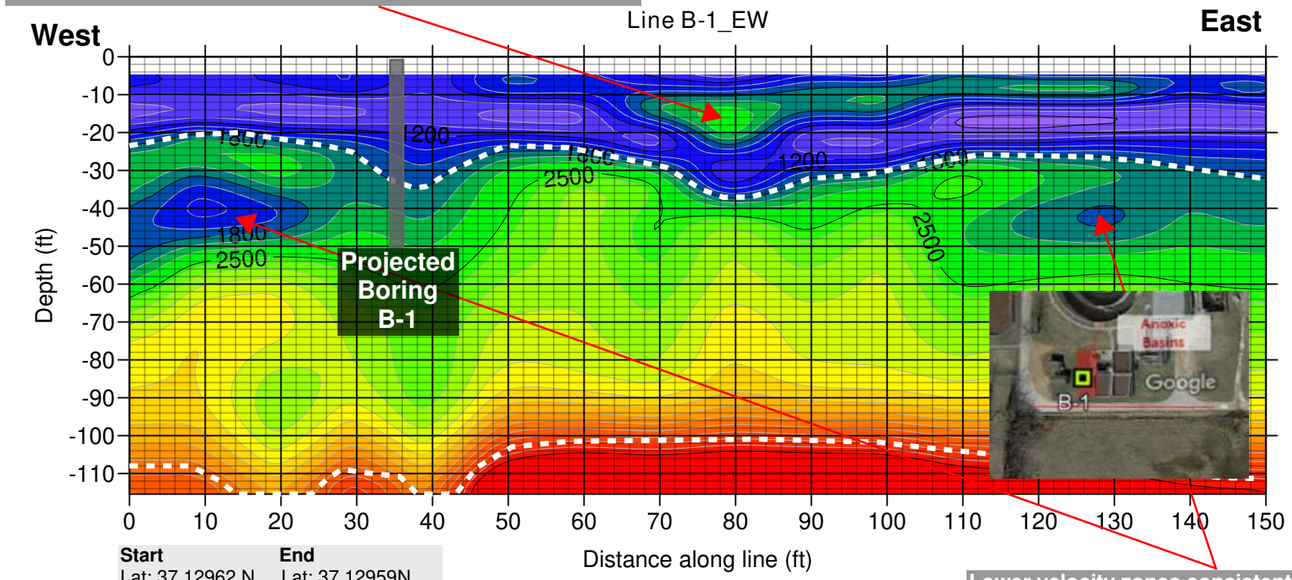
Shear Wave Velocity (ft/sec)



Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5{,}000$
Rock	$2{,}500 < V_s \leq 5{,}000$
Very dense soil and soft rock	$1{,}200 < V_s \leq 2{,}500$
Stiff soil	$600 < V_s \leq 1{,}200$
Soft soil	$V_s < 600$

Legend	Notes	MASW Profile - Line B-2_30E & B-2_30W
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 8, 2020 Terracon

Potentially a large boulder (weathered caprock) over stiff soil.



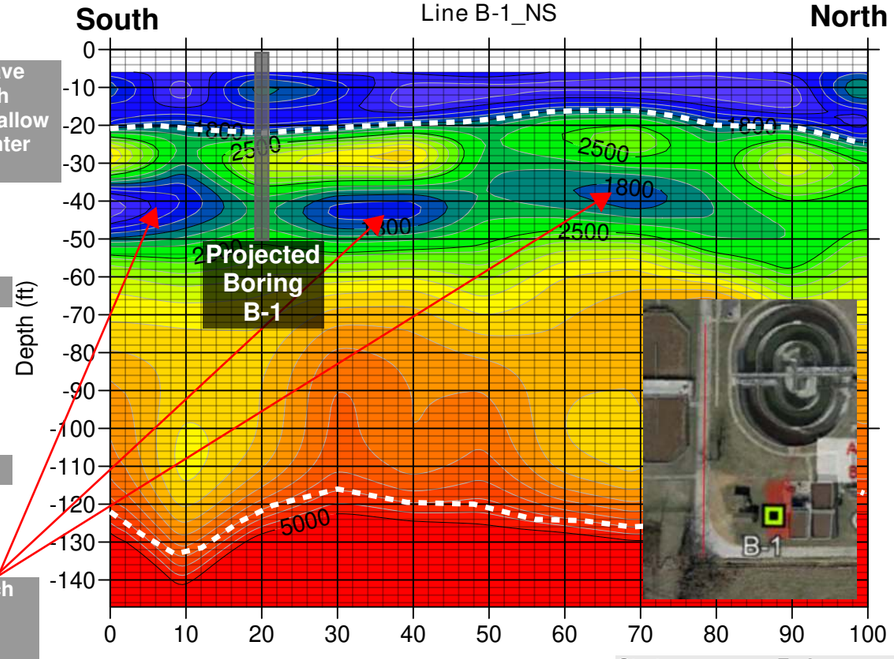
Start	End
Lat: 37.12962 N	Lat: 37.12959N
Lon: 93.48902W	Lon: 93.48853W

Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

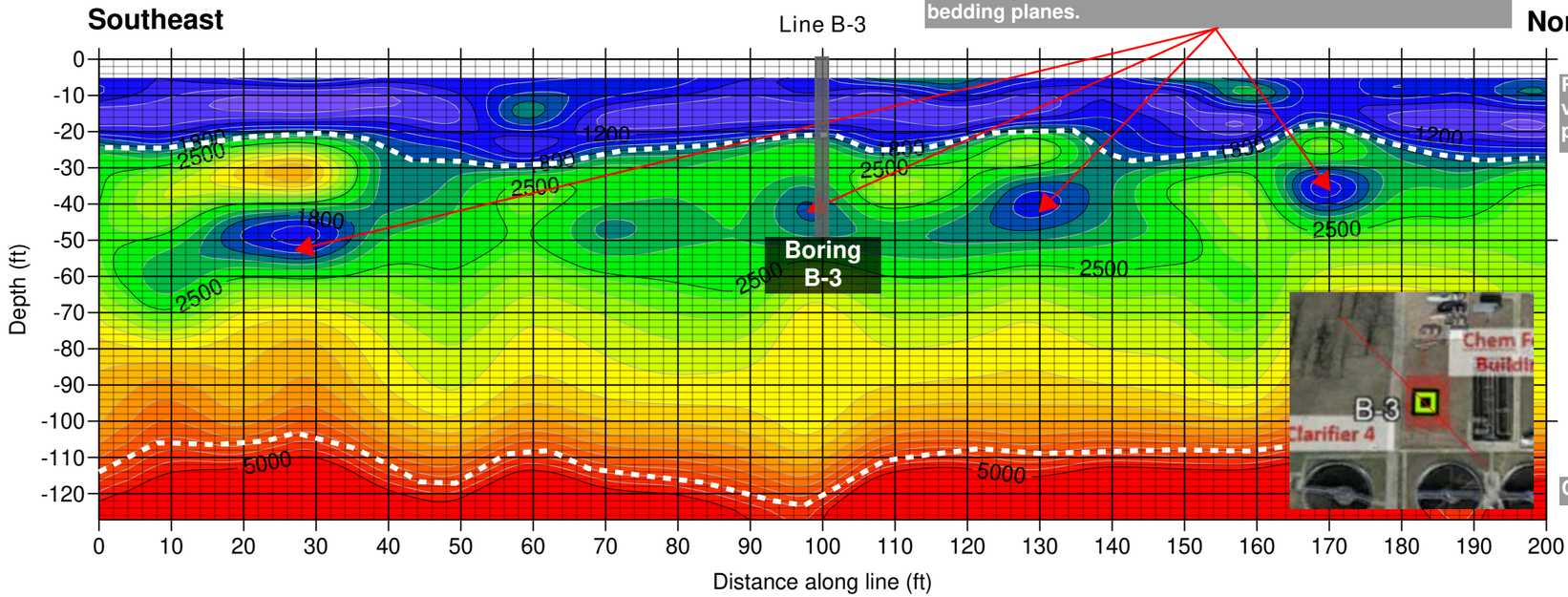
Fractured Bedrock

Competent Bedrock

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Linear pattern is consistent with dissolution along bedding planes or dissolution and fracturing at the intersection of vertical fractures and bedding planes.



Start	End
Lat: 37.12980 N	Lat: 37.13004N
Lon: 93.48916W	Lon: 93.48923W



Residual soils: Shear wave velocities consistent with potentially soft soils.

Shear Wave Velocity (ft/sec)

400 1000 1600 2200 2800 3400 4000 4600

Fractured Bedrock

Competent Bedrock

Start	End
Lat: 37.13065 N	Lat: 37.13099 N
Lon: 93.48893W	Lon: 93.48946W

Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5,000$
Rock	$2,500 < V_s \leq 5,000$
Very dense soil and soft rock	$1,200 < V_s \leq 2,500$
Stiff soil	$600 < V_s \leq 1,200$
Soft soil	$V_s < 600$

Legend	Notes	MASW Profiles - B-1_EW, NS & B-3
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 9, 2020 Terracon

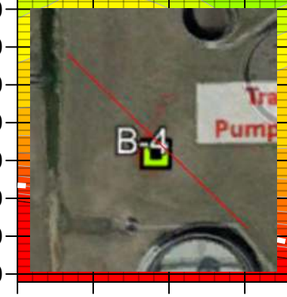
Southeast — Line B-4 — Northwest

Potentially a large boulder (weathered caprock) over stiff soil.

Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

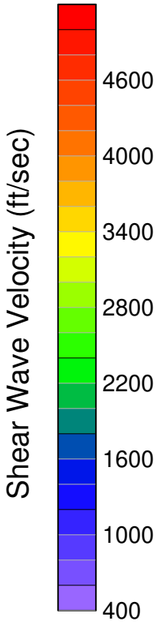
Fractured Bedrock

Competent Bedrock



Start	End
Lat: 37.13039N	Lat: 37.13074N
Lon: 93.48759W	Lon: 93.48800W

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Linear pattern is consistent with dissolution along bedding planes or dissolution and fracturing at the intersection of vertical fractures and bedding planes.



North — Line B-7_W — South

Potentially a large boulder (weathered caprock) over stiff soil.

Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

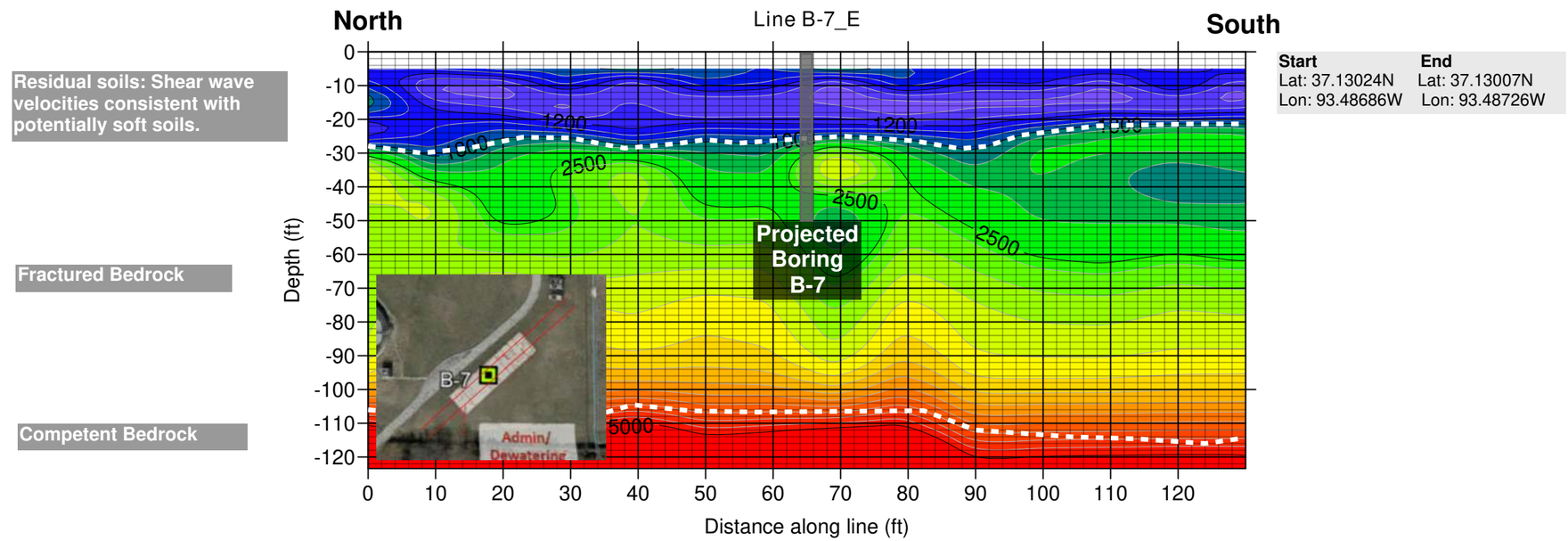
Fractured Bedrock

Competent Bedrock

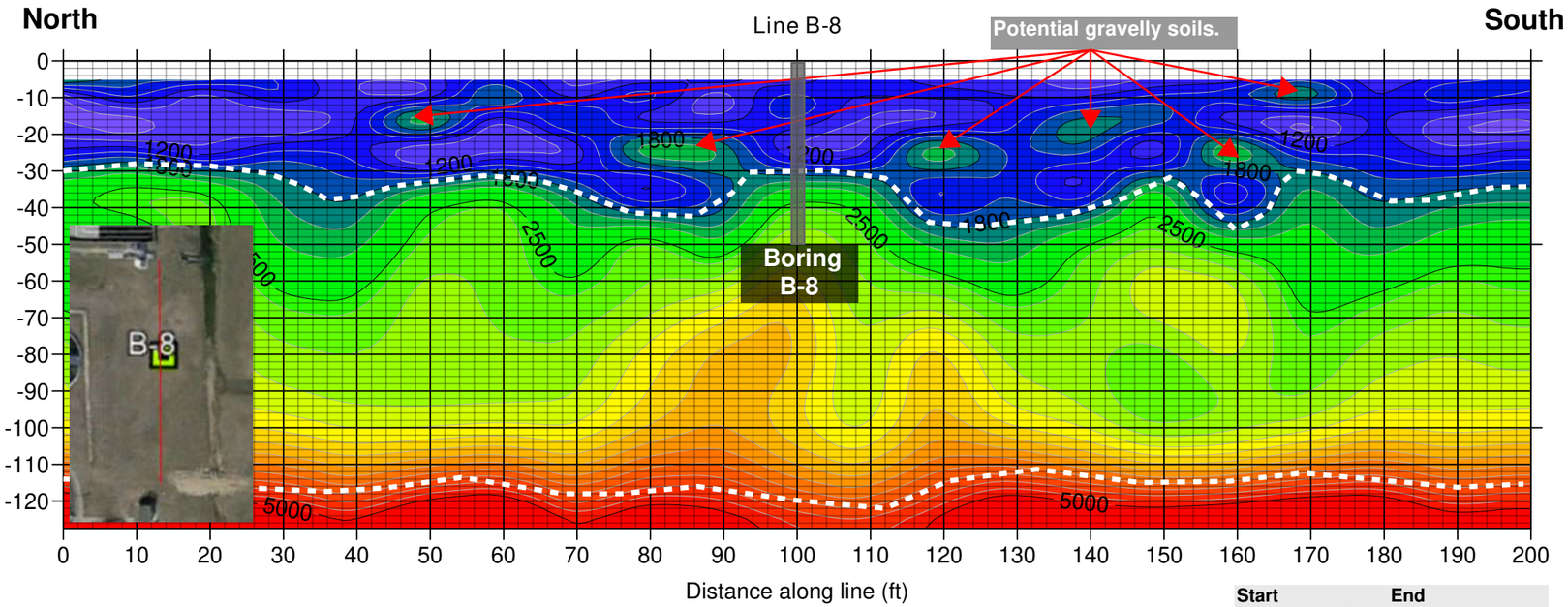
Start	End
Lat: 37.13032N	Lat: 37.13006N
Lon: 93.48686W	Lon: 93.48738W

Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5{,}000$
Rock	$2{,}500 < V_s \leq 5{,}000$
Very dense soil and soft rock	$1{,}200 < V_s \leq 2{,}500$
Stiff soil	$600 < V_s \leq 1{,}200$
Soft soil	$V_s < 600$

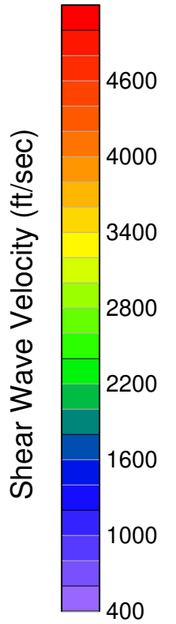
Legend	Notes	MASW Profiles - B-4 & B-7_W
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 9, 2020 Terracon



Start	End
Lat: 37.13024N	Lat: 37.13007N
Lon: 93.48686W	Lon: 93.48726W



Start	End
Lat: 37.13084N	Lat: 37.13028N
Lon: 93.48836W	Lon: 93.48835W



Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5{,}000$
Rock	$2{,}500 < V_s \leq 5{,}000$
Very dense soil and soft rock	$1{,}200 < V_s \leq 2{,}500$
Stiff soil	$600 < V_s \leq 1{,}200$
Soft soil	$V_s < 600$

Legend	Notes	MASW Profiles - B-7_E & B-8
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 9, 2020 Terracon

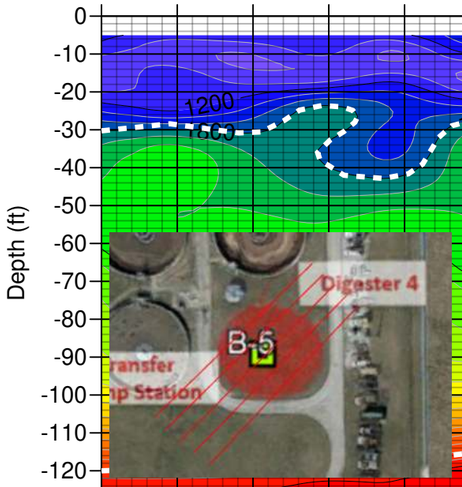
Northeast

Lilne B-5_15E

Southwest

Start
Lat: 37.13100 N
Lon: 93.48699 W

End
Lat: 37.13049 N
Lon: 93.48730W



Residual soils: Shear wave velocities indicate potentially soft soils.

Fractured Bedrock

Competent Bedrock

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Linear pattern is consistent with dissolution along bedding planes or dissolution and fracturing at the intersection of vertical fractures and bedding planes.

Line B-5_15W

Start
Lat: 37.13087 N
Lon: 93.48714 W

End
Lat: 37.13041 N
Lon: 93.48746W

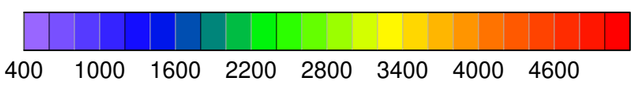
Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

Fractured Bedrock

Competent Bedrock

Potentially a large boulder (weathered caprock) over stiff soil.

Shear Wave Velocity (ft/sec)



Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5,000$
Rock	$2,500 < V_s \leq 5,000$
Very dense soil and soft rock	$1,200 < V_s \leq 2,500$
Stiff soil	$600 < V_s \leq 1,200$
Soft soil	$V_s < 600$

Legend	Notes	MASW Profiles - B-5_15E & B-5_15W
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 8, 2020

Terracon

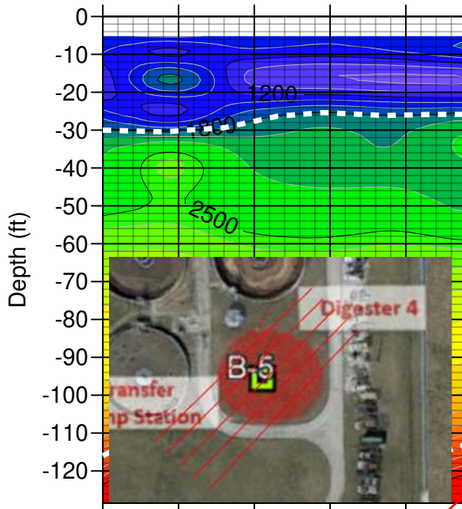
Northeast

Southwest

Line B-5_30E

Start
Lat: 37.13100 N
Lon: 93.48699 W

End
Lat: 37.13049 N
Lon: 93.48730W



Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

Fractured Bedrock

Competent Bedrock

Potentially a large boulder (weathered caprock) over stiff soil.

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Appears that a potential fracture zone intersects the soil-bedrock interface at this location.

Line B-5_30W

Start
Lat: 37.13085 N
Lon: 93.48724 W

End
Lat: 37.13035N
Lon: 93.48762W

Residual soils: Shear wave velocities consistent with potentially soft soils.

Fractured Bedrock

Competent Bedrock

Potentially a large boulder (weathered caprock) over stiff soil.

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Appears that a potential fracture zone intersects the soil-bedrock interface at this location.

Shear Wave Velocity (ft/sec)

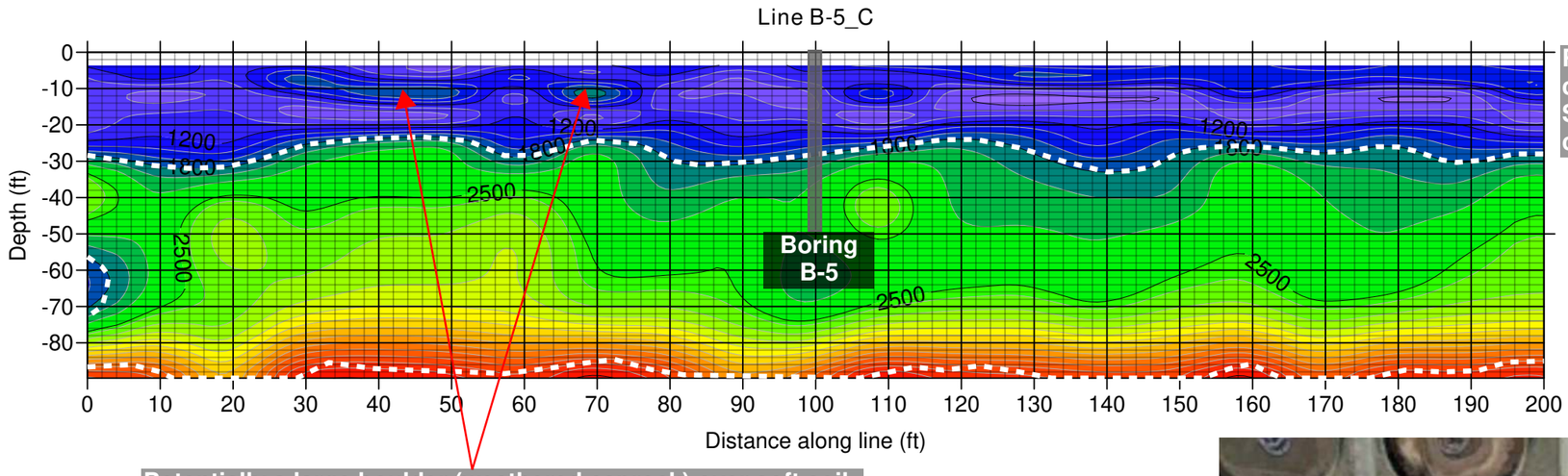
Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5{,}000$
Rock	$2{,}500 < V_s \leq 5{,}000$
Very dense soil and soft rock	$1{,}200 < V_s \leq 2{,}500$
Stiff soil	$600 < V_s \leq 1{,}200$
Soft soil	$V_s < 600$

Legend	Notes	MASW Profiles - B-5_30E & B-5_30W
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 8, 2020 Terracon

Northeast

Southwest

Line B-5_C



Start
Lat: 37.13101N
Lon: 93.48701W

End
Lat: 37.13054N
Lon: 93.48734W

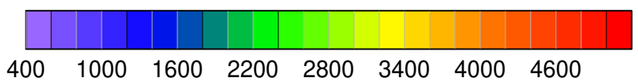
Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

Fractured Bedrock

Competent Bedrock

Potentially a large boulder (weathered caprock) over soft soil.

Shear Wave Velocity (ft/sec)



Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5{,}000$
Rock	$2{,}500 < V_s \leq 5{,}000$
Very dense soil and soft rock	$1{,}200 < V_s \leq 2{,}500$
Stiff soil	$600 < V_s \leq 1{,}200$
Soft soil	$V_s < 600$

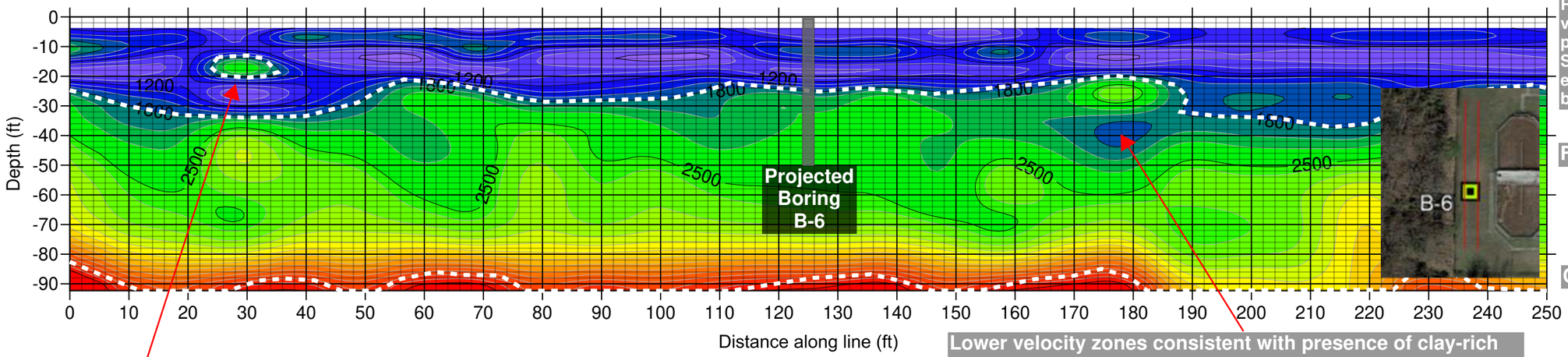
Legend	Notes	MASW Profile - B-5_C
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 8, 2020 Terracon

South **North**

Line B-6_E

Start
Lat: 37.12994N
Lon: 93.48970W

End
Lat: 37.13061N
Lon: 93.48966W



Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

Fractured Bedrock

Competent Bedrock

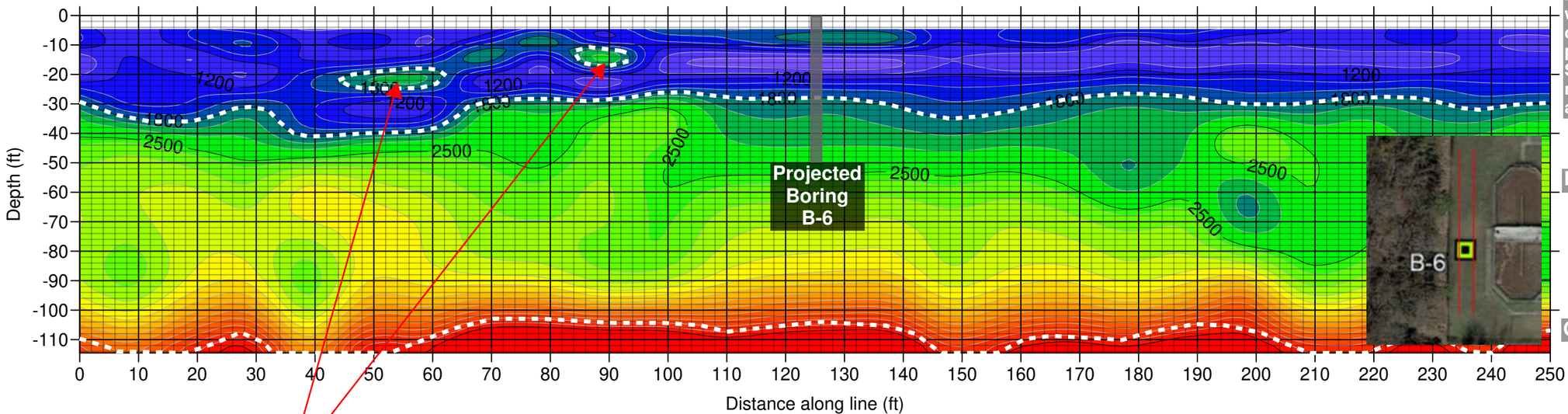
Potentially a large boulder (weathered caprock) over soft soil.

Lower velocity zones consistent with presence of clay-rich or highly fractured rock. Appears that a potential fracture zone intersects the soil-bedrock interface at this location.

Line B-6_W

Start
Lat: 37.12988N
Lon: 93.48985W

End
Lat: 37.13056N
Lon: 93.48973W



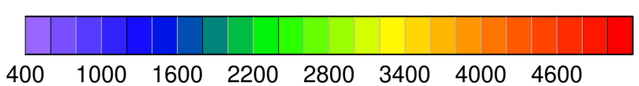
Residual soils: Shear wave velocities consistent with potentially soft soils. Shallow excavations may encounter cobbles and boulders.

Fractured Bedrock

Competent Bedrock

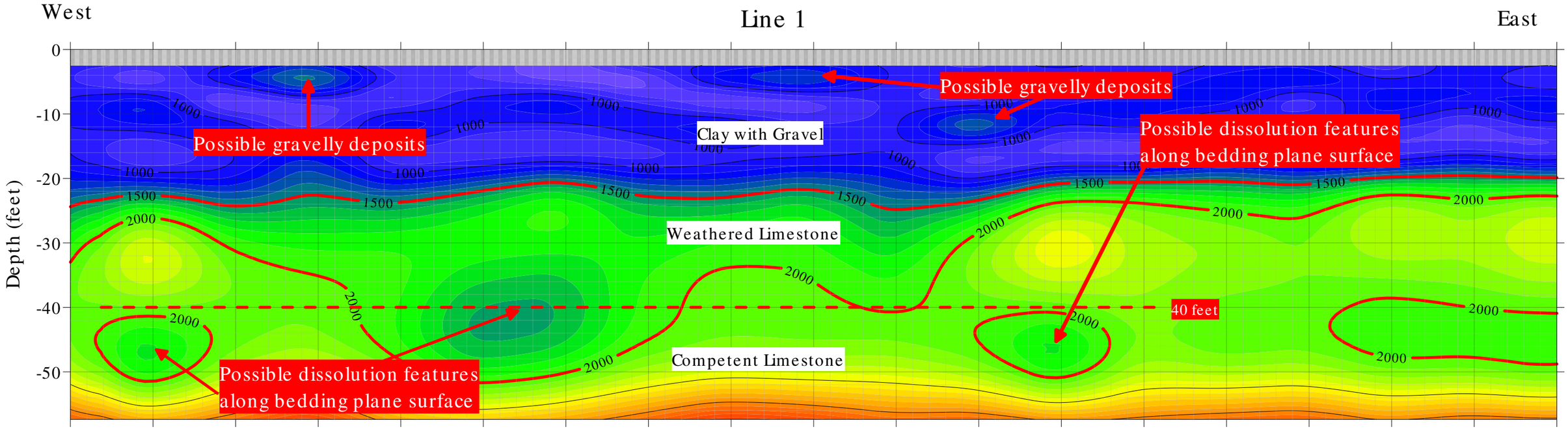
Potentially a large boulder (weathered caprock) over soft soil.

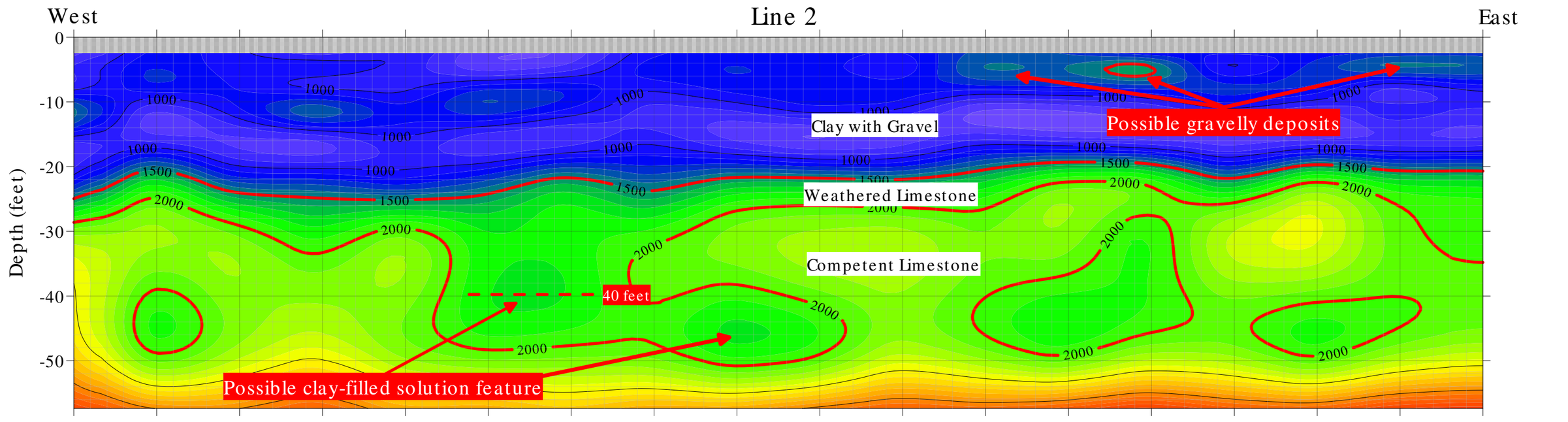
Shear Wave Velocity (ft/sec)

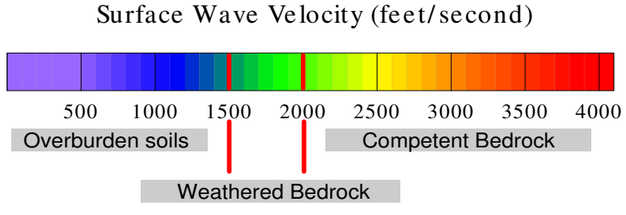


Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5{,}000$
Rock	$2{,}500 < V_s \leq 5{,}000$
Very dense soil and soft rock	$1{,}200 < V_s \leq 2{,}500$
Stiff soil	$600 < V_s \leq 1{,}200$
Soft soil	$V_s < 600$

Legend	Notes	MASW Profiles - B-6_E & B-6_W
	1. Profile Scales: Horizontal 1" = 20' Vertical 1" = 40'	Project: City of Republic WWTF Client: Burns & McDonald Location: Republic, MO Project No.: B5205029 Date: October 8, 2020 Terracon







Soil Properties Table

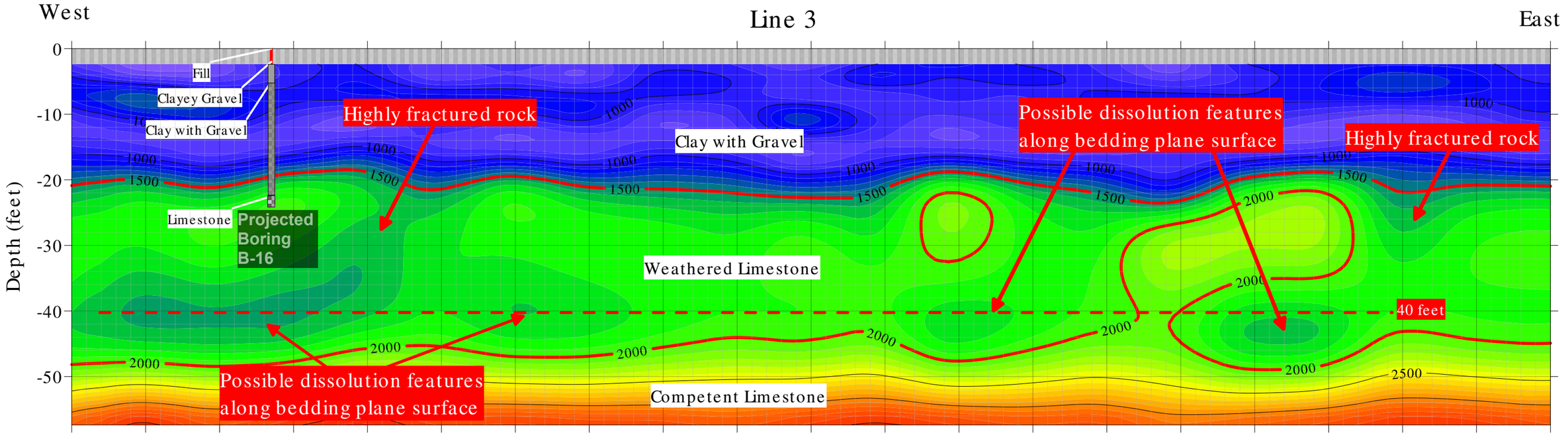
Soil Profile	Shear Wave Velocity (ft/s)
Hard rock	$V_s > 5,000$
Rock	$2,500 < V_s \leq 5,000$
Very dense soil and soft rock	$1,200 < V_s \leq 2,500$
Stiff soil	$600 < V_s \leq 1,200$
Soft soil	$V_s < 600$

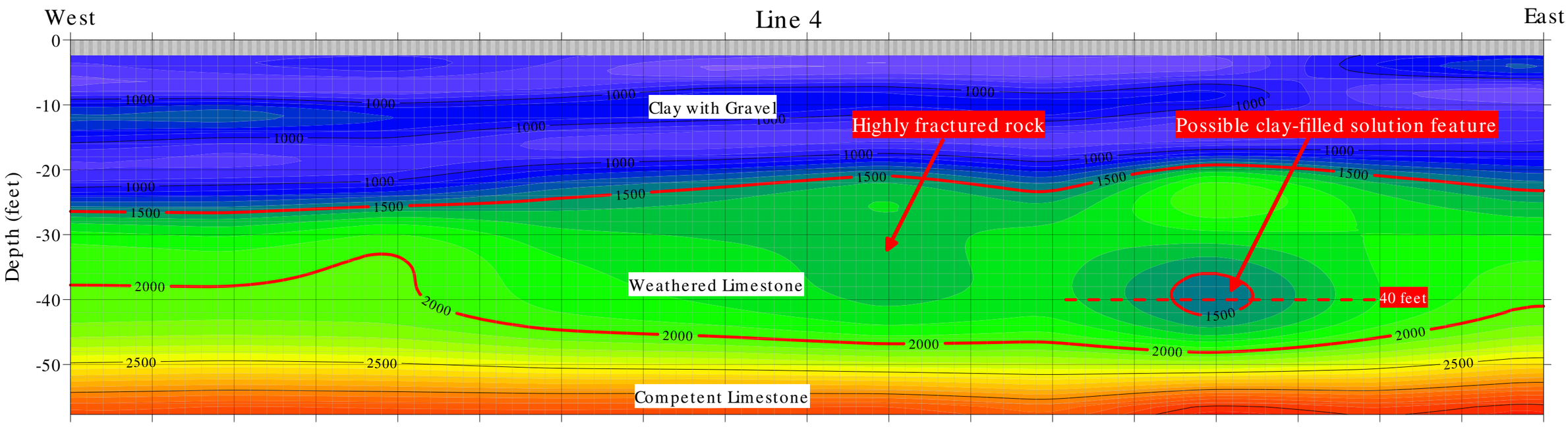
Notes

1. Red countours indicate approximate locations of material type changes.
2. Red dashed line represents possible dissolution features along a bedding plane at about 40 feet bsg.
3. Major gridlines on 10-foot intervals

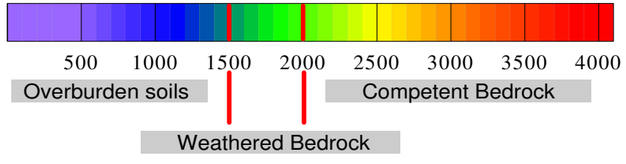
MASW Cross Sections

Project: Republic WWTF
Client: Burns & McDonnell
Location: Republic, Missouri
Terracon Project No.: B5215111
Date: July 26, 2022





Surface Wave Velocity (feet/second)



Soil Properties Table

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Notes

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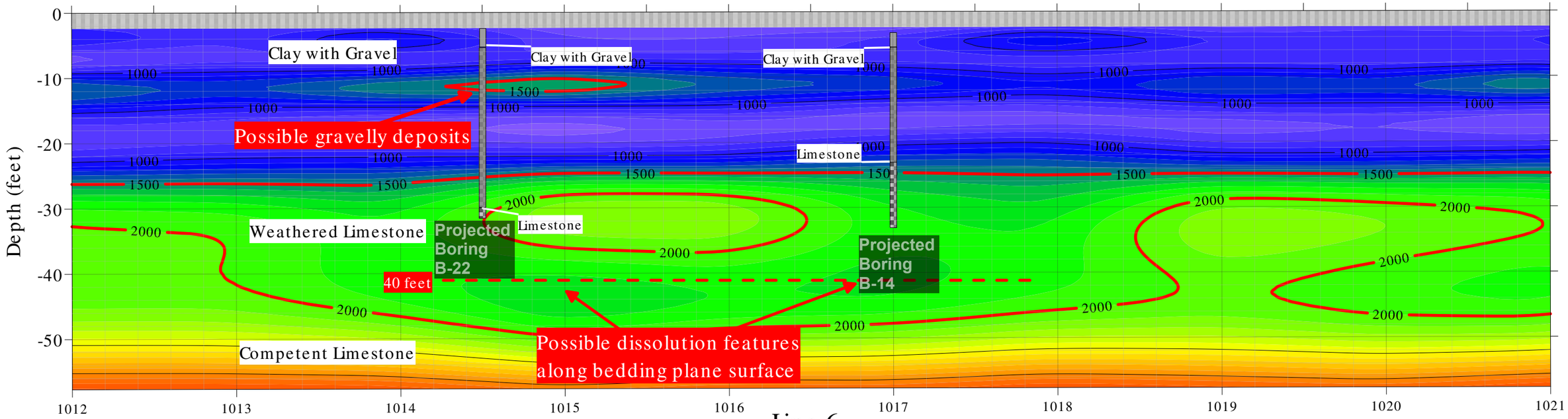
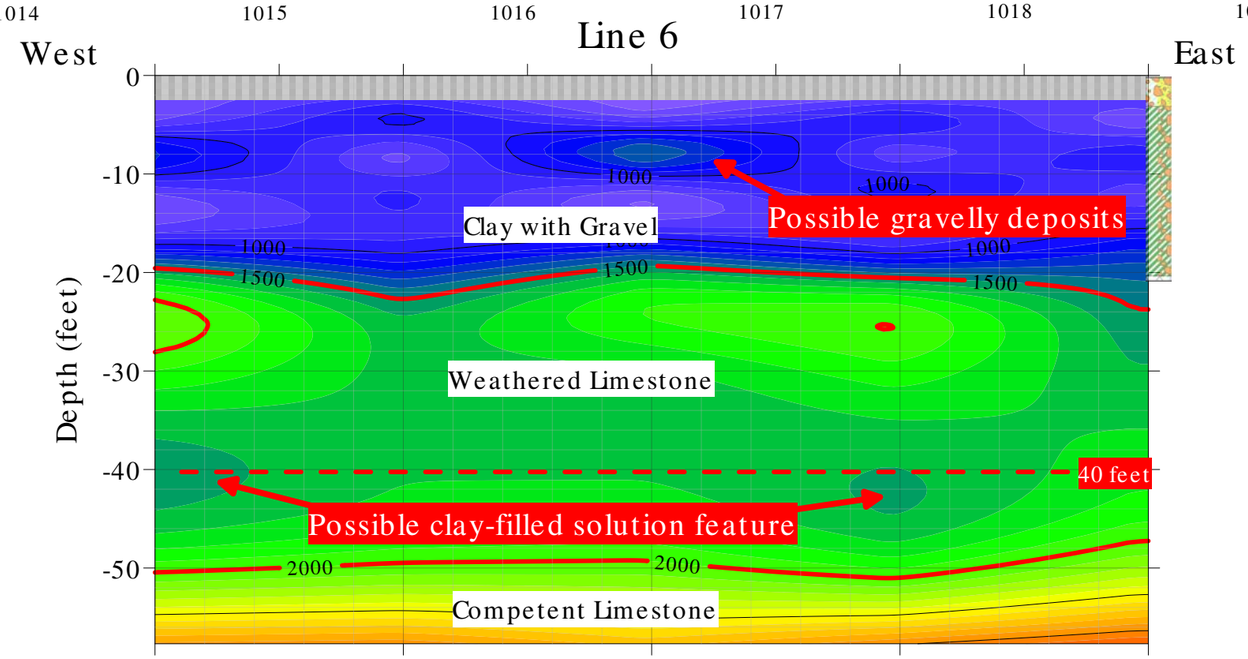
MASW Cross Sections

Project: Republic WWTF
Client: Burns & McDonnell
Location: Republic, Missouri
Terracon Project No.: B5215111
Date: July 26, 2022

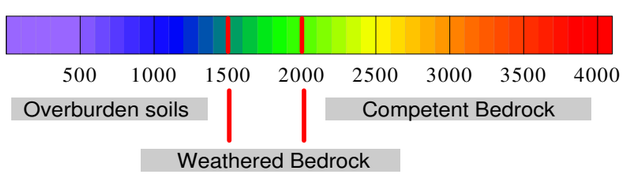
Line 5



Line 6



Surface Wave Velocity (feet/second)



Soil Properties Table

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Notes

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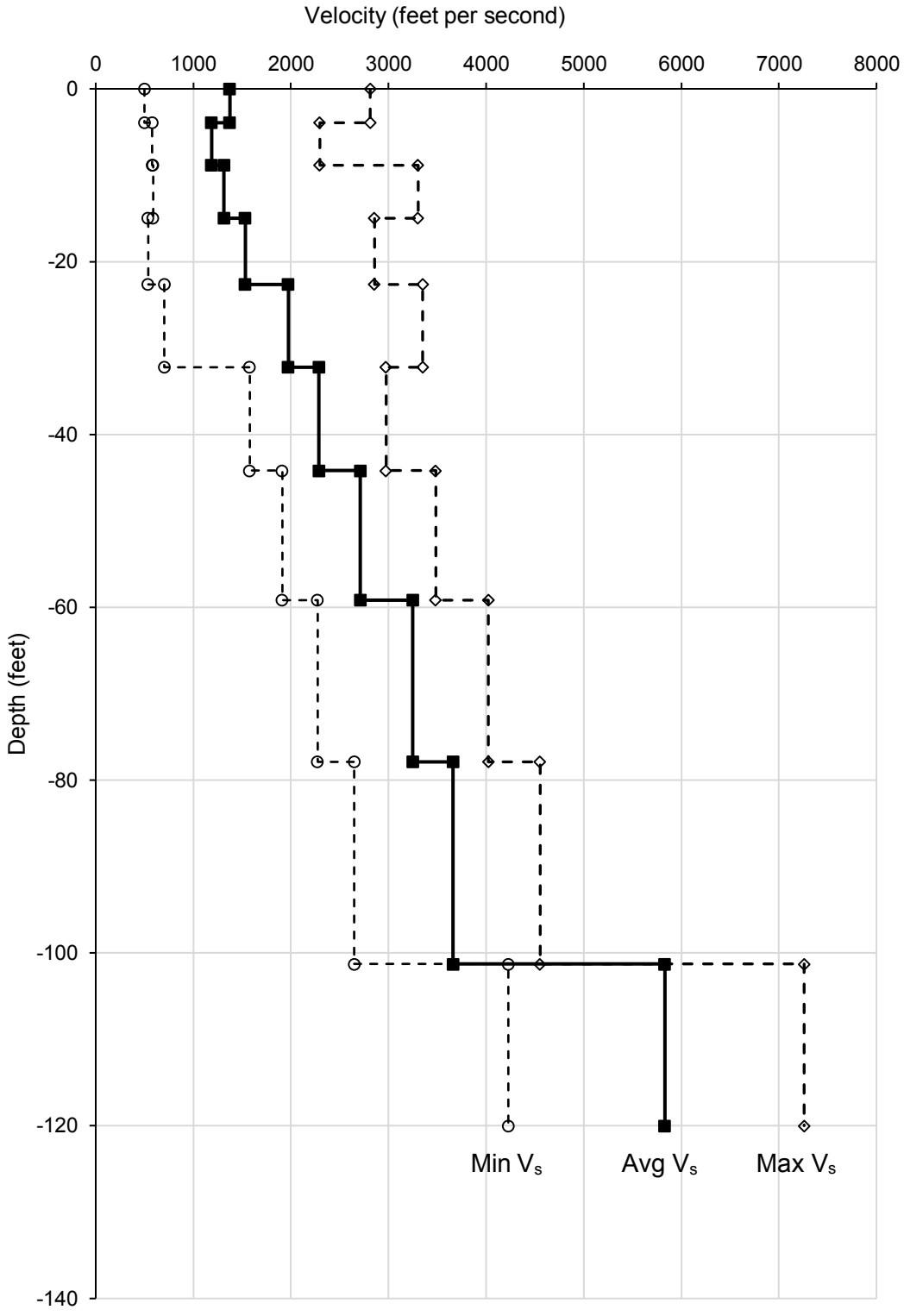
3. Major grid lines on 10-foot intervals

MASW Cross Sections

Project: Republic WWTF
Client: Burns & McDonnell
Location: Republic, Missouri
Terracon Project No.: B5215111
Date: July 26, 2022

Shear Wave Velocity Profile



Average Shear Wave Velocity (rounded) = 2,300 ft/s

Site Class BC

Project Manager: KDF	Project No. B52050290	Terracon GeoReport	SHEAR WAVE VELOCITY PROFILE
Drawn by: PBL	Scale: NA	11600 Lilburn Park Rd Saint Louis, MO 63146-3535	REPUBLIC WASTEWATER TREATMENT PLANT IMPROVEMENTS N. West Ave. Republic, Missouri
Checked by: KCB	File Name: Vs Profile		
Approved by: KDF	Date: 11/18/2020		

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System
Description of Rock Properties

GENERAL NOTES

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Rock Core  Split Spoon	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (psf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 500	0 - 1
Loose	4 - 9	Soft	500 to 1,000	2 - 4
Medium Dense	10 - 29	Medium Stiff	1,000 to 2,000	4 - 8
Dense	30 - 50	Stiff	2,000 to 4,000	8 - 15
Very Dense	> 50	Very Stiff	4,000 to 8,000	15 - 30
		Hard	> 8,000	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12
GRAIN SIZE TERMINOLOGY		**PLASTICITY DESCRIPTION**	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

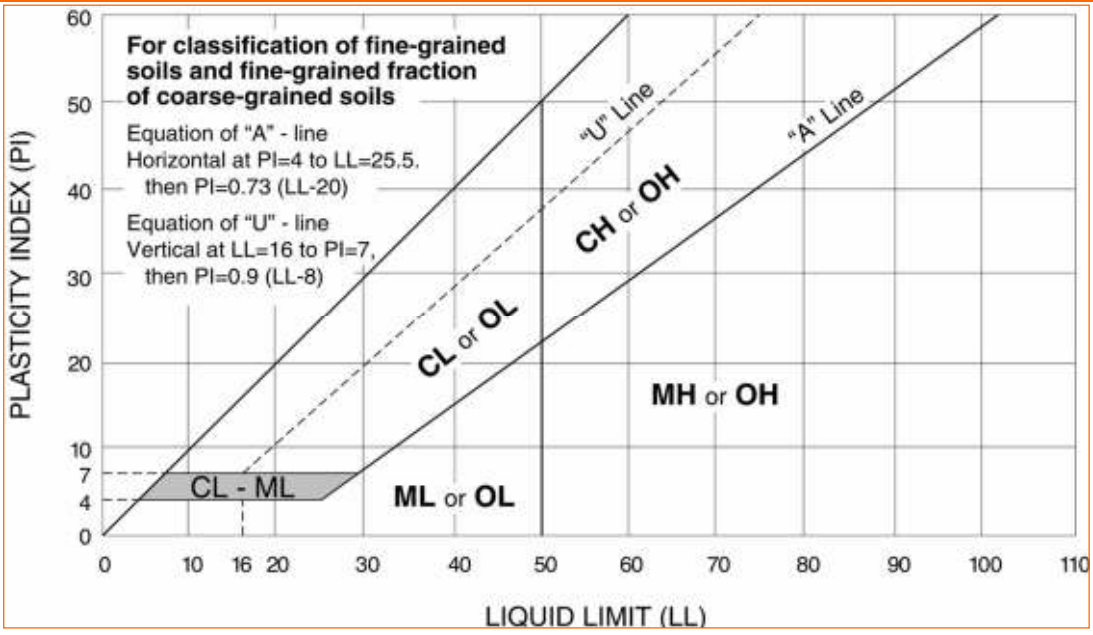
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009
Technical Manual for Design and Construction of Road Tunnels – Civil Elements

DESCRIPTION OF ROCK PROPERTIES

WEATHERING	
Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)	
Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding, and Foliation Spacing in Rock [1]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designator (RQD) [1]

RQD, as a percentage	Diagnostic description
Exceeding 90	Excellent
90 – 75	Good
75 – 50	Fair
50 – 25	Poor
Less than 25	Very poor

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

Joint Openness Descriptors

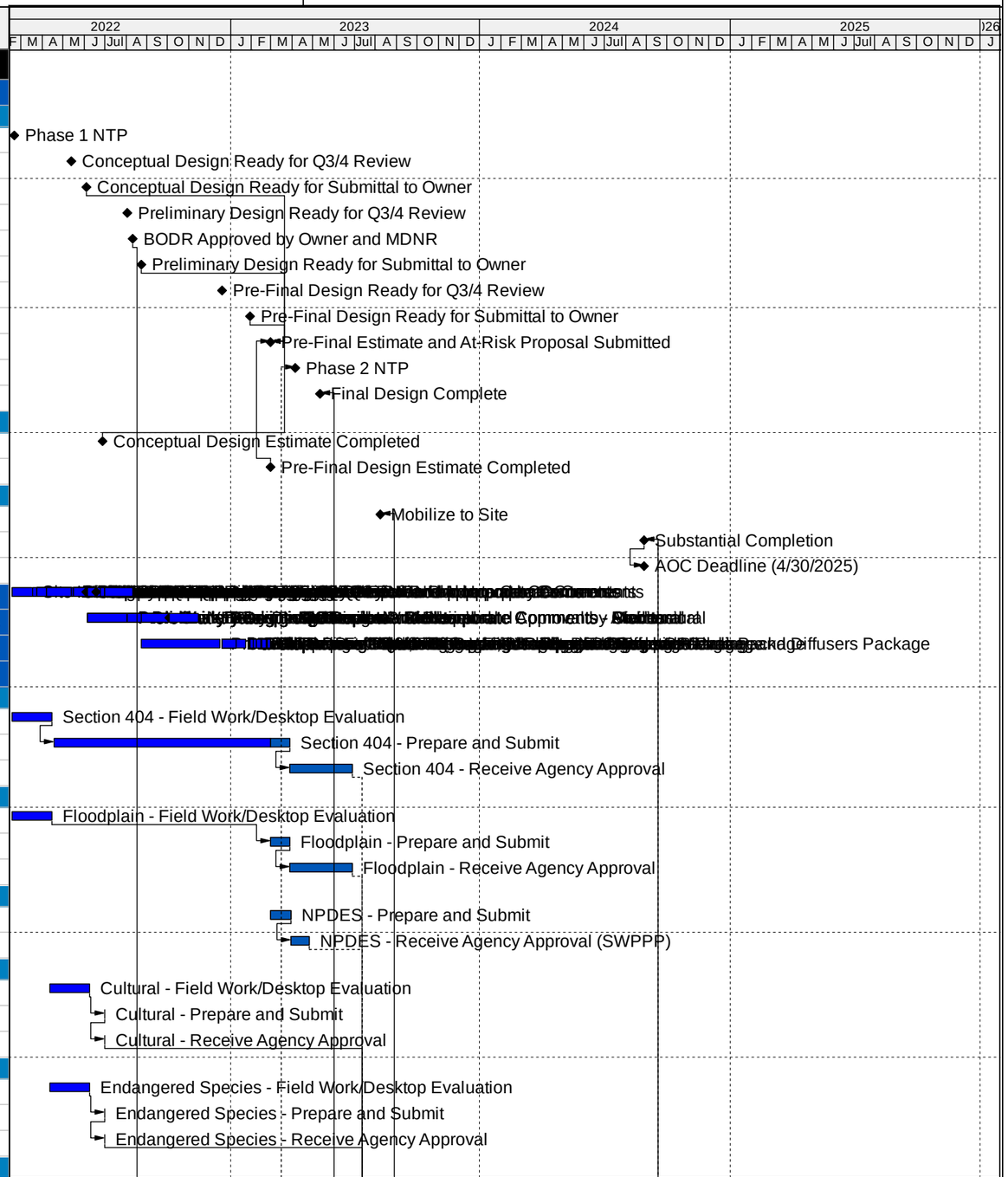
Openness	Descriptor
No Visible Separation	Tight
Less than 1/32 in.	Slightly Open
1/32 to 1/8 in.	Moderately Open
1/8 to 3/8 in.	Open
3/8 in. to 0.1 ft.	Moderately Wide
Greater than 0.1 ft.	Wide

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

EXHIBIT J – PROJECT SCHEDULE

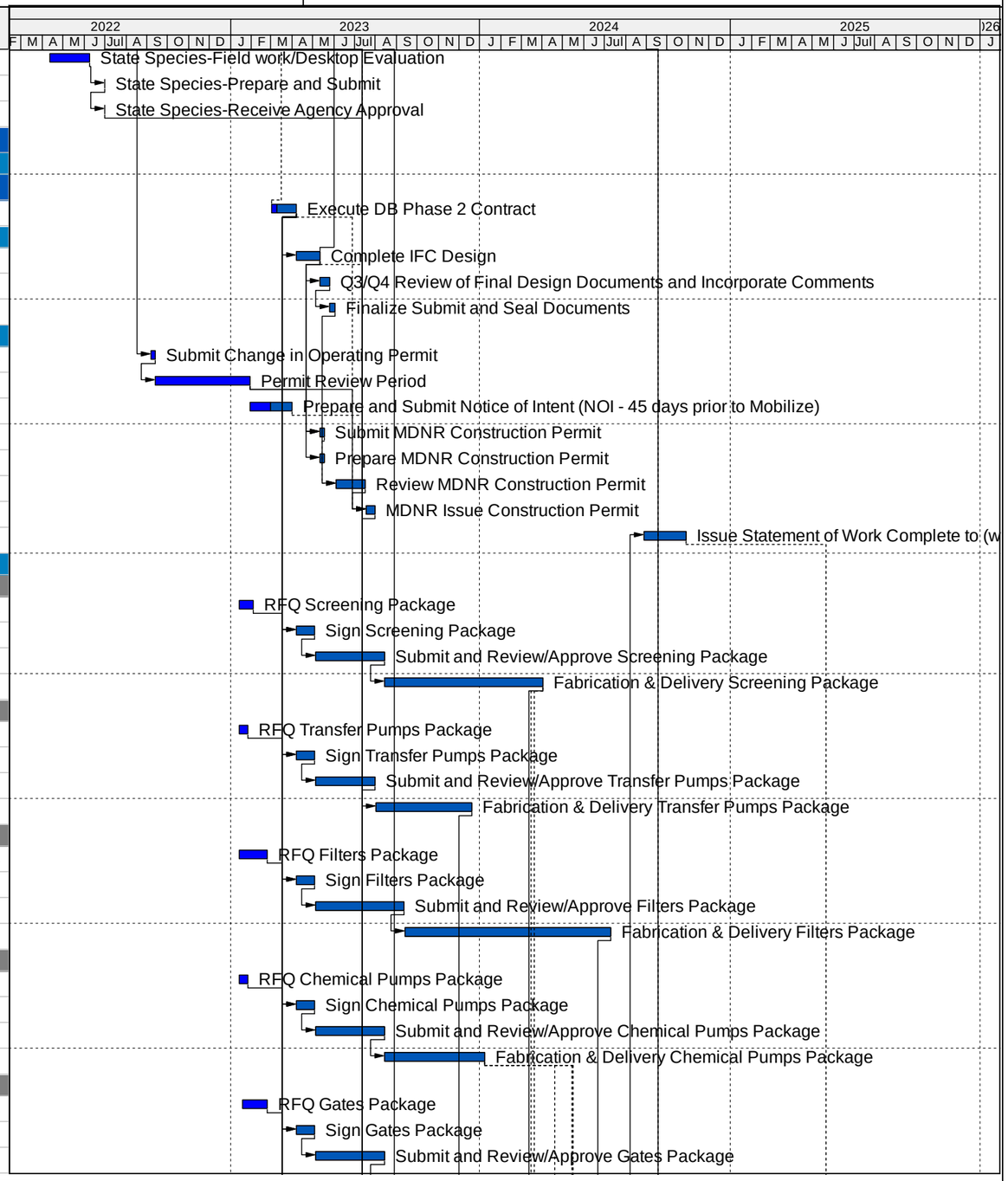
Republic, MO WWTP - Blending

Activity ID	Activity Name	Remaining Duration	Start	Finish
Republic, MO WWTP - Blending		552	16-Feb-22 A	30-Apr-25
Major Milestones		355	18-Feb-22 A	28-Aug-24
Engineering		26	18-Feb-22 A	11-May-23
Blending-MS-60-12	Phase 1 NTP	0	18-Feb-22 A	
Blending-MS-30-1	Conceptual Design Ready for Q3/4 Review	0		13-May-22 A
Blending-MS-30-2	Conceptual Design Ready for Submittal to Owner	0		03-Jun-22 A
Blending-MS-60-1	Preliminary Design Ready for Q3/4 Review	0		02-Aug-22 A
Blending-MS-30-3	BODR Approved by Owner and MDNR	0		11-Aug-22 A
Blending-MS-60-3	Preliminary Design Ready for Submittal to Owner	0		23-Aug-22 A
Blending-MS-90-1	Pre-Final Design Ready for Q3/4 Review	0		19-Dec-22 A
Blending-MS-90-2	Pre-Final Design Ready for Submittal to Owner	0		30-Jan-23 A
Blending-MS-90-3	Pre-Final Estimate and At-Risk Proposal Submitted	0	01-Mar-23 A	
Blending-MS-100-1	Phase 2 NTP	0	06-Apr-23*	
Blending-MS-100-2	Final Design Complete	0		11-May-23
Estimating		0	28-Jun-22 A	28-Feb-23 A
Blending-MS-30-EST	Conceptual Design Estimate Completed	0		28-Jun-22 A
Blending-MS-90-EST	Pre-Final Design Estimate Completed	0		28-Feb-23 A
Construction		269	07-Aug-23	28-Aug-24
Blending-MS-Const-1	Mobilize to Site	0		07-Aug-23
Blending-MS-Const-2	Substantial Completion	0		28-Aug-24
Blending-MS-Const-3	AOC Deadline (4/30/2025)	0		28-Aug-24
BODR & Conceptual Design - Phase 1		0	16-Feb-22 A	11-Aug-22 A
Preliminary Design - Phase 1		0	06-Jun-22 A	14-Nov-22 A
Pre-Final Design - Phase 1		0	24-Aug-22 A	01-Mar-23 A
Environmental Permitting - Phase 1		86	16-Feb-22 A	28-Jun-23
Clean Water Act Section 401 & 404		86	16-Feb-22 A	28-Jun-23
EPMT-PH1-1790	Section 404 - Field Work/Desktop Evaluation	0	16-Feb-22 A	15-Apr-22 A
EPMT-PH1-1800	Section 404 - Prepare and Submit	21	18-Apr-22 A	28-Mar-23
EPMT-PH1-1810	Section 404 - Receive Agency Approval	65	29-Mar-23	28-Jun-23
Greene County, MO Floodplain Development		86	16-Feb-22 A	28-Jun-23
EPMT-PH1-1850	Floodplain - Field Work/Desktop Evaluation	0	16-Feb-22 A	15-Apr-22 A
EPMT-PH1-1860	Floodplain - Prepare and Submit	21	28-Feb-23	28-Mar-23
EPMT-PH1-1870	Floodplain - Receive Agency Approval	65	29-Mar-23	28-Jun-23
NPDES Stormwater Permit		41	28-Feb-23	25-Apr-23
EPMT-PH1-1880	NPDES - Prepare and Submit	23	28-Feb-23	30-Mar-23
EPMT-PH1-1890	NPDES - Receive Agency Approval (SWPPP)	18	31-Mar-23	25-Apr-23
National Historic Preservation Act Section 106		0	11-Apr-22 A	01-Jul-22 A
EPMT-PH1-1900	Cultural - Field Work/Desktop Evaluation	0	11-Apr-22 A	09-Jun-22 A
EPMT-PH1-1910	Cultural - Prepare and Submit	0	01-Jul-22 A	01-Jul-22 A
EPMT-PH1-1920	Cultural - Receive Agency Approval	0	01-Jul-22 A	01-Jul-22 A
Endangered Species Act		0	11-Apr-22 A	01-Jul-22 A
EPMT-PH1-1930	Endangered Species - Field Work/Desktop Evaluation	0	11-Apr-22 A	09-Jun-22 A
EPMT-PH1-1940	Endangered Species - Prepare and Submit	0	01-Jul-22 A	01-Jul-22 A
EPMT-PH1-1950	Endangered Species - Receive Agency Approval	0	01-Jul-22 A	01-Jul-22 A
State Protected Species		0	11-Apr-22 A	01-Jul-22 A



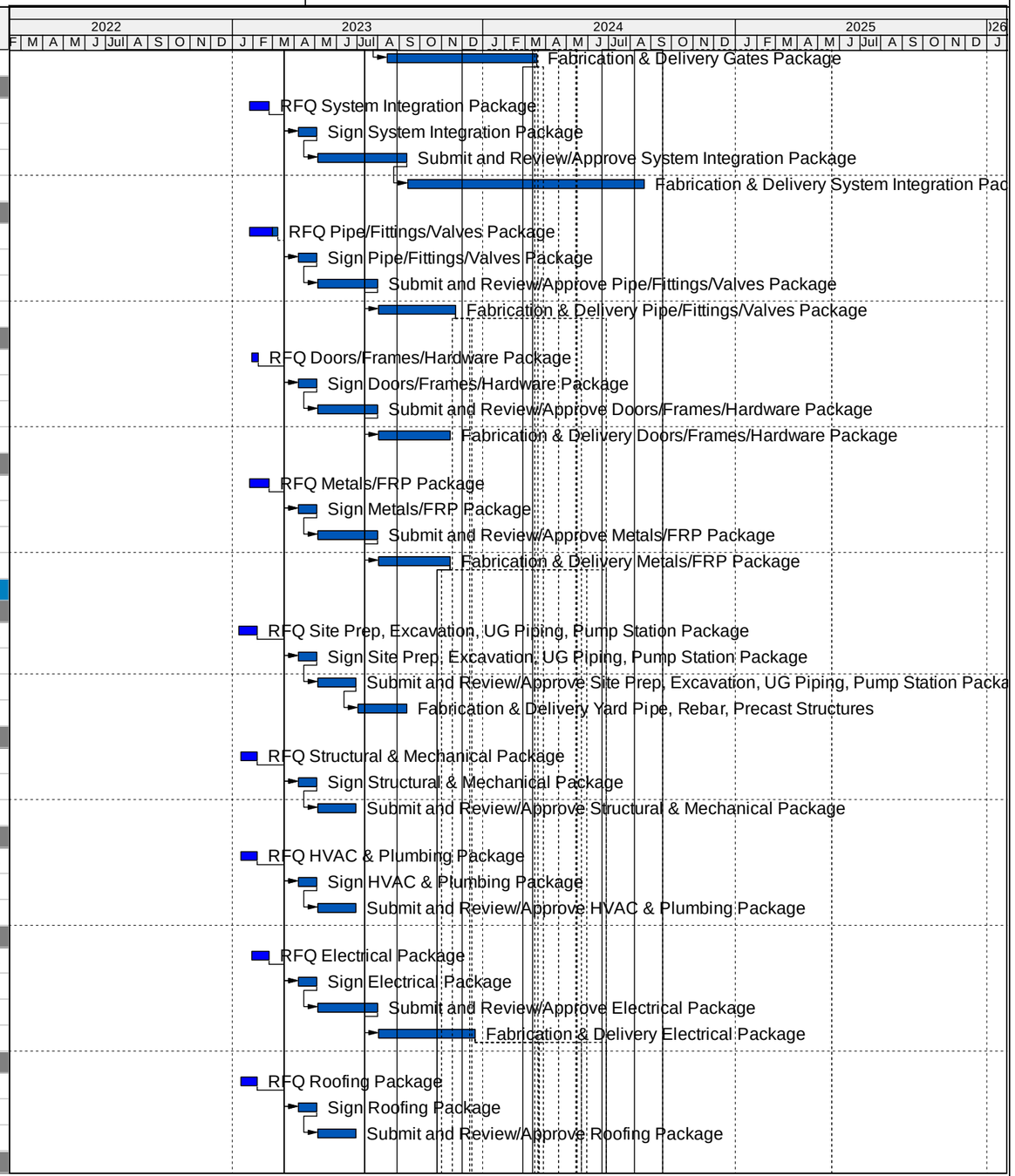
Republic, MO WWTP - Blending

Activity ID	Activity Name	Remaining Duration	Start	Finish
EPMT-PH1-2000	State Species-Field work/Desktop Evaluation	0	11-Apr-22 A	09-Jun-22 A
EPMT-PH1-2010	State Species-Prepare and Submit	0	01-Jul-22 A	01-Jul-22 A
EPMT-PH1-2020	State Species-Receive Agency Approval	0	01-Jul-22 A	01-Jul-22 A
Procurement & Subcontracting - Phase 1		0		
Plan		0		
Phase 2		552	07-Sep-22 A	30-Apr-25
Blending-PH2-2070	Execute DB Phase 2 Contract	21	02-Mar-23 A	06-Apr-23
IFC Design		40	07-Apr-23	02-Jun-23
Blending-IFC-2080	Complete IFC Design	25	07-Apr-23	11-May-23
Blending-IFC-2090	Q3/Q4 Review of Final Design Documents and Incorporate Comments	10	12-May-23	25-May-23
Blending-IFC-2100	Finalize Submit and Seal Documents	5	26-May-23	02-Jun-23
Permitting		425	07-Sep-22 A	28-Oct-24
Blending-PMT-2090	Submit Change in Operating Permit	0	07-Sep-22 A	13-Sep-22 A
Blending-PMT-3000	Permit Review Period	0	13-Sep-22 A	30-Jan-23 A
Blending-PMT-3035	Prepare and Submit Notice of Intent (NOI - 45 days prior to Mobilize)	24	30-Jan-23 A	31-Mar-23
Blending-PMT-3010	Submit MDNR Construction Permit	5	12-May-23	18-May-23
Blending-PMT-3005	Prepare MDNR Construction Permit	5	12-May-23	18-May-23
Blending-PMT-3020	Review MDNR Construction Permit	30	05-Jun-23	17-Jul-23
Blending-PMT-3030	MDNR Issue Construction Permit	10	18-Jul-23	31-Jul-23
Blending-PMT-3040	Issue Statement of Work Complete to (within 60 days of SC)	43	28-Aug-24	28-Oct-24
Procurement		378	13-Jan-23 A	21-Aug-24
Screening / Washer Compactor Package		250	13-Jan-23 A	01-Apr-24
Blending-PC-3050	RFQ Screening Package	0	13-Jan-23 A	02-Feb-23 A
Blending-PC-3060	Sign Screening Package	20	07-Apr-23	04-May-23
Blending-PC-3070	Submit and Review/Approve Screening Package	70	05-May-23	14-Aug-23
Blending-PC-3080	Fabrication & Delivery Screening Package	160	15-Aug-23	01-Apr-24
Transfer Pumps Package		180	13-Jan-23 A	20-Dec-23
Blending-PC-3090	RFQ Transfer Pumps Package	0	13-Jan-23 A	27-Jan-23 A
Blending-PC-3100	Sign Transfer Pumps Package	20	07-Apr-23	04-May-23
Blending-PC-3110	Submit and Review/Approve Transfer Pumps Package	60	05-May-23	31-Jul-23
Blending-PC-3120	Fabrication & Delivery Transfer Pumps Package	100	01-Aug-23	20-Dec-23
Filters Package		320	13-Jan-23 A	10-Jul-24
Blending-PC-3130	RFQ Filters Package	0	13-Jan-23 A	24-Feb-23 A
Blending-PC-3140	Sign Filters Package	20	07-Apr-23	04-May-23
Blending-PC-3150	Submit and Review/Approve Filters Package	90	05-May-23	12-Sep-23
Blending-PC-3160	Fabrication & Delivery Filters Package	210	13-Sep-23	10-Jul-24
Chemical Feed System Package		190	13-Jan-23 A	08-Jan-24
Blending-PC-3170	RFQ Chemical Pumps Package	0	13-Jan-23 A	27-Jan-23 A
Blending-PC-3180	Sign Chemical Pumps Package	20	07-Apr-23	04-May-23
Blending-PC-3190	Submit and Review/Approve Chemical Pumps Package	70	05-May-23	14-Aug-23
Blending-PC-3200	Fabrication & Delivery Chemical Pumps Package	100	15-Aug-23	08-Jan-24
Gates Package		240	18-Jan-23 A	18-Mar-24
Blending-PC-3370	RFQ Gates Package	0	18-Jan-23 A	24-Feb-23 A
Blending-PC-3380	Sign Gates Package	20	07-Apr-23	04-May-23
Blending-PC-3390	Submit and Review/Approve Gates Package	70	05-May-23	14-Aug-23



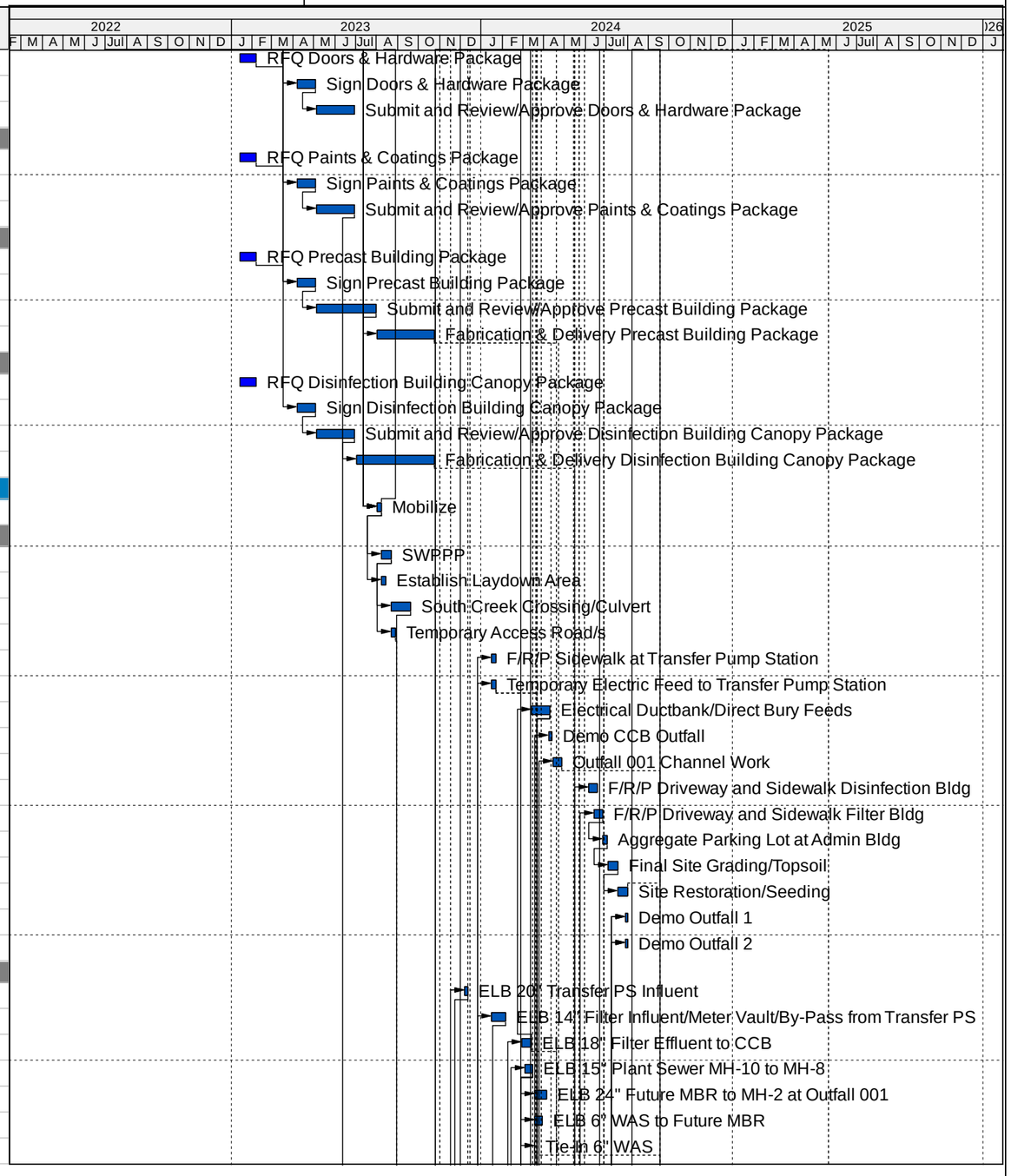
Republic, MO WWTP - Blending

Activity ID	Activity Name	Remaining Duration	Start	Finish
Blending-PC-3400	Fabrication & Delivery Gates Package	150	15-Aug-23	18-Mar-24
System Integration Package		350	26-Jan-23 A	21-Aug-24
Blending-PC-3450	RFQ System Integration Package	0	26-Jan-23 A	24-Feb-23 A
Blending-PC-3460	Sign System Integration Package	20	07-Apr-23	04-May-23
Blending-PC-3470	Submit and Review/Approve System Integration Package	90	05-May-23	12-Sep-23
Blending-PC-3480	Fabrication & Delivery System Integration Package	240	13-Sep-23	21-Aug-24
Pipe/Fittings/Valves Package		188	27-Jan-23 A	21-Nov-23
Blending-PC-3490	RFQ Pipe/Fittings/Valves Package	7	27-Jan-23 A	08-Mar-23
Blending-PC-3500	Sign Pipe/Fittings/Valves Package	20	07-Apr-23	04-May-23
Blending-PC-3510	Submit and Review/Approve Pipe/Fittings/Valves Package	60	05-May-23	31-Jul-23
Blending-PC-3520	Fabrication & Delivery Pipe/Fittings/Valves Package	80	01-Aug-23	21-Nov-23
Doors/Frames/Hardware Package		155	30-Jan-23 A	14-Nov-23
Blending-PC-3410	RFQ Doors/Frames/Hardware Package	0	30-Jan-23 A	07-Feb-23 A
Blending-PC-3420	Sign Doors/Frames/Hardware Package	20	07-Apr-23	04-May-23
Blending-PC-3430	Submit and Review/Approve Doors/Frames/Hardware Package	60	05-May-23	31-Jul-23
Blending-PC-3440	Fabrication & Delivery Doors/Frames/Hardware Package	75	01-Aug-23	14-Nov-23
Metals/FRP Package		155	27-Jan-23 A	14-Nov-23
Blending-PC-3345	RFQ Metals/FRP Package	0	27-Jan-23 A	24-Feb-23 A
Blending-PC-3350	Sign Metals/FRP Package	20	07-Apr-23	04-May-23
Blending-PC-3355	Submit and Review/Approve Metals/FRP Package	60	05-May-23	31-Jul-23
Blending-PC-3365	Fabrication & Delivery Metals/FRP Package	75	01-Aug-23	14-Nov-23
Subcontracts		180	11-Jan-23 A	20-Dec-23
Site Prep, Excavation, UG Piping, Pump Station Package		110	11-Jan-23 A	12-Sep-23
Blending-SUB-3610	RFQ Site Prep, Excavation, UG Piping, Pump Station Package	0	11-Jan-23 A	06-Feb-23 A
Blending-SUB-3620	Sign Site Prep, Excavation, UG Piping, Pump Station Package	20	07-Apr-23	04-May-23
Blending-SUB-3630	Submit and Review/Approve Site Prep, Excavation, UG Piping, Pump St	40	05-May-23	30-Jun-23
Blending-SUB-3640	Fabrication & Delivery Yard Pipe, Rebar, Precast Structures	50	03-Jul-23	12-Sep-23
Structural & Mechanical Package		60	13-Jan-23 A	30-Jun-23
Blending-SUB-3690	RFQ Structural & Mechanical Package	0	13-Jan-23 A	06-Feb-23 A
Blending-SUB-3700	Sign Structural & Mechanical Package	20	07-Apr-23	04-May-23
Blending-SUB-3710	Submit and Review/Approve Structural & Mechanical Package	40	05-May-23	30-Jun-23
HVAC & Plumbing Package		60	13-Jan-23 A	30-Jun-23
Blending-SUB-3770	RFQ HVAC & Plumbing Package	0	13-Jan-23 A	06-Feb-23 A
Blending-SUB-3780	Sign HVAC & Plumbing Package	20	07-Apr-23	04-May-23
Blending-SUB-3790	Submit and Review/Approve HVAC & Plumbing Package	40	05-May-23	30-Jun-23
Electrical Package		180	30-Jan-23 A	20-Dec-23
Blending-SUB-3810	RFQ Electrical Package	0	30-Jan-23 A	24-Feb-23 A
Blending-SUB-3820	Sign Electrical Package	20	07-Apr-23	04-May-23
Blending-SUB-3830	Submit and Review/Approve Electrical Package	60	05-May-23	31-Jul-23
Blending-SUB-3840	Fabrication & Delivery Electrical Package	100	01-Aug-23	20-Dec-23
Roofing Package		60	13-Jan-23 A	30-Jun-23
Blending-SUB-3890	RFQ Roofing Package	0	13-Jan-23 A	06-Feb-23 A
Blending-SUB-3900	Sign Roofing Package	20	07-Apr-23	04-May-23
Blending-SUB-3910	Submit and Review/Approve Roofing Package	40	05-May-23	30-Jun-23
Doors & Hardware Package		60	13-Jan-23 A	30-Jun-23



Republic, MO WWTP - Blending

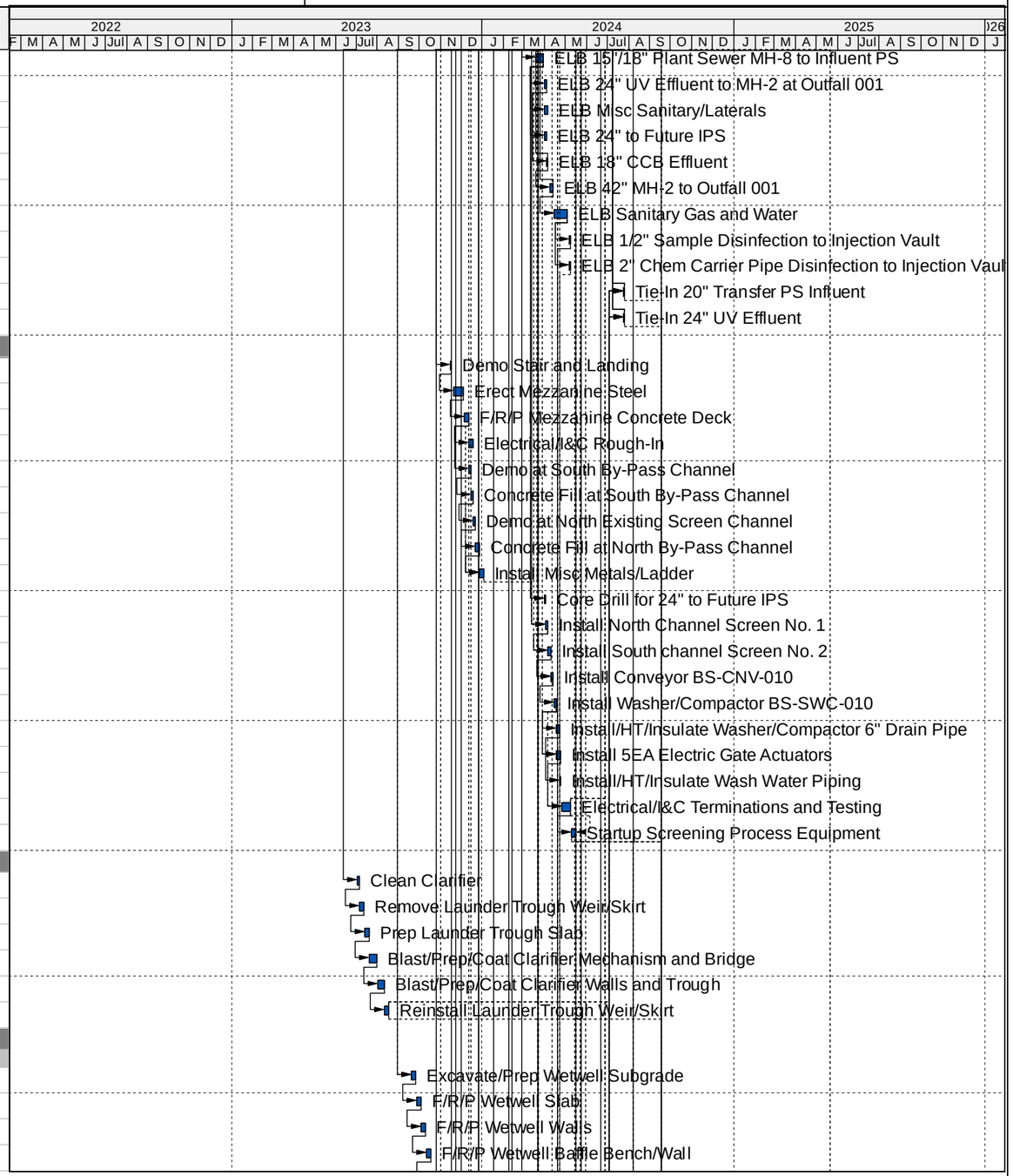
Activity ID	Activity Name	Remaining Duration	Start	Finish
Blending-SUB-3930	RFQ Doors & Hardware Package	0	13-Jan-23 A	06-Feb-23 A
Blending-SUB-3940	Sign Doors & Hardware Package	20	07-Apr-23	04-May-23
Blending-SUB-3950	Submit and Review/Approve Doors & Hardware Package	40	05-May-23	30-Jun-23
Paints & Coatings Package		60	13-Jan-23 A	30-Jun-23
Blending-SUB-3970	RFQ Paints & Coatings Package	0	13-Jan-23 A	06-Feb-23 A
Blending-SUB-3980	Sign Paints & Coatings Package	20	07-Apr-23	04-May-23
Blending-SUB-3990	Submit and Review/Approve Paints & Coatings Package	40	05-May-23	30-Jun-23
Precast Building Package		140	13-Jan-23 A	24-Oct-23
Blending-PC-3570	RFQ Precast Building Package	0	13-Jan-23 A	06-Feb-23 A
Blending-PC-3580	Sign Precast Building Package	20	07-Apr-23	04-May-23
Blending-PC-3590	Submit and Review/Approve Precast Building Package	60	05-May-23	31-Jul-23
Blending-PC-3600	Fabrication & Delivery Precast Building Package	60	01-Aug-23	24-Oct-23
Disinfection Building Canopy Package		140	13-Jan-23 A	24-Oct-23
Blending-PC-3610	RFQ Disinfection Building Canopy Package	0	13-Jan-23 A	06-Feb-23 A
Blending-PC-3620	Sign Disinfection Building Canopy Package	20	07-Apr-23	04-May-23
Blending-PC-3630	Submit and Review/Approve Disinfection Building Canopy Package	40	05-May-23	30-Jun-23
Blending-PC-3640	Fabrication & Delivery Disinfection Building Canopy Package	80	03-Jul-23	24-Oct-23
Construction		294	03-Jul-23	27-Aug-24
Blending-CN-4070	Mobilize	5	01-Aug-23	07-Aug-23
Site Work		250	08-Aug-23	31-Jul-24
Blending-CN-4180	SWPPP	10	08-Aug-23	21-Aug-23
Blending-CN-4185	Establish Laydown Area	5	08-Aug-23	14-Aug-23
Blending-CN-4190	South Creek Crossing/Culvert	20	22-Aug-23	19-Sep-23
Blending-CN-4195	Temporary Access Road/s	5	22-Aug-23	28-Aug-23
Blending-CN-4230	F/R/P Sidewalk at Transfer Pump Station	5	16-Jan-24	22-Jan-24
Blending-CN-4245	Temporary Electric Feed to Transfer Pump Station	5	16-Jan-24	22-Jan-24
Blending-CN-4240	Electrical Ductbank/Direct Bury Feeds	20	14-Mar-24	10-Apr-24
Blending-CN-4200	Demo CCB Outfall	5	08-Apr-24	12-Apr-24
Blending-CN-4198	Outfall 001 Channel Work	10	15-Apr-24	26-Apr-24
Blending-CN-4220	F/R/P Driveway and Sidewalk Disinfection Bldg	8	06-Jun-24	17-Jun-24
Blending-CN-4215	F/R/P Driveway and Sidewalk Filter Bldg	8	14-Jun-24	25-Jun-24
Blending-CN-4225	Aggregate Parking Lot at Admin Bldg	5	26-Jun-24	02-Jul-24
Blending-CN-4235	Final Site Grading/Topsoil	10	03-Jul-24	17-Jul-24
Blending-CN-4250	Site Restoration/Seeding	10	18-Jul-24	31-Jul-24
Blending-CN-4205	Demo Outfall 1	3	29-Jul-24	31-Jul-24
Blending-CN-4210	Demo Outfall 2	3	29-Jul-24	31-Jul-24
Yard Pipe		161	08-Dec-23	26-Jul-24
Blending-CN-4285	ELB 20" Transfer PS Influent	3	08-Dec-23	12-Dec-23
Blending-CN-4295	ELB 14" Filter Influent/Meter Vault/By-Pass from Transfer PS	15	16-Jan-24	05-Feb-24
Blending-CN-4300	ELB 18" Filter Effluent to CCB	10	29-Feb-24	13-Mar-24
Blending-CN-4305	ELB 15" Plant Sewer MH-10 to MH-8	10	04-Mar-24	15-Mar-24
Blending-CN-4310	ELB 24" Future MBR to MH-2 at Outfall 001	15	18-Mar-24	05-Apr-24
Blending-CN-4345	ELB 6" WAS to Future MBR	10	18-Mar-24	29-Mar-24
Blending-CN-4350	Tie-In 6" WAS	2	18-Mar-24	19-Mar-24



BURNS McDONNELL

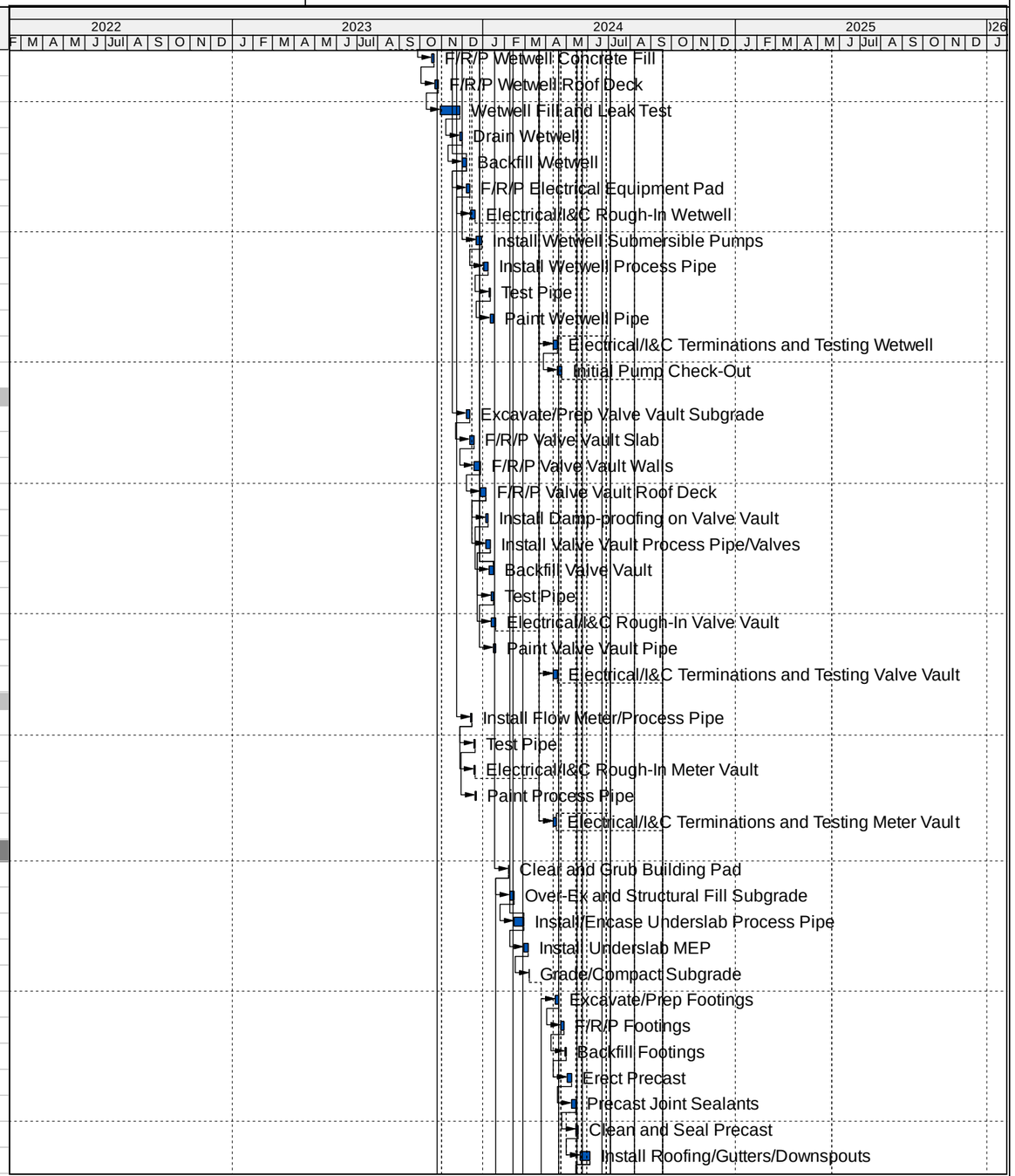
Republic, MO WWTP - Blending

Activity ID	Activity Name	Remaining Duration	Start	Finish
Blending-CN-4308	ELB 15"/18" Plant Sewer MH-8 to Influent PS	10	18-Mar-24	29-Mar-24
Blending-CN-4320	ELB 24" UV Effluent to MH-2 at Outfall 001	3	01-Apr-24	03-Apr-24
Blending-CN-4355	ELB Misc Sanitary/Laterals	5	01-Apr-24	05-Apr-24
Blending-CN-4365	ELB 24" to Future IPS	3	01-Apr-24	03-Apr-24
Blending-CN-4315	ELB 18" CCB Effluent	2	04-Apr-24	05-Apr-24
Blending-CN-4330	ELB 42" MH-2 to Outfall 001	5	08-Apr-24	12-Apr-24
Blending-CN-4280	ELB Sanitary Gas and Water	15	15-Apr-24	03-May-24
Blending-CN-4335	ELB 1/2" Sample Disinfection to Injection Vault	3	06-May-24	08-May-24
Blending-CN-4340	ELB 2" Chem Carrier Pipe Disinfection to Injection Vault	3	06-May-24	08-May-24
Blending-CN-4290	Tie-In 20" Transfer PS Influent	2	25-Jul-24	26-Jul-24
Blending-CN-4325	Tie-In 24" UV Effluent	2	25-Jul-24	26-Jul-24
Screening Facility		127	15-Nov-23	15-May-24
Blending-CN-4380	Demo Stair and Landing	3	15-Nov-23	17-Nov-23
Blending-CN-4385	Erect Mezzanine Steel	10	20-Nov-23	04-Dec-23
Blending-CN-4390	F/R/P Mezzanine Concrete Deck	5	05-Dec-23	11-Dec-23
Blending-CN-4395	Electrical/I&C Rough-In	5	12-Dec-23	18-Dec-23
Blending-CN-4400	Demo at South By-Pass Channel	3	12-Dec-23	14-Dec-23
Blending-CN-4405	Concrete Fill at South By-Pass Channel	2	15-Dec-23	18-Dec-23
Blending-CN-4415	Demo at North Existing Screen Channel	3	19-Dec-23	21-Dec-23
Blending-CN-4420	Concrete Fill at North By-Pass Channel	2	22-Dec-23	27-Dec-23
Blending-CN-4425	Install Misc Metals/Ladder	3	28-Dec-23	02-Jan-24
Blending-CN-4410	Core Drill for 24" to Future IPS	2	01-Apr-24	02-Apr-24
Blending-CN-4430	Install North Channel Screen No. 1	3	02-Apr-24	04-Apr-24
Blending-CN-4435	Install South channel Screen No. 2	3	05-Apr-24	09-Apr-24
Blending-CN-4440	Install Conveyor BS-CNV-010	3	10-Apr-24	12-Apr-24
Blending-CN-4445	Install Washer/Compactor BS-SWC-010	3	15-Apr-24	17-Apr-24
Blending-CN-4450	Install/HT/Insulate Washer/Compactor 6" Drain Pipe	3	18-Apr-24	22-Apr-24
Blending-CN-4455	Install 5EA Electric Gate Actuators	5	18-Apr-24	24-Apr-24
Blending-CN-4460	Install/HT/Insulate Wash Water Piping	2	23-Apr-24	24-Apr-24
Blending-CN-4465	Electrical/I&C Terminations and Testing	10	25-Apr-24	08-May-24
Blending-CN-4470	Startup Screening Process Equipment	5	09-May-24	15-May-24
Clarifier		33	03-Jul-23	17-Aug-23
Blending-CN-4475	Clean Clarifier	2	03-Jul-23	05-Jul-23
Blending-CN-4480	Remove Launder Trough Weir/Skirt	5	06-Jul-23	12-Jul-23
Blending-CN-4485	Prep Launder Trough Slab	5	13-Jul-23	19-Jul-23
Blending-CN-4495	Blast/Prep/Coat Clarifier Mechanism and Bridge	8	20-Jul-23	31-Jul-23
Blending-CN-4505	Blast/Prep/Coat Clarifier Walls and Trough	8	01-Aug-23	10-Aug-23
Blending-CN-4515	Reinstall Launder Trough Weir/Skirt	5	11-Aug-23	17-Aug-23
Transfer Pump Station		152	20-Sep-23	24-Apr-24
Wetwell		152	20-Sep-23	24-Apr-24
Blending-CN-4490	Excavate/Prep Wetwell Subgrade	5	20-Sep-23	26-Sep-23
Blending-CN-4500	F/R/P Wetwell Slab	5	27-Sep-23	03-Oct-23
Blending-CN-4520	F/R/P Wetwell Walls	5	04-Oct-23	10-Oct-23
Blending-CN-4530	F/R/P Wetwell Baffle Bench/Wall	5	11-Oct-23	17-Oct-23



Republic, MO WWTP - Blending

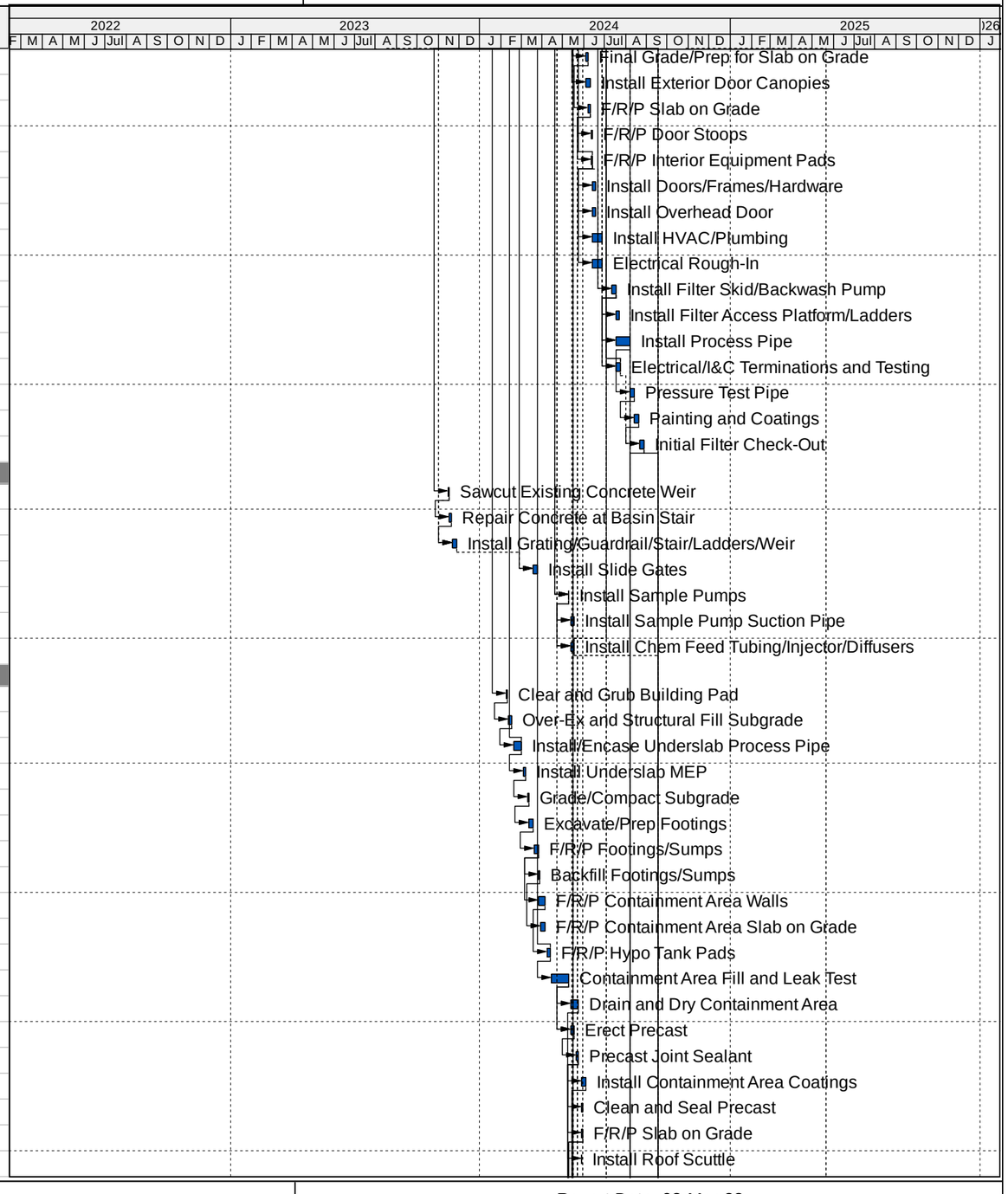
Activity ID	Activity Name	Remaining Duration	Start	Finish
Blending-CN-4540	F/R/P Wetwell Concrete Fill	3	18-Oct-23	20-Oct-23
Blending-CN-4545	F/R/P Wetwell Roof Deck	5	23-Oct-23	27-Oct-23
Blending-CN-4550	Wetwell Fill and Leak Test	20	30-Oct-23	27-Nov-23
Blending-CN-4560	Drain Wetwell	3	28-Nov-23	30-Nov-23
Blending-CN-4570	Backfill Wetwell	5	01-Dec-23	07-Dec-23
Blending-CN-4580	F/R/P Electrical Equipment Pad	3	08-Dec-23	12-Dec-23
Blending-CN-4630	Electrical/I&C Rough-In Wetwell	5	13-Dec-23	19-Dec-23
Blending-CN-4585	Install Wetwell Submersible Pumps	5	21-Dec-23	29-Dec-23
Blending-CN-4590	Install Wetwell Process Pipe	5	02-Jan-24	08-Jan-24
Blending-CN-4610	Test Pipe	2	09-Jan-24	10-Jan-24
Blending-CN-4620	Paint Wetwell Pipe	3	11-Jan-24	15-Jan-24
Blending-CN-4635	Electrical/I&C Terminations and Testing Wetwell	5	11-Apr-24	17-Apr-24
Blending-CN-4645	Initial Pump Check-Out	5	18-Apr-24	24-Apr-24
Valve Vault		91	08-Dec-23	17-Apr-24
Blending-CN-5400	Excavate/Prep Valve Vault Subgrade	2	08-Dec-23	11-Dec-23
Blending-CN-5405	F/R/P Valve Vault Slab	5	12-Dec-23	18-Dec-23
Blending-CN-5410	F/R/P Valve Vault Walls	5	19-Dec-23	27-Dec-23
Blending-CN-5415	F/R/P Valve Vault Roof Deck	5	28-Dec-23	04-Jan-24
Blending-CN-5420	Install Damp-proofing on Valve Vault	2	05-Jan-24	08-Jan-24
Blending-CN-5425	Install Valve Vault Process Pipe/Valves	5	05-Jan-24	11-Jan-24
Blending-CN-5422	Backfill Valve Vault	5	09-Jan-24	15-Jan-24
Blending-CN-5430	Test Pipe	2	12-Jan-24	15-Jan-24
Blending-CN-5440	Electrical/I&C Rough-In Valve Vault	5	12-Jan-24	18-Jan-24
Blending-CN-5435	Paint Valve Vault Pipe	3	16-Jan-24	18-Jan-24
Blending-CN-5445	Electrical/I&C Terminations and Testing Valve Vault	5	11-Apr-24	17-Apr-24
Meter Vault		86	13-Dec-23	15-Apr-24
Blending-CN-5450	Install Flow Meter/Process Pipe	3	13-Dec-23	15-Dec-23
Blending-CN-5455	Test Pipe	2	18-Dec-23	19-Dec-23
Blending-CN-5465	Electrical/I&C Rough-In Meter Vault	3	18-Dec-23	20-Dec-23
Blending-CN-5460	Paint Process Pipe	2	20-Dec-23	21-Dec-23
Blending-CN-5470	Electrical/I&C Terminations and Testing Meter Vault	3	11-Apr-24	15-Apr-24
Filter Building		144	06-Feb-24	27-Aug-24
Blending-CN-4640	Clear and Grub Building Pad	2	06-Feb-24	07-Feb-24
Blending-CN-4650	Over-Ex and Structural Fill Subgrade	5	08-Feb-24	14-Feb-24
Blending-CN-4660	Install/Encase Underslab Process Pipe	10	15-Feb-24	28-Feb-24
Blending-CN-4670	Install Underslab MEP	5	29-Feb-24	06-Mar-24
Blending-CN-4680	Grade/Compact Subgrade	2	07-Mar-24	08-Mar-24
Blending-CN-4690	Excavate/Prep Footings	5	15-Apr-24	19-Apr-24
Blending-CN-4740	F/R/P Footings	5	22-Apr-24	26-Apr-24
Blending-CN-4760	Backfill Footings	2	29-Apr-24	30-Apr-24
Blending-CN-4770	Erect Precast	5	01-May-24	07-May-24
Blending-CN-4775	Precast Joint Sealants	5	08-May-24	14-May-24
Blending-CN-4780	Clean and Seal Precast	3	15-May-24	17-May-24
Blending-CN-4790	Install Roofing/Gutters/Downspouts	10	20-May-24	03-Jun-24



BURNS McDONNELL

Republic, MO WWTP - Blending

Activity ID	Activity Name	Remaining Duration	Start	Finish
Blending-CN-4800	Final Grade/Prep for Slab on Grade	3	04-Jun-24	06-Jun-24
Blending-CN-4870	Install Exterior Door Canopies	5	04-Jun-24	10-Jun-24
Blending-CN-4810	F/R/P Slab on Grade	2	07-Jun-24	10-Jun-24
Blending-CN-4820	F/R/P Door Stoops	3	11-Jun-24	13-Jun-24
Blending-CN-4840	F/R/P Interior Equipment Pads	3	11-Jun-24	13-Jun-24
Blending-CN-4850	Install Doors/Frames/Hardware	3	14-Jun-24	18-Jun-24
Blending-CN-4860	Install Overhead Door	3	14-Jun-24	18-Jun-24
Blending-CN-4880	Install HVAC/Plumbing	10	14-Jun-24	27-Jun-24
Blending-CN-5320	Electrical Rough-In	10	14-Jun-24	27-Jun-24
Blending-CN-5330	Install Filter Skid/Backwash Pump	5	11-Jul-24	17-Jul-24
Blending-CN-5335	Install Filter Access Platform/Ladders	3	18-Jul-24	22-Jul-24
Blending-CN-5340	Install Process Pipe	15	18-Jul-24	07-Aug-24
Blending-CN-5365	Electrical/I&C Terminations and Testing	5	18-Jul-24	24-Jul-24
Blending-CN-5345	Pressure Test Pipe	4	08-Aug-24	13-Aug-24
Blending-CN-5355	Painting and Coatings	5	14-Aug-24	20-Aug-24
Blending-CN-5390	Initial Filter Check-Out	5	21-Aug-24	27-Aug-24
Chlorine Basin and Injection Vault		129	15-Nov-23	17-May-24
Blending-CN-5005	Sawcut Existing Concrete Weir	2	15-Nov-23	16-Nov-23
Blending-CN-5010	Repair Concrete at Basin Stair	2	17-Nov-23	20-Nov-23
Blending-CN-5015	Install Grating/Guardrail/Stair/Ladders/Weir	5	21-Nov-23	28-Nov-23
Blending-CN-5020	Install Slide Gates	5	19-Mar-24	25-Mar-24
Blending-CN-5025	Install Sample Pumps	2	09-May-24	10-May-24
Blending-CN-5030	Install Sample Pump Suction Pipe	5	13-May-24	17-May-24
Blending-CN-5035	Install Chem Feed Tubing/Injector/Diffusers	5	13-May-24	17-May-24
Chemical Disinfection		105	08-Feb-24	05-Jul-24
Blending-CN-5050	Clear and Grub Building Pad	2	08-Feb-24	09-Feb-24
Blending-CN-5060	Over-Ex and Structural Fill Subgrade	5	12-Feb-24	16-Feb-24
Blending-CN-5070	Install/Encase Underslab Process Pipe	10	19-Feb-24	01-Mar-24
Blending-CN-5080	Install Underslab MEP	5	04-Mar-24	08-Mar-24
Blending-CN-5110	Grade/Compact Subgrade	2	11-Mar-24	12-Mar-24
Blending-CN-5150	Excavate/Prep Footings	5	13-Mar-24	19-Mar-24
Blending-CN-5160	F/R/P Footings/Sumps	5	20-Mar-24	26-Mar-24
Blending-CN-5170	Backfill Footings/Sumps	2	27-Mar-24	28-Mar-24
Blending-CN-5190	F/R/P Containment Area Walls	8	27-Mar-24	05-Apr-24
Blending-CN-5180	F/R/P Containment Area Slab on Grade	5	29-Mar-24	04-Apr-24
Blending-CN-5200	F/R/P Hypo Tank Pads	5	08-Apr-24	12-Apr-24
Blending-CN-5220	Containment Area Fill and Leak Test	20	15-Apr-24	10-May-24
Blending-CN-5230	Drain and Dry Containment Area	10	13-May-24	24-May-24
Blending-CN-5260	Erect Precast	5	13-May-24	17-May-24
Blending-CN-5265	Precast Joint Sealant	5	20-May-24	24-May-24
Blending-CN-5240	Install Containment Area Coatings	5	28-May-24	03-Jun-24
Blending-CN-5270	Clean and Seal Precast	3	28-May-24	30-May-24
Blending-CN-5350	F/R/P Slab on Grade	2	28-May-24	29-May-24
Blending-CN-5480	Install Roof Scuttle	1	28-May-24	28-May-24



Republic, MO WWTP - Blending

Activity ID	Activity Name	Remaining Duration	Start	Finish
Blending-CN-5490	Install Roofing/Gutters/Downspouts	10	28-May-24	10-Jun-24
Blending-CN-5380	F/R/P Interior Tank/Equipment Pads	5	30-May-24	05-Jun-24
Blending-CN-5370	F/R/P Door Stoops	3	30-May-24	03-Jun-24
Blending-CN-5500	Install Hypo Bulk Tanks	2	04-Jun-24	05-Jun-24
Blending-CN-5510	Erect PEMB Canopy	10	06-Jun-24	19-Jun-24
Blending-CN-5530	Install Doors/Frames/Hardware	5	06-Jun-24	12-Jun-24
Blending-CN-5540	Install Overhead Door	3	06-Jun-24	10-Jun-24
Blending-CN-5550	Install HVAC/Plumbing	10	06-Jun-24	19-Jun-24
Blending-CN-5560	Electrical Rough-In	10	06-Jun-24	19-Jun-24
Blending-CN-5570	Install Bisulfite Tank	0	06-Jun-24	06-Jun-24
Blending-CN-5580	Install Chemical Feed Pump Skids	3	06-Jun-24	10-Jun-24
Blending-CN-5590	Install Process Piping	10	11-Jun-24	24-Jun-24
Blending-CN-5610	Electrical/I&C Terminations and Testing	5	11-Jun-24	17-Jun-24
Blending-CN-5520	Install FRP Ladders and Grating	3	20-Jun-24	24-Jun-24
Blending-CN-5600	Painting and Coatings	3	25-Jun-24	27-Jun-24
Blending-CN-5620	Initial Chem Feed Check-Out	5	28-Jun-24	05-Jul-24
Startup & Completion		170	28-Aug-24	30-Apr-25
Blending-CN-4170	Substantial Completion	0		28-Aug-24
Blending-CN-4160	Startup - Blending	40	28-Aug-24	23-Oct-24
Blending-CN-5360	AOC Blending Project - Contractual EPA Date	0		30-Apr-25*

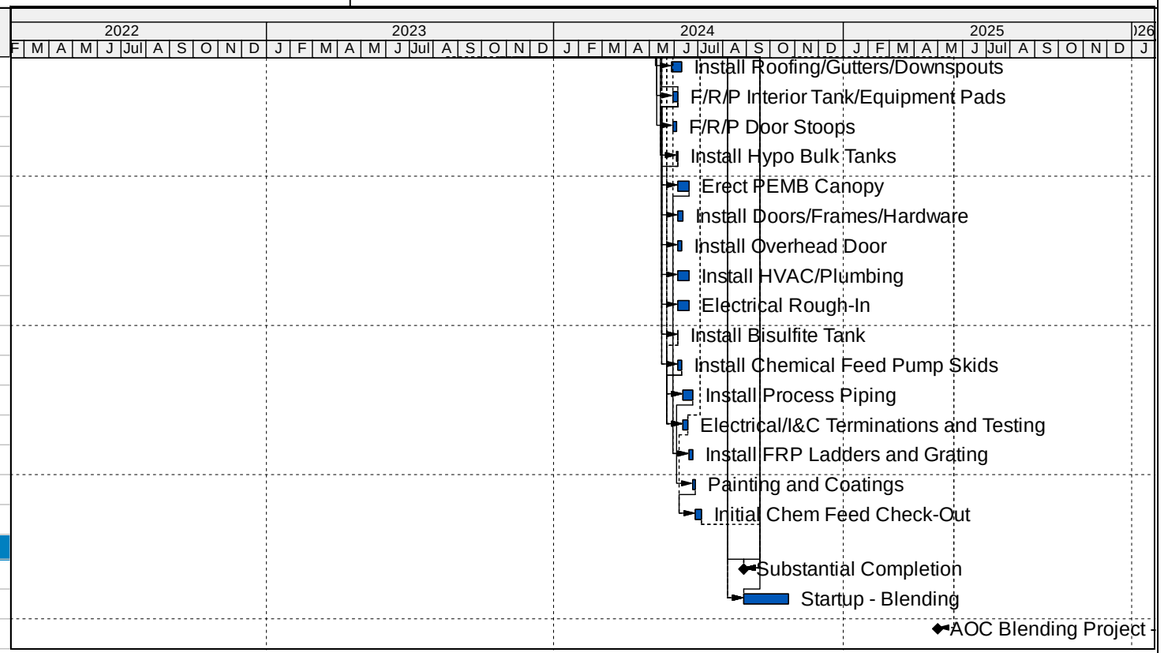


EXHIBIT K – PRELIMINARY DESIGN DOCUMENTS

The Preliminary Design Documents consist of the Work Description and Concept Design Drawings.

Work Description

This Work Description identifies major definable components of the Project as they can be defined at the time that the Agreement was prepared. In addition to the major components called out herein, the Work Description outlines the general requirements for each design element. The intent of this document is to establish the scope and criteria of products, materials, and equipment to be furnished and installed under the Agreement. The Design-Builder will develop the final design documents and construct the Work in accordance with the criteria identified herein.

01 00 00 GENERAL CONDITIONS

1. All supervision, administrative costs, and temporary facilities necessary to construct the work.
2. No sales tax included. Owner to provide exemption certificate for the project.
3. Temporary Power will be provided by the Design Builder.
4. Does not include cost for water consumption for testing of structures or facilities.
5. Does not include cost of chemicals for startup, testing or operation of the facility.
6. Includes cost of obtaining, installing, and maintaining the SWPPP.
7. Builders risk insurance will be provided by Design Builder.
8. Design and construction administration are included for the duration of the schedule.
9. Design will be completed following the 2018 IBC except where noted.
10. Special Inspections will be performed by a 3rd party and paid for by the Design Builder.
11. Civil testing lab services will be performed by a 3rd party and paid for by the Design-Builder, including civil testing for soil and concrete.
12. Performance and Payment bonds are included for the entire contract amount Surety companies executing BONDS will appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in Missouri."
13. All O&M manuals will be provided in paper (1 set) and electronic PDF form.
14. In the event that there are discrepancies between the Preliminary Engineering Report and this document, this document shall govern.
15. This project is under current prevailing wages as of the date of the contract execution.
16. The Design-Builder agrees to take steps to ensure that disadvantaged business enterprises (DBEs) are utilized when possible as sources of supplies, equipment, construction, and services as required by 2 CFR 200.321.

01 01 00 SPECIAL SITE CONDITIONS

1. No hazardous or special waste are known of at this time or anticipated to be encountered in the course of this project.
2. Groundwater is expected to be consistent with the conditions documented as part of the geotechnical investigation.
3. On site soils are expected to be consistent with those documented as part of the geotechnical investigation.

01 01 50 OWNER FURNISHED ITEMS

1. Operation and maintenance of existing facilities during construction and through project start-up.
2. Access to project sites as needed to perform work.
3. Land acquisition, easements or right-of-way as may be required.
4. Cost of offsite power, gas, telecom, ISP upgrades if required.
5. Chemicals as required for startup and testing, including initial fill of new chemical systems.

01 50 00 CONSTRUCTION EQUIPMENT

1. All construction equipment necessary to complete the work is included.

02 41 19 DEMOLITION – GENERAL

1. Includes fees for disposal for any excess material.
2. Demolition of existing site improvements, such as asphalt paving, concrete sidewalks, light poles, etc. to limits required for installation of new construction.
3. Demolition of existing influent screen, and concrete/cutting and coring to facilitate new screen installation.
4. Demolition of existing chlorine contact basin influent stop gates and 1" chlorine line.
5. Demolition of Outfall 001 structure, Outfall 002 structure and outfall protection, and Chlorine Contact Basin outfall.

03 10 00 FORMWORK

1. Exterior Forms
    a. Fill any repairable honeycomb; patch all tie holes.
    b. No architectural or rubbed finish; no grout finish.
    c. Joints to be noticeable, but not protruding.
    d. Chamfer tops on all exposed edges.

03 15 50 VAPOR RETARDER

1. ASTM E1745, Class A or B, min thickness of 10 mil.
2. Applied below all concrete slabs to receive concrete coatings or other floor

coverings.

03 20 00 REINFORCING

1. Deformed bars: ASTM A615, Grade 60 – No epoxy
2. Mechanical splices used where indicated.
3. Rebar quantities based upon 200 lbs per cubic yard of concrete.
4. Drill and epoxy dowels at interface of new concrete construction to existing structures.

03 30 00 CONCRETE

1. ASTM C150 Type I/II or ASTM C595 Type IL (MS) with Type F fly ash.
   a. Fly ash shall be omitted if Type F is not available.
   b. If ASTM C595 Portland Lime Cement (PLC) is used, Type IL (HS) is also acceptable.
   c. Silica fume may be substituted up to 10% replacement of Portland Cement (PC) or Portland Lime Cement (PLC)
2. 1" nominal maximum aggregate
3. Fill and encasement – 3,000 psi
4. Site pavements, curbs, gutters, and sidewalks – 4,000 psi
5. Structural concrete – 4,500 psi
6. Pre-cast concrete – As determined by precast manufacturer design.
7. All concrete supplied for the project will meet the latest applicable code.
8. Foundations
   a. All foundations to extend below frost line.
   b. No deep foundation elements required based on the geotechnical report.
   c. Reference Div 31 for subgrade requirements.
9. PVC waterstop at all construction joints in wastewater containing structures.
10. The transfer pump station wet well will be leak tested in accordance with ACI 350.1

03 41 00 PRECAST ARCHITECTURAL CONCRETE

1. Exterior and interior insulated wall panels, including reveals, and light and medium sandblast textures.
2. Solid prestressed roof plank panels at the filter building and disinfection building, supported by precast wall haunches.
3. Stainless steel embedded plates and connection hardware:
   a. Stainless steel where exposed or crosses a panel joint.
   b. Uncoated steel at all other locations.

03 35 00 CONCRETE FINISHING

1. Steel trowel all floor finish in buildings.
2. Float finish for all below grade surfaces.
3. Broomed finish at stair landing pads and concrete walking surfaces.
4. No concrete coatings to be applied except at the exterior chemical storage area at

the disinfection building.

05 05 19 CONCRETE ANCHORS

1. Wet or submerged service: AISI Type 304 or 316 adhesive anchors where indicated.
2. Non-submerged anchors in moderate to severe corrosion potential: AISI Type 304 or 316 adhesive anchors or wedge anchors where indicated.
3. Low corrosion potential: galvanized wedge or adhesive anchors
4. Adhesive epoxy:
    a. Hilti Hit-HY 200 for dry installations.
    b. Hilti Hit HY-500 for wet installations.
    c. Hilti Hit HY-270 for masonry.
    d. Approved equal.

05 12 00 STEEL

1. Shapes: Wide flange, ASTM A992. Channels, angles, and plates, ASTM A36.
2. Hot-dipped galvanized steel and hardware unless indicated otherwise.
3. Stainless steel:
    a. AISI Type 304 or 316 where indicated.
4. Anchor bolts:
    a. Cast-in-place: Galvanized or stainless steel ASTM F1554 Grade 36 anchor bolts
    b. Post-installed anchors:
        - See Section **05 05 19**

05 31 00 STEEL DECKING

1. 1 ½” depth, ASTM A653, Grade 50.
2. Zinc-coated G90 finish.
3. Welded or screw fasteners at supports and side laps.

05 45 00 ALUMINUM

1. Aluminum association structural shapes, 6061-T6 with 304 stainless steel bolts.
2. Guardrail: 1.9” OD aluminum two rail system with kickplate unless indicated to match existing four rail system.
3. Handrail: 1.5” OD aluminum.
4. Ladders to be of aluminum construction unless noted otherwise.
5. Grating to be swage locked striated I-bar grating with banded openings.
6. Stair treads to be serrated swage locked bar grating.
7. See Section 08 34 83 for Floor Access Doors.

05 50 00 MISCELLANEOUS METALS

1. Bollards – 6-inch diameter Schedule 40 Steel, painted safety yellow, with rust-inhibitive paint.

06 10 00 ROUGH CARPENTRY

1. Treated wood blocking at roof and roof parapet.

06 70 00 FIBERGLASS REINFORCED PRODUCTS (FRP)

1. FRP ladders and grating to be supplied at the chemical storage area and at other areas indicated.
2. Resin system: premium grade vinyl ester.

07 16 00 DAMPPROOFING

1. Apply to exterior of concrete walls at the following locations:
    a. Transfer Pump Station Valve Vault
    b. Transfer Pump Station Meter Vault
    c. Chemical Injection Vault
2. Product: Coal Tar-Epoxy Damproofing:
    a. Tnemec Tneme-Tar Hi Build Series 46H-413; 16-20 mils DFT.
        i. Or Engineer Approved Equal
3. Bituminous Dampproofing:
    a. General: Provide products recommended by manufacturer for designated application and suitable for service intended.
    b. Cold-Applied, Coal Tar-Epoxy Dampproofing: Roll or spray applied heavy-duty water-resistant epoxy coating made with pitch for protection of concrete from severe chemical fumes and corrosive vapors. Coating shall be suitable for buried or immersion conditions.

07 50 00 MEMBRANE ROOFING / FLASHING / SHEET METAL

1. Buildings to have minimum 80 mil PVC Membrane Roofing System to meet regional hail requirements.
2. Vapor barrier and tapered insulation on roof deck.
3. Perimeter of building to have prefinished metal coping on top of parapet wall.
4. Conductor heads and downspouts to be provided at each scupper.
5. Overflow scuppers trimmed with prefinished sheet metal.
6. Canopy roof with galvalume standing seam roofing, gutter, and downspout.
7. 3’-0”x3’-0” roof scuttle with ladder, safety post and guardrail with gate for fall protection.
8. Sunshade/canopies at 2ea single passage doors at the filter building, and 1ea at the filter building exterior mounted electrical equipment/control panel.

07 90 00 JOINT SEALANTS

1. Doors/windows/louvers and construction joints in concrete.
2. Interior and exterior vertical precast wall joints and interior horizontal precast roof plank joints.
3. Interior joints at top of walls.
4. Fire rated mineral wool and sealant where required.

08 16 10 FRP DOORS / ALUMINUM FRAMES

1. All single passage doors; 3’-0”x7’-2” 1-3/4 thick with 2” frame.
2. All double passage doors: 6’-4”x7’-2” 1-3/4” thick with 2” frame, Disinfection Electrical Room to have removable mullion and transom and chemical area to have transom mounted louver.
3. All doors to have glazing except exterior doors into electrical rooms.

08 34 83 FLOOR ACCESS DOORS

1. Aluminum construction with Type 316 stainless steel hardware.
2. Load rating:
    a. Pedestrian traffic: 300 psf
    b. Vehicular traffic: AASHTO HS-20
3. Provide protective grating where indicated.

08 70 00 DOOR HARDWARE

1. Standard door hardware; includes lever handle, weather stripping, drip cap, threshold, sweep, hinges, closers, locksets, astragals, panic devices as required by code for egress.
2. Finishes to be suitable for their environment.

08 80 00 GLAZING

1. Exterior: Insulated glazing unit (IGU) low-E coating, tinted, tempered.

08 90 00 OVERHEAD DOORS

1. Manual powder coated steel or anodized aluminum.

09 90 00 COATINGS

1. Color coded painting of exposed-to-view piping if not stainless steel or PVC.
2. All exposed process piping to have color coded labels or stencils with directional arrows.
3. 2 coat epoxy/polyurethane system for all bollards and non-stainless steel or HDG pipe/supports exposed to UV.

4. 2 coat epoxy coating system for interior/submerged non-stainless steel or HDG pipe/supports not exposed to UV.
5. Hot-dip galvanized steel will not be coated.
6. Chemical containment to have 3 coat chemical resistant containment coating.
7. Touch-up paint as required for non-stainless-steel equipment.
8. Peak Flow Clarifier mechanism, launder trough, and interior basin wall, including all prep and wash down as required.

10 00 00 SPECIALTIES

1. 6" deep prefinished aluminum louvers with insect screen.
2. Signage: Chemical warning signs
3. Signage: Aluminum Building Identification letters
4. Fire extinguishers: Approved fire extinguishers with wall brackets – 10 lb. ABC units for all buildings as required.
5. Fire extinguishers: Clean agent units for Electrical rooms

22 00 00 PLUMBING

1. Materials:
   (a) Natural Gas Piping:
      a. Below Grade: Polyethylene
      b. Above Grade: Black Steel (threaded)
   (b) Drainage and Vent Piping: Sch. 40 PVC
   (c) Potable/Non-Potable Water:
      a. Below Grade NPS 3 and smaller: Copper
      b. Above Grade NPS 2 and smaller: Copper
   (d) Pipe Insulation:
      a. Type: Flexible Elastomeric
      b. Thickness: 1" to 1.5"
      c. R-Value: R-4 per inch
   (e) Hangers/Supports and Hardware:
      a. Disinfection Building: Stainless Steel
      b. Filter Building: Stainless Steel
2. Disinfection Building Fixtures:
   (a) Reduced pressure backflow preventor
   (b) Two Combination Emergency Shower/Eyewash
   (c) Two Through-wall Emergency Shower
   (d) Two Through-wall Emergency Eyewash
   (e) Three Tepid water mixing valves for emergency shower/eyewash equipment
   (f) Tank-style, 119 gal. electric water heater w/6 kW heating element
   (g) Recirculation pump for hot water line
   (h) Floor drains
3. Filter Building Fixtures:
   (a) Hose bibb
   (b) Floor drains

23 00 00 HVAC

1. Materials:
   (a) Ductwork:
      a. Disinfection Building: Aluminum
      b. Filter Building: Aluminum
   (b) Hangers/Supports and Hardware:
      a. Disinfection Building: Stainless Steel
      b. Filter Building: Stainless Steel
2. Disinfection Building Equipment:
   (a) Gas-Fired Makeup Air Unit (DFM-MAU-001)
      a. Electrical (V/Ph/Hz): 480/3/60
      b. Natural Gas input: 150 MBH
      c. Accessories:
         1. Unit-mounted NEMA 3R disconnect switch
         2. Roof curb
         3. Filters
         4. Gas pressure regulator
         5. Sail switch
   (b) Aluminum Upblast Exhaust Fans (DFB-EF-001 and DFB-EF-003)
      a. Electrical (V/Ph/Hz): 120/1/60
      b. Accessories:
         1. Unit-mounted NEMA 4X disconnect switch
         2. Roof curb
         3. Sail switch
   (c) Aluminum Upblast Exhaust Fan (DFB-EF-002)
      a. Electrical (V/Ph/Hz): 120/1/60
      b. Accessories:
         1. Unit-mounted NEMA 4X disconnect switch
         2. Roof curb
         3. Motorized control damper
   (d) Thermostat with automatic changeover capability (DFB-T-001)
   (e) Go/No-Go lights inside and outside every entrance to both rooms at Disinfection Building (Four total)
3. Filter Building Equipment:
   (a) Explosion-Proof Aluminum Upblast Exhaust Fan (FLT-EF-001)
      a. Electrical (V/Ph/Hz): 120/1/60
      b. Accessories:
         1. Unit-mounted NEMA 4X disconnect switch
         2. Wall-mounting bracket kit
         3. Motorized control damper
         4. Explosion-proof motor rated for C1D1 environment, with aluminum rub ring
   (b) Explosion-Proof Electric Unit Heaters (FLT-EUH-001 and 002)
      a. Electrical (V/Ph/Hz): 480/3/60

b. Electric Heating Element: 5 kW
c. Accessories:
    1. Unit-mounted, explosion-proof disconnect switch
    2. Unit mounted, explosion-proof thermostat
    3. Wall-mounting bracket kit

(c) Explosion-proof thermostat with automatic changeover capability rated for Class 1, Division 1 environment (FLT-T-001)

26 05 11 ELECTRICAL CONDUCTORS AND CABLES

1. Cable:
    a. LV Power: 600V, XHHW-2 insulation, PVC jacket.
        i. Exception: MC style armored flexible cable may be used in Administration Building for lighting and small power.
    b. LV VFD Motor Feeder: 1000/2000V rated VFD power cable. XHHW-2 with 100% copper tape shield, three-phase conductors w/ three symmetrical grounds, and overall PVC jacket.
    c. LV Control: 600V, #14AWG multiconductor, XHHW-2 insulation, overall PVC jacket.
    a. Instrument: 600V, #18 AWG, twisted pair/triad with PVC insulation and PVC jacket. Individual shielding.
    b. Category 6: Unshielded, bonded pairs, #23 AWG solid conductors, polyolefin insulation, PVC jacket. Belden 7940A or equal.
    c. Fiber: Stranding as indicated, loose-tube, PVC jacket, water-blocked.
    d. In-Plant: OS2 single mode
2. Cable Terminations:
    a. Motors: 1-hole compression lugs with motor splice kit (3M 5300-series or equal) except 2-hole compression lugs for #4/0 AWG and larger.
    b. Controls: Pre-insulated ferrules or ring lugs as required by device.
    c. Instruments: Pre-insulated ferrules or locking fork lugs to match device.
    d. Single-mode Fiber: Field-installed duplex LC connectors.
    e. Cable Splices: No splicing except for low voltage lighting and receptacle circuits.

26 05 26 GROUNDING AND BONDING

1. Bare copper, tinned, #3/0 AWG min. for counterpoise and risers.
2. Below-grade Connections: Welded (CAD Weld).
3. Above-Grade Connections: Bolted/mechanical. Silicon-bronze hardware.
4. Ground Rods: 3/4”x10’, copper-clad steel, pointed or segmented-type.
5. Test Wells: HDPE or polymer concrete handholes.
6. Equipment to be grounded:
    a. Steel-reinforced concrete foundations, #3/0 AWG.
    b. Building/Structural Steel, #3/0 AWG.
    c. Controls (PLC) Cabinets/Panels, #2 AWG.
    d. Cable Tray, #3/0 AWG.

e. Motors 50 HP and larger, #3/0 AWG.
f. Motors less than 50 HP, #2 AWG.
g. Electrical Distribution Equipment 400 Amp or greater, #3/0 AWG.
h. Electrical Distribution Equipment less than 400 Amp, #2 AWG.
i. Platforms and Handrails, #2 AWG.

26 05 33 RACEWAY, BOXES, SEALS, AND FITTINGS

Refer to the Space Materials Matrix for conduit types, support materials, and enclosure ratings/materials to be used in each location.

26 05 36 CABLE TRAY

1. Aluminum, Ladder-type with 9" rung and 6" rail. Install per NEMA VE-2.

26 05 43 UNDERGROUND DUCT BANK, RACEWAY AND MANHOLES

1. Duct Banks:
    a. Reinforcement:
        i. Steel reinforcement and structural concrete required within 5-feet of foundations, manholes, passing under roadways and other driving surfaces.
        ii. Yard duct banks will be installed with a flowable utility fill, no reinforcement required.
    b. Direct-Bury: Banks of direct-bury conduit (not passing under driving surfaces) will be installed with a flowable utility fill.
    c. Concrete and Utility Fill: Red-dyed flowable fill except min. 2500-psi concrete for steel-reinforced duct bank.
    d. Minimum Coverage: 30-inches.
2. Raceway:
    a. Duct Bank: Reference Materials Matrix
    b. Direct-Buried:
        i. Reference materials matrix.
    c. Risers: PVC-coated RGS or Rigid Fiberglass (RTRC) elbows. Risers to be PVC-coated RGS except where permitted otherwise by Engineer.
3. Handholes:
    a. Precast concrete manholes for duct banks.
    b. Small yard handholes for additional pulling (e.g. yard lighting) may be polymer concrete (e.g. Quazite boxes).
    c. Install traceable caution tape to mark all underground electrical.

26 05 53 IDENTIFICATION

1. Provide instruments with wired SS tags.
2. Label individual conductors for control and instrument cables (heat shrink-type labels).
3. Label cables at each termination point, box entry, and splice (wrap around-type

labels).
4. Equipment Nameplates:
    a. White with black lettering, 4”x2”.
5. Required for each device/equipment with a cable.

26 05 73 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

1. By Design Builder.

26 22 13 LOW VOLTAGE DISTRIBUTION TRANSFORMERS

1. Dry-type, ventilated with 115℃ rise.

26 24 16 PANELBOARDS

1. Copper or aluminum bus, main breaker, fully-rated.
2. Surge Protection Device (with Surge Counter) required for all panelboards. (Assume 80kA rating as minimum)
3. Panels shall be provided with spare breakers to fill panel space. Spare breakers shall be 20A, 3-P for 480-Vac and 1-P for 120-Vac.

26 29 13 ENCLOSED CONTROLLERS

1. Safety Switches:
    a. Heavy-duty type, make-before break.
    b. Enclosure: Refer to Space Material Matrix.
    c. Provide auxiliary SPDT contact option for VFD safety switches.
2. Pilot Devices:
    a. Heavy duty, 30mm, NEMA 4X.
    b. Lights to be push-to-test LED.
    c. Green devices for “OFF”, red devices for “ON”, amber devices for “FAULT”.
3. Motor Starters:
    a. Provide with adjustable magnetic-only motor circuit protector (MCP). MCP to be provided with external, lockable handle that indicates “ON”, “OFF”, and “TRIP”.
    b. Provide with 120-Vac CPT and controls as indicated.
    c. Starters for process equipment to be provided with Ethernet-capable solid-state overload relay.
4. Contactors: Magnetically held, 30A, minimum 6-pole with Hand-Off-Auto control and indicating lights.Refer to specifications

26 29 23 VARIABLE FREQUENCY DRIVES

1. Provide voltage, horsepower, input/output filters, and low harmonic drive architecture as indicated (Active-front end, 18-pulse, or Matrix topologies). Total

3 VFD for transfer pumping.
2. Provide with input circuit breaker.
3. Provide with 120-Vac CPT, controls, and pilot devices (As per 26 29 13) as indicated.
4. Provide with minimum of six (6) digital inputs, relay outputs for "Run Status" and "Drive Fault", 4-20mA analog input, and Ethernet/IP capability.

26 50 00 LIGHTING

1. As required in the lighting schedule and plans.

31 20 50 SITE EXCAVATION / BACKFILL

1. All compactions shall be per Standard Proctor (ASTM D698) using sheepsfoot roller or self-propelled compactor.
2. Excavation shall be as necessary to construct structures in accordance with the drawings.
3. Fill to be acquired onsite to extents possible and offsite as necessary for all backfill of new structures.
4. Finish grading of site and access roads.
5. Compact to 95% of the material's standard Proctor dry density for backfill.
6. Riprapping of New Outfall 001.
7. Riprapping of South creek crossing
8. Dewatering creek crossing and other excavations.

31 20 50 STRUCTURAL EXCAVATION

1. All compactions shall be per Standard Proctor (ASTM D698) using sheepsfoot roller or self-propelled compactor.
2. Backfilling of Structures to 95% for general soil and structural fill.
3. Pavement and floor slabs subgrade to 95%.
4. Overexcavation of high plasticity soil to a minimum of 2' below foundations and floor slabs backfilled with Low Volume Change (LVC) structural fill.
5. Backfill around structure walls will include a 1'-6" wide column of granular material around the walls with the remainder of backfill completed with on-site soils.

31 20 50 TRENCH EXCAVATION/BACKFILL

1. 4" aggregate bedding below pipe and 12" aggregate bedding above pipe– 1 ½" crushed granular materials.
2. Backfill around pipe. Above pipe – 24" to 95% per Standard Proctor (ASTM D 698)
3. 12" clear concrete unreinforced encasement – all process piping below structures and basins.

32 11 23 CRUSHED AGGREGATE BASE COURSE

1. 4” MODOT Grade 4 below concrete driveway and as shown on plans.
2. 8” MODOT Type 5 Aggregate replacing all existing asphalt drive removal and as shown on plans.
3. 4-foot wide, 4” thick MODOT Grade 4 between sidewalks and buildings.

32 16 00 CURBS, GUTTERS, STAIRS, SIDEWALKS AND DRIVEWAYS

1. All curb shall be 6-inches tall unless specified otherwise on the drawings.
2. All sidewalks shall slope away from the building at a minimum of 0.50% and a max of 2.0% to ensure drainage and ADA compliance.
3. Grade, Form, Pour, Finish, and Strip Sidewalks
4. Sidewalks to be 5-foot wide minimum, 4-inches thick.
5. All sidewalks shall have a minimum 2% cross-slope.
6. Grade, Form, Pour, Finish, and Strip curb and gutter.
7. Control joints shall be spaced every 5-feet (max) in sidewalks and every 10-feet in curb and gutter.
8. No caulking of control joints.
9. Concrete shall be 4000psi.

32 92 00 SEEDING

1. Design/Builder to return topsoil and fine grade site and seed any disturbed areas.
2. Seed mix will be suitable for continued Owner maintenance.
3. Seeding areas to be clear of vegetation, rock, and other materials which would interfere with grading and tillage operations.
4. Topsoil will be stockpiled at beginning of the project and re-spread or removed off site at the end.
5. No topsoil import is included in the project.

33 11 00 PIPING

1. Buried Yard Piping:
   (a) Ductile Iron Pipe: AWWA C115, C150, and C151.
      a. All pipe and fittings shall be cement-mortar lined per AWWA C104 except the following will be Protecto 401 ceramic epoxy lined if ductile iron pipe is used:
         1. Peak flow clarifier to transfer pump station.
         2. Transfer pump station to filter building.
         3. WAS piping from decant equalization basin to future MBR connection.
      b. Minimum 350 psi for 4-inch through 12-inch diameter pipes.
      c. Minimum 250 psi for 14-inch through 20-inch diameter pipes.
      d. Minimum 200 psi for 24-inch diameter pipes.
   (b) PVC: AWWA C900
      a. Minimum 150 psi for 4- through 12-inch diameter sewer pipes.

b. Minimum 100 psi for 14- through 20-inch diameter sewer pipes.
c. Minimum 200 psi for 4- through 6-inch diameter water main pipes.

(c) Restrained mechanical or restrained push-on-type joints for pipe and fittings.
(d) Ductile iron piping to include exterior bituminous coating for pipe and fittings.
(e) Ductile iron piping to include polyethylene encasement (minimum 8 mils) for pipe and fittings.

2. Water Service Piping:
   (a) For pipes less than or equal to 3-inches in diameter.
   (b) Polyethylene plastic tubing: ASTM D2737 SDR 9 200 psi
   (c) PVC: ASTM D1785 Schedule 80 PVC
3. Interior Process Piping
   (a) Ductile Iron Pipe, Flanged Pipe & Fittings
   (b) Primed and painted.
4. Exposed Exterior Process Piping
   (a) Ductile Iron Pipe, Flanged Pipe & Fittings
   (b) Primed and painted.
   (c) Heat traced (for freeze protection), insulated, and jacketed.
5. Misc PVC Pipe
   (a) Sch 80, Glue Fittings
   (b) All solvents must be compatible with chemicals being used.
6. Chemical Feed Piping
   (c) Chemical feed piping to be flexible PE tubing in PVC carrier pipe or rigid PVC piping

33 31 13 GRAVITY PIPE

1. Buried Yard Piping: Ductile Iron ASTM A746
2. Buried Yard Piping: PVC
   a. ASTM F891 for cleanouts and laterals only.
   b. ASTM D3034 SDR 35 (for depths of cover less than or equal to 10-feet).
   c. ASTM D3034 SDR 26 (for depths of cover greater than 10-feet).
   d. ASTM F679 minimum 46 psi pipe stiffness (for depths of cover less than or equal to 10-feet).
   e. ASTM F679 minimum 115 psi pipe stiffness (for depths of greater than 10-feet).
3. RCP
   a. ASTM C76 for flared end section only.
4. ASTM F891 PVC cleanouts and Cast-Iron cleanouts.
5. Manholes
   (a) Standard Precast Concrete Manholes, minimum 48-inch diameter, minimum wall thickness equal to 1/12 of inside diameter (in inches) plus one inch, minimum 6-inch base section.
   (b) Special shallow, Precast Concrete Manholes needed for MH-1 and MH-2 as indicated on the drawings.
   (c) Resilient pipe connectors.
   (d) FRP or Steel Steps at 12- to 16-inch intervals.
   (e) Neenah manhole frame and covers.

33 12 16 VALVES

1. Valves AWWA nut, manual handwheel, or motor actuation, as indicated on the drawings. Buried valves shall be mechanical joint, exposed/interior valves shall be flanged. Paint shall be epoxy in the interior and on the exterior per AWWA C550.
2. Air Release Valves shall conform to AWWA C512.
   (a) Heavy-duty wastewater style
   (b) Stainless steel internal parts
   (c) Isolation valve at connection
3. Butterfly valves for water service shall conform to AWWA C504.
   (a) Ductile or cast iron body
   (b) 316 stainless steel stem
   (c) Synthetic rubber seat
4. Check valves shall by swing-type and conform to AWWA C508.
   (a) Iron body
   (b) Full opening
   (c) Stainless steel hinge pin with outside lever and weight
5. Plug valves shall conform to AWWA C517.
   (a) Cast iron body and cover
   (b) Cast or ductile iron plug
   (c) Synthetic rubber facing
6. Valve boxes shall be two-piece cast iron with extension stems and marked drop cover.

33 31 50 PIPE INSTALLATION

1. General pipe installation and jointing.
2. Polyethylene encasement for DIP.
3. Field testing.
4. Disinfection for potable water.

33 32 22 SUBMERSIBLE PUMPS

1. Equipment manufacturer: KSB, Sulzer, Flygt, or Equal.
2. Three (3) Submersible Pumps
   a. Capacity: 1,390 gpm
   b. Design Head: 33 feet
   c. Max Horsepower: 350 hp
3. Accessories:
   a. Pump Discharge Connection
   b. Rail Guides, stainless steel
   c. Lifting Chain or Cable
   d. Guide Rails
   e. Cable Holder
4. Spare Parts:
   a. Bearings – 1 complete set
   b. Wear Parts – 1 complete set

5. Startup:
    a. Supplier shall provide start-up, and testing services for pumps as specified in DIVISION 01 and Section 33 32 22.

35 20 16 SLIDE GATES

1. Equipment manufacturer: Rodney Hunt, Waterman, Hydro Gate, Whipps, Golden Harvest, or Equal.
1. Conform to AWWA C561
2. Two enclosed, Self-Contained, Rising Stem Slide Gates with manual actuators at the existing Chlorine Contact Basin
3. Five electric actuators for existing gates at the Influent Screening channel.
4. Accessories:
    a. Rising Stems, 304 stainless steel
    b. Seals, neoprene
    c. Fasteners and Anchor Bolts, 316 stainless steel
    d. Actuator Lift Nuts
    e. Wheel or Crank Operators
    f. Stop Collars
5. Spare Parts:
    a. As recommended by manufacturer.
6. Startup:
    a. Supplier shall provide start-up, and testing services for gates as specified in DIVISION 01, including leak testing.

Division 40 PROCESS CONTROL AND INSTRUMENTATION REQUIREMENTS

1. Provide Control Panels
    a. DFB-CP-060
    b. TSP-CP-060
2. Provide instrumentation and other equipment.
    a. Disinfection Building:
        i. Provide and install a radar level sensor to storage tanks (count 3), flange mount.
        ii. Provide and install one fill station to include indication and alarming for all three tanks.
        iii. Provide and install two analyzer transmitters and three chlorine sensors.
        iv. Program chemical feeds systems (count 2) for duty/standby operation, no failover, operator selectable duty pump.
        v. Chemical feed systems to dose per engineer supplied rates as calculated by mag flow meter measure date. With operator selectable manual setpoints.
        vi. Provide alarming for chlorine concentrations.
    b. Headworks
        i. Provide an install one level sensor.
    c. Transfer Pumps
        i. Provide and install four float level switches and one level sensor.

ii. Program on 3 duty/one standby control scheme for transfer pumps. Scheme shall maintain wet well level. Float backup scheme shall be hard wired.

3. Control Panel Hardware Requirements:
    a. UPS: Double conversion online-type, 15-minute backup in each PLC/RIO Enclosure
    b. Field Terminations: PLC/RIO Enclosures shall be provided with dedicated field wiring terminals. Field wires shall not terminate directly on control equipment.
    c. Enclosures shall be free-standing, NEMA 12 with 3-pt latch and pad-lockable handle for electrical rooms. NEMA 4X SS for all other locations.
    d. Communication Protocol: Ethernet/IP.
    e. Network Switches: Allen Bradley Managed Switches, with SFPs and port counts as shown in network drawing.
    f. PLCs:
        i. Allen-Bradley CompactLogix for process equipment skids
    g. RIOs
        i. Allen Bradley ControlLogix I/O system
    h. IO Counts
        i. As shown in the P&IDs. 25% spare of each type Minimum
4. Instrumentation Requirements
    a. Float Switch: Free-floating, mercury-free level switch.
    b. Magnetic Flow Meters: Remote aluminum NEMA 4X transmitter, local display, 120-Vac power supply, 4-20mA HART output, measurement + reference electrodes, flanged body, submergence rated where installed below-grade, 0.5% accuracy, grounding rings.
    c. Pressure Gages: Bourdon tube-type or diaphragm type, 4.5” dial, 1% accuracy, 2-valve block and bleed manifold except provide compatible diaphragm seals for chemical lines.
    d. Pressure Transmitters: Die-cast aluminum NEMA 4X housing, local display, 316L wetted parts, 1/2” NPT process connection, 0.075% accuracy, close-coupled mounting, 2-valve block and bleed manifold, 4-20mA HART output.
    e. Non-Contacting Level Transmitters: Radar technology, PVDF or PTFE process connection material, 4-20mA output, loop powered, 0.2-inch accuracy, echo viewing and masking capability, remote display. 6” flange connections for bulk tank and through floor sleeve connections, 2” NPT for other bracket mounted units.
    f. Remote Displays: Die-cast aluminum NEMA 4X housing, backlit LCD display, loop powered, 4-20mA input, 0.75” character height.
    g. Free Chlorine Analyzer: Packaged colorimetric analyzer suitable for EPA reporting. Package to include reagent preparation/feed, sample conditioning, and analyzer/transmitter. Transmitter to include 4-20 mA output and a min. of two (2) dry contact outputs. Analyzer to perform self-test and auto-blanking between samples to compensate for varying sample quality, line

voltage, and light source age. Package shall be capable of self-cleaning and thirty (30) days unattended operation.
(1) Hach CL17sc sensor.
(2) Supply Hach SC4500 transmitter.

5. Software Requirements:
    a. Integration with other PLC Software:
        i. Wonderware
    b. Integration with Ethernet-capable Equipment:
        i. VFDs.
    c. Integration of Process Equipment: Integrate Ethernet I/P IO from Filter Skid as indicated by P&IDs. Provide new screens for transfer pumps, disinfection, and filter to provide remote monitoring. Integrate Ethernet I/P IO from Bar Screen skid as indicated in the P&IDs to provide remote monitoring of the screening system.
    d. Integration of new equipment into Owners existing SCADA software (Wonderware). PLC logic to reside on owners existing ControlLogix PLC.

2. Other work
    a. PLC / HMI / Reports Programming Development, Testing, Startup, Training.
    b. Controls Startup, Configuration, Testing, Training, O&M Manuals.

46 21 13 FLEXIBLE RAKE BAR SCREENS

1. Equipment manufacturer: Duperon, Parkson, or Equal
2. Two (2) Influent Bar Screens
    a. Peak Capacity (each): 8 MGD
    b. Maximum Effective Spacing: ¼ inch
    c. Minimum Angle of Screen: 70 degrees
3. One (1) Screenings Conveyor
    a. Heat traced and insulated
4. One (1) Screenings Washer/Compactor
    a. Heat traced and insulated
5. Accessories:
    a. Side Frames
    b. Link System
    c. Dead Plate
    d. Rake Wiper
    e. Discharge Chute
    f. Side Shields
    g. Screen Enclosure
    h. Drive Unit
    i. Heat Tracing
    j. Conveyor Inlet Hoppers
    k. Compactor Discharge Tube

6. Spare Parts:
    a. As recommended by Manufacturer
    b. Any special tools required for maintenance
7. Startup:
    a. Provide services as specified in DIVISION 01.
    b. After installation, a field mechanical and electrical performance test shall be performed in the presence of the Purchaser.
        i. Each piece of equipment shall be tested for normal start, stop, and emergency stop cycles.
        ii. Each piece of equipment shall be field tested and the equipment calibrated to demonstrate that all equipment will satisfactorily perform the functions and criteria specified.

46 31 41 DISC FILTERS

1. Equipment manufacturer: Aqua Aerobics or Nexom.
2. One (1) Disk Cloth Filter
    a. Peak Daily Flow (PDF): 6.0 MGD
    b. Maximum Nominal Size: 10 micron
    c. Maximum Number of Disks per Filter: 12
3. Accessories:
    a. Backwash Pumps as required
    b. Instrumentation and controls by Manufacturer
4. Spare Parts:
    a. As recommended by Manufacturer.
    b. Any special tools required for maintenance.
5. Startup:
    a. Provide services as specified in DIVISION 01 and Section 46 31 41.
    b. After installation, a field mechanical and electrical performance test shall be performed in the presence of the Purchaser.
        i. Each piece of equipment shall be tested for normal start, stop, and emergency stop cycles.
        ii. Each piece of equipment shall be field tested and the equipment calibrated to demonstrate that all equipment will satisfactorily perform the functions and criteria specified.

46 33 01 CHEMICAL FEED AND STORAGE SYSTEMS

1. Liquid Feed Systems:
2. Two dual-pump skids shall be provided. One compatible with sodium hypochlorite and one compatible with sodium bisulfite.
3. Metering skids shall be provided with:
    (a) Two pumps, calibration column, pressure gauges, pressure relief valve, pulsation damper, and isolation valves. Pumps will have integral controls.
    (b) Pumps shall be diaphragm with adjustable stroke length or variable frequency drive by ProMinent, Grundfos, or Equal.

4. Chemical Storage Systems
   (a) Two 3,000 gal outdoor, single-wall bulk tanks for sodium hypochlorite
   (b) One 1,500 gal indoor, double-wall bulk tank for sodium bisulfite.
5. Chemical injection quills and diffusers by Saf-T-Flo or equal.

Pre-Final Design Drawings

The Pre-Final Design Drawing package includes the drawings listed below. All drawings are the listed Revision and dated January 9, 2023.

DRAWING No.	DRAWING NAME
GENERAL	
010G001	COVER
010G002	INDEX I
010G003	INDEX II
010G004	GENERAL LEGEND
010G005	SPACE MATERIAL MATRIX
CIVIL	
010C001	CIVIL LEGEND, ABBREVIATIONS, AND KEY MAP
010C002	CIVIL GENERAL NOTES
010CD101	CIVIL DEMOLITION PLAN AREA 2
010CD102	CIVIL DEMOLITION PLAN AREA 3
010CD103	CIVIL DEMOLITION PLAN AREA 4
010CD104	CIVIL DEMOLITION PLAN AREA 6
010CD105	CIVIL DEMOLITION PLAN AREA 7
010CD106	CIVIL DEMOLITION PLAN AREA 8
010C100	CIVIL OVERALL PROPERTY PLAN
010C101	CIVIL OVERALL SITE PLAN
010C102	CIVIL SITE PLAN AREA 2
010C103	CIVIL SITE PLAN AREA 3
010C104	CIVIL SITE PLAN AREA 4
010C105	CIVIL SITE PLAN AREA 6
010C106	CIVIL SITE PLAN AREA 7
010C107	CIVIL SITE PLAN AREA 8
010C108	CIVIL GRADING PLAN AREA 2
010C109	CIVIL GRADING PLAN AREA 3
010C110	CIVIL GRADING PLAN AREA 4
010C111	CIVIL GRADING PLAN AREA 6
010C112	CIVIL GRADING PLAN AREA 7
010C113	CIVIL GRADING PLAN AREA 8
010C114	CIVIL YARD PIPING PLAN AREA 2
010C115	CIVIL YARD PIPING PLAN AREA 3
010C116	CIVIL YARD PIPING PLAN AREA 4
010C117	CIVIL YARD PIPING PLAN AREA 6
010C118	CIVIL YARD PIPING PLAN AREA 7
010C119	CIVIL YARD PIPING PLAN AREA 8
010C120	CIVIL YARD PIPING PLAN POINT TABLES
010C501	CIVIL DETAIL SHEET 1

DRAWING No.	DRAWING NAME
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010S001	STRUCTURAL LEGEND AND ABBREVIATIONS
010S002	STRUCTURAL GENERAL NOTES
010S003	STATEMENT OF SPECIAL INSPECTION SHEET 1
010S004	STATEMENT OF SPECIAL INSPECTION SHEET 2
010S501	STRUCTURAL STANDARD CONCRETE DETAILS SHEET 1
010S502	STRUCTURAL STANDARD CONCRETE DETAILS SHEET 2
010S503	STRUCTURAL STANDARD CONCRETE DETAILS SHEET 3
010S504	STRUCTURAL STANDARD CONCRETE DETAILS SHEET 4
010S505	STRUCTURAL STANDARD CONCRETE DETAILS SHEET 5
010S506	STRUCTURAL STANDARD CONCRETE DETAILS SHEET 6
010S507	STRUCTURAL STANDARD STEEL DETAILS SHEET 1
010S508	STRUCTURAL STANDARD STEEL DETAILS SHEET 2
010S509	STRUCTURAL STANDARD STEEL DETAILS SHEET 3
010S510	STRUCTURAL STANDARD STEEL DETAILS SHEET 4
020SD101	INFLUENT SCREENING CONVEYOR & DEWATERING DEMOLITION PLAN AND SECTION
020S101	INFLUENT SCREENING CONVEYOR & DEWATERING PLAN @ EL 1252-89'
020S102	INFLUENT SCREENING CONVEYOR & DEWATERING PLANS
020S301	INFLUENT SCREENING CONVEYOR & DEWATERING SECTIONS AND DETAILS
040S101	TRANSFER PUMP STATION VALVE VAULT PLANS AND SECTIONS
040S102	TRANSFER PUMP STATION WET WELL PLANS
040S301	TRANSFER PUMP STATION WET WELL SECTIONS
050S101	FILTER BUILDING FOUNDATION PLAN
050S102	FILTER BUILDING ROOF PLAN
050S301	FILTER BUILDING SECTIONS
050S401	FILTER BUILDING PLATFORM ENLARGED PLAN, SECTIONS, AND DETAILS
060S101	DISINFECTION BUILDING FOUNDATION PLAN
060S102	DISINFECTION BUILDING ROOF PLAN
060S301	DISINFECTION BUILDING SECTIONS SHEET 1
060S302	DISINFECTION BUILDING SECTIONS SHEET 2
065S101	CHLORINE CONTACT BASIN TOP PLAN
065S301	CHLORINE CONTACT BASIN SECTIONS AND DETAILS SHEET 1
065S302	CHLORINE CONTACT BASIN SECTIONS AND DETAILS SHEET 2
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010A001	ARCHITECTURAL LEGEND AND ABBREVIATIONS
010A002	ARCHITECTURAL GENERAL NOTES
030A101	PEAK FLOW CLARIFIER PLAN AND SECTION

DRAWING No.	DRAWING NAME
030A201	PEAK FLOW CLARIFIER NORTH AND SOUTH ELEVATIONS
050A101	FILTER BUILDING FLOOR PLAN
050A102	FILTER BUILDING ROOF PLAN
050A201	FILTER BUILDING NORTH AND SOUTH ELEVATIONS
050A202	FILTER BUILDING EAST AND WEST ELEVATIONS
050A301	FILTER BUILDING SECTIONS
050A601	FILTER BUILDING SCHEDULES AND DETAILS SHEET 1
050A602	FILTER BUILDING SCHEDULES AND DETAILS SHEET 2
060A101	DISINFECTION BUILDING FLOOR PLAN AND CODE REVIEW
060A102	DISINFECTION BUILDING ROOF PLAN
060A201	DISINFECTION BUILDING NORTH AND SOUTH ELEVATIONS
060A202	DISINFECTION BUILDING EAST AND WEST ELEVATIONS
060A301	DISINFECTION BUILDING SECTIONS
060A601	DISINFECTION BUILDING SCHEDULES AND DETAILS SHEET 1
060A601	DISINFECTION BUILDING SCHEDULES AND DETAILS SHEET 2
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010M001	MECHANICAL LEGEND, ABBREVIATIONS AND GENERAL NOTES
010M501	MECHANICAL STANDARD DETAILS
050M101	FILTER BUILDING MECHANICAL FLOOR PLAN
050M102	FILTER BUILDING MECHANICAL ROOF PLAN
050M601	FILTER BUILDING MECHANICAL SCHEDULES AND SEQUENCE OF OPERATIONS
060M101	DISINFECTION BUILDING MECHANICAL FLOOR PLAN
060M102	DISINFECTION BUILDING MECHANICAL ROOF PLAN
060M301	DISINFECTION BUILDING MECHANICAL SECTIONS AND NATURAL GAS RISER DIAGRAM
060M601	DISINFECTION BUILDING MECHANICAL SCHEDULES AND SEQUENCE OF OPERATIONS
PLUMBING	
010P501	PLUMBING STANDARD DETAILS
020P101	INFLUENT SCREENING PLUMBING PLAN
050P101	FILTER BUILDING PLUMBING FLOOR PLAN AND SCHEDULES
050P701	FILTER BUILDING PLUMBING RISER DIAGRAMS
060P101	DISINFECTION BUILDING PLUMBING FLOOR PLAN
060P301	DISINFECTION BUILDING PLUMBING SECTIONS
060P601	DISINFECTION BUILDING PLUMBING SCHEDULES AND RISER DIAGRAMS
PROCESS & INSTRUMENTATION	
010DI601	P&ID LEGEND, ABBREVIATIONS, AND GENERAL NOTES SHEET 1
010DI602	P&ID LEGEND, ABBREVIATIONS, AND GENERAL NOTES SHEET 2

DRAWING No.	DRAWING NAME
	P&ID LEGEND, ABBREVIATIONS, AND GENERAL NOTES SHEET 3
010DI603	
010DI604	INFLUENT SCREENING P&ID
010DI606	PEAK FLOW CLARIFIER AND TRANSFER PUMP STATION P&ID
010DI607	DISC FILTER P&ID
010DI608	CHEMICAL VAULT AND SAMPLING P&ID
010DI609	CHEMICAL DISINFECTION P&ID
010DI610	SODIUM HYPOCHLORITE FEED SYSTEM P&ID
010DI611	SODIUM BISULFITE FEED SYSTEM P&ID
PROCESS	
010D001	PROCESS LEGEND, ABBREVIATIONS AND GENERAL NOTES
010D501	PROCESS STANDARD DETAILS SHEET 1
010D502	PROCESS STANDARD DETAILS SHEET 2
010D503	PROCESS STANDARD DETAILS SHEET 3
010D601	PROCESS FLOW DIAGRAM
010D602	PEAK FLOW HYDRAULIC PROFILE
010D603	PEAK FLOW DESIGN PARAMETERS
020DD101	INFLUENT SCREENING DEMOLITION PLAN
020D101	INFLUENT SCREENING PLAN
020D102	INFLUENT SCREENING LOWER LEVEL PLAN
020D301	INFLUENT SCREENING SECTION A
020D302	INFLUENT SCREENING SECTION B
040D101	TRANSFER PUMP STATION PLAN
040D301	TRANSFER PUMP STATION SECTION
050D101	FILTER BUILDING PLAN
050D301	FILTER BUILDING SECTIONS
060D101	DISINFECTION BUILDING PLAN
060D301	DISINFECTION BUILDING SECTIONS
065DD101	CHLORINE CONTACT BASIN DEMOLITION PLAN
065DD301	CHLORINE CONTACT BASIN DEMOLITION SECTION
065D101	CHLORINE CONTACT BASIN PLAN
065D301	CHLORINE CONTACT BASIN SECTION
ELECTRICAL	
010E001	ELECTRICAL LEGEND
010E011	OVERALL ONE-LINE DIAGRAM
010E012	BAR SCREEN 480V TEMPORARY POWER PANEL ONE-LINE DIAGRAM
010E013	TRANSFER PUMP STATION TEMPORARY POWER PANEL ONE-LINE DIAGRAM
010E014	FILTER 480V POWER PANEL ONE-LINE DIAGRAM
010E015	DISINFECTION 480V POWER ONE-LINE DIAGRAM
010E021	OVERALL NETWORK DIAGRAM
010E022	PHASE 1 NETWORK DIAGRAM

DRAWING No.	DRAWING NAME
010E041	PANELBOARD SCHEDULES SHEET 1
010E042	PANELBOARD SCHEDULES SHEET 2
010E051	LUMINAIRE SCHEDULE
010E061	CONTROL DIAGRAMS SHEET 1
010E101	OVERALL ELECTRICAL SITE PLAN
010E102	ELECTRICAL SITE PLAN AREA 2
010E103	ELECTRICAL SITE PLAN AREA 3
010E104	ELECTRICAL SITE PLAN AREA 7
010E301	ELECTRICAL DUCT BANK SECTIONS
010E501	ELECTRICAL STANDARD DETAILS SHEET 1
010E502	ELECTRICAL STANDARD DETAILS SHEET 2
010E503	ELECTRICAL STANDARD DETAILS SHEET 3
010E504	ELECTRICAL STANDARD DETAILS SHEET 4
010E505	ELECTRICAL STANDARD DETAILS SHEET 5
020E101	INFLUENT SCREENING CONVEYOR AND DEWATERING POWER AND GROUNDING LOWER LEVEL PLAN
020E102	INFLUENT SCREENING CONVEYOR AND DEWATERING POWER AND GROUNDING UPPER LEVEL PLAN
020E103	INFLUENT SCREENING CONVEYOR AND DEWATERING INSTRUMENTATION AND CONTROLS LOWER LEVEL PLAN
020E104	INFLUENT SCREENING CONVEYOR AND DEWATERING INSTRUMENTATION AND CONTROLS UPPER LEVEL PLAN
020E301	INFLUENT SCREENING CONVEYOR AND DEWATERING SECTIONS A, B, C
030E101	PEAK FLOW CLARIFIER ELECTRICAL PLAN
040E101	TRANSFER PUMP STATION ABOVE GRADE ELECTRICAL PLAN
040E102	TRANSFER PUMP STATION BELOW GRADE ELECTRICAL PLAN
050E101	FILTER BUILDING POWER AND GROUNDING PLAN
050E102	FILTER BUILDING SMALL POWER AND LIGHTING PLAN
050E103	FILTER BUILDING INSTRUMENTATION AND CONTROLS PLAN
050E104	FILTER BUILDING ELECTRICAL ROOF PLAN
050E301	FILTER BUILDING SECTION A
060E101	DISINFECTION BUILDING POWER AND GROUNDING PLAN
060E102	DISINFECTION BUILDING SMALL POWER AND LIGHTING PLAN
060E103	DISINFECTION BUILDING INSTRUMENTATION AND CONTROLS PLAN
060E104	DISINFECTION BUILDING ROOF ELECTRICAL PLAN
065E101	CHLORINE CONTACT BASIN ELECTRICAL PLAN
065E501	CHLORINE CONTACT BASIN CHEMICAL VAULT

REFERENCE

HOOD - RICH ARCHITECTS & CONSULTING ENGINEERS

22	CHLORINE CONTACT CHAMBERS & FLOW METER & OUTLET STRUCTURES

DRAWING No.	DRAWING NAME
SCOTT CONSULTING ENGINEERS, P.C.	
10	INFLUENT PUMPING STATION PLANS, SECTIONS AND DETAILS
11	INFLUENT PUMPING STATION SECTIONS AND DETAILS

EXHIBIT L – ARPA SPECIFICATION INSERTS

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)

1. As used in these specifications:
   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
   b. "Director" means Director, Office of Federal Contract Compliance Programs United States Department of Labor, or any person to whom the Director delegates authority;
   c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
   d. "Minority" includes:
      (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction Contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.
5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and training programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting it's EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than once month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment sources, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory affect by continually monitoring all personnel and employment related activities to ensure that

the EEO policy and the Contractor's obligations under these Specifications are being carried out.

n. Ensure that all facilities and company activities re nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications providing that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these Specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these Specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligation under these Specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these Specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these Specifications, the Director shall proceed in accordance with 41-CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, Contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation in each trade
All years	2%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any).

Participation Goals for Minority Contractors per the
October 2019 Department of Labor OFCCP - Technical Assistance Guide

Missouri Counties

Adair 4.0	Howard 4.0	Ray 12.7
Andrew 3.2	Howell 2.3	Reynolds 11.4
Atchison 10.0	Iron 11.4	Ripley 11.4
Audrain 4.0	Jackson 12.7	St. Charles 14.7
Barry 2.3	Jasper 2.3	St. Clair 14.7
Barton 2.3	Jefferson 14.7	St. Francois 11.4
Bates 10.0	Johnson 10.0	Ste. Genevieve 11.4
Benton 10.0	Knox 4.0	St. Louis 14.7
Bollinger 11.4	Laclede 2.3	St. Louis City 14.7
Boone 4.0	Lafayette 10.0	Saline 10.0
Buchanan 3.2	Lawrence 2.3	Schuyler 4.0
Butler 11.4	Lewis 3.1	Scotland 4.0
Caldwell 10.0	Lincoln 11.4	Scott 11.4
Callaway 4.0	Linn 4.0	Shannon 2.3
Camden 4.0	Livingston 10.0	Shelby 4.0
Cape Girardeau 11.4	McDonald 2.3	Stoddard 11.4
Carroll 10.0	Macon 4.0	Stone 2.3
Carter 11.4	Madison 11.4	Sullivan 4.0
Cass 12.7	Maries 11.4	Taney 2.3
Cedar 2.3	Marion 2.4	Texas 2.3
Chariton 4.0	Mercer 10.0	Vernon 2.3
Christian 2.0	Miller 4.0	Warren 11.4
Clark 3.4	Mississippi 11.4	Washington 11.4
Clay 12.7	Moniteau 4.0	Wayne 11.4
Clinton 10.0	Monroe 4.0	Webster 2.3
Cole 4.0	Montgomery 11.4	Worth 10.0
Cooper 4.0	Morgan 4.0	Wright 2.3
Crawford 11.4	New Madrid 26.5	
Dade 2.3	Newton 2.3	
Dallas 2.3	Nodaway 10.0	
Daviess 10.0	Oregon 2.3	
De Kalb 10.0	Osage 4.0	
Dent 11.4	Ozark 2.3	
Douglas 2.3	Pemiscot 26.5	
Dunklin 26.5	Perry 11.4	
Franklin 14.7	Pettis 10.0	
Gasconade 11.4	Phelps 11.4	
Gentry 10.0	Pike 3.1	
Greene 2.0	Platte 12.7	
Grundy 10.0	Polk 2.3	
Harrison 10.0	Pulaski 2.3	
Henry 10.0	Putnam 4.0	
Hickory 2.3	Ralls 3.1	
Holt 10.0	Randolph 4.0	

EXECUTIVE ORDER
05-30

WHEREAS, since 1990, the Office of Administration, State of Missouri has endeavored to "establish and implement a plan to increase and maintain the participation of certified socially and economically disadvantaged small business concerns or minority business enterprises, directly or indirectly, in contracts for supplies, services, and construction contracts, consistent with targets determined after an appropriate study conducted to determine the availability of socially and economically disadvantaged small business concerns and minority business enterprises in the marketplace;" pursuant to Senate Bills 808 & 672 passed by the General Assembly and signed into law by then Governor Ashcroft; and

WHEREAS, such a study was conducted and found statistically significant disparities in state contractual expenditures for construction and the purchase of goods and services, as compared to the ready, willing and able minority and women-owned business enterprises (M/WBEs) in the state; and

WHEREAS, Executive Order 98-21 established goals to increase the percentage of goods and services procured from certified M/WBEs; and

WHEREAS, the goals for M/WBE participation established in Executive Order 98-21 have not been substantially met; and statistically significant disparities in state contractual expenditures for construction and the purchase of goods and services from minority and women-owned businesses in the state still exist; and

WHEREAS, on September 27, 2004, Behavioral Interventions, Inc. filed a lawsuit in the U.S. District Court, in the Western District of Missouri challenging the propriety of Missouri's M/WBE program. In January 2005, a preliminary injunction was issued ordering the Office of Administration, State of Missouri to suspend the placing of M/WBE requirements in any procurement by the State of Missouri. Because of the uncertainty created in the aftermath of the litigation, the program has undergone comprehensive revision not only to withstand constitutional scrutiny, but also to more adequately address the compelling needs and obstacles of minority and women-owned businesses to gain greater access to business opportunities, both public and private, within the state of Missouri; and

WHEREAS, the State of Missouri is dedicated to the compelling governmental interest in remedying race and sex based discrimination in a manner consistent with state and federal law; and

WHEREAS, the State of Missouri is committed to enhancing the economic health and prosperity of the state by promoting the greater use of minority and women-owned businesses. Job creation for Missouri residents, and therefore the success of minority and women-owned businesses, are paramount goals of this Administration; and

WHEREAS, the State of Missouri will gain enormously from improvements in expanded business opportunities for Missouri residents created by the expansion of minority and women-owned businesses and through the additional tax revenues generated by those individuals and businesses; and

WHEREAS, to further these goals, which are of the highest priority of this Administration, it is the policy of this Administration to develop economic opportunities for minority and women-owned businesses wherever possible.

NOW, THEREFORE, I, Matt Blunt, Governor of the State of Missouri, under the authority vested in me under the constitution and the laws of this state, to fulfill the mandate of the General Assembly in Senate Bills 808 & 672 and to pursue the compelling interest of remedying discrimination, do hereby declare the following narrowly tailored policies and procedures shall be adopted by the Executive Branch of state government in procuring all types of goods and services:

1. The Office of Supplier and Workforce Diversity (OSWD) is established to replace the Office of Equal Opportunity. All the authority, powers and privileges of the Office of Equal Opportunity is transferred to the OSWD. The Director of OSWD shall be appointed by the Governor. The Director of OSWD shall report to the Commissioner of Administration. The Director shall have primary responsibility for assisting in the coordination and implementation of affirmative action throughout all departments of the executive branch of state government, including programs to increase M/WBE participation, and advising the Governor on issues regarding equal employment opportunity, affirmative action, and efforts to administer affirmative action goals and timetables for implementation throughout the departments of the executive branch.

   The Office of State Compliance Officer is hereby abolished. The Director of OSWD shall be the State's chief compliance officer for the executive branch of state government to ensure that the State of Missouri is complying with all federal and state laws concerning equal employment opportunity and affirmative action. If needed, the Director shall assist each department in developing an Affirmative Action Plan of Implementation. Additionally, the Director of OSWD shall review progress reports of the departments and shall meet biannually with each department director to evaluate departmental results and determine the course of future affirmative action goals, timetables, recruiting, planning, and implementation. The results of each meeting shall be reported in writing to the Governor and Commissioner of Administration.

   Not later than January first of each calendar year, the Director of OSWD shall provide a report to the Governor and the Commissioner of Administration which summarizes the activities of each department pursuant to this Order and which contains recommendations for additional programs to accomplish the purposes of this Order.

   The Commissioner of Administration shall provide the Director of OSWD with such facilities, staff, resources, equipment, and supplies as are necessary to carry out the duties set forth herein. The Director of OSWD shall submit a proposal each fiscal year to the Commissioner of Administration detailing the needs of the Office of Supplier and Workforce Diversity.

2. All state agencies shall continue to make every feasible effort to target the percentage of goods and services procured from certified MBEs and WBEs to 10% and 5%, respectively. These efforts shall include participation in an Executive Branch Contract Compliance Council which shall, in cooperation with the OSWD, review procurement efforts to assist in meeting the requirements of this Executive Order.

3. The Divisions of Purchasing and Materials Management (PMM) and Facilities Management, Design and Construction (FMDC) within the Office of Administration shall be authorized to implement the following programs to increase M/WBE procurement:

   a. PMM shall be authorized to encourage prime contractors to subcontract with M/WBEs on all contracts of $100,000 or greater. OSWD contracts shall include a provision for participation which will allow the bidders to tailor a plan to fit the contract. Mandatory percentage goals of M/WBE participation shall not be established in violation of federal or state law. M/WBE participation shall be encouraged by PMM in consultation with OSWD and the user agency depending on the availability of M/WBE vendors in the applicable commodity/service and geographical area. PMM shall consider M/WBE participation as a significant factor in a contract bid. The M/WBE participation will be evaluated along with other criteria in the award of a bid. It is intended that 10% MBE and 5% WBE percentage is desired. The participation can be met through the use of prime contractors, subcontractors, suppliers, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

OSWD in conjunction with PMM shall also appoint a M/WBE Purchasing Manager for the purpose of promoting and coordinating the participation of M/WBEs in State of Missouri contracts.

b. FMDC shall be authorized to evaluate M/WBE participation in design contracts, as part of the quality-based selection process, for construction projects worth $1.5 million or more. On contracts with lesser value, FMDC shall make special efforts to target M/WBEs as prime contractors. Overall participation targets for each fiscal year shall be 10% MBE and 5% WBE; however, mandatory percentage goals shall not be established in violation of federal or state law. The targets may be met through the use of prime contractors, subcontractors, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

FMDC shall also be authorized to seek participation of M/WBEs on construction contracts. The targets shall be set on a project by project basis by FMDC in consultation with the OSWD, taking into account the availability of M/WBE contractors in the applicable geographic area and construction trade, with the overall participation targets for each fiscal year at 10% MBE and 5% WBE. The targets may be met through the use of prime contractors, subcontractors, suppliers, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

c. Both FMDC and the PMM shall establish policies or rules to implement these programs which shall include a waiver provision for prime contractors who make a good faith effort to attain such targets but do not succeed. They shall also establish enforcement procedures in cooperation with the OSWD to assist contractors to meet subcontracting commitments. Their programs shall be reviewed annually to determine whether targets should be modified.

d. FMDC and PMM are authorized and directed to identify and consult with such entities as the St. Louis Minority Business Council, the Kansas City Minority Supplier Council and the Kansas City Council of Women Business Owners in identifying M/WBEs to participate in state procurements.

4. OSWD shall monitor the programs and work with FMDC and PMM in their implementation. The OSWD shall have the following responsibilities and carry out the following tasks:

a. to actively recruit, facilitate and serve as a clearinghouse for M/WBE contractors to participate in the programs;

b. to cooperate with the PMM and the FMDC in the administration and enforcement of the M/WBE participation programs;

c. to cooperate with the PMM and the FMDC in the development of policies, forms, and procedures to carry out the requirements of the M/WBE participation programs;

d. to participate in M/WBE target setting;

e. to perform fact-gathering and record-keeping to determine both the effectiveness of state participation programs and the availability and utilization of eligible M/WBEs on individual projects, including levels of participation and availability in specific areas;

f. to certify contractors as M/WBEs;

g. to assess the continuing need for M/WBE participation targets for specific contracting areas;

h. to monitor contractor participation with M/WBE targets; and

i. to recommend sanctions for contractors who fail to faithfully execute M/WBE participation plans during the course of contract performance.

5. The programs shall be reviewed annually to monitor the level of M/WBE participation achieved in state contracting areas during the previous year. An assessment of the programs and whether their continuation is necessary shall be delivered to the Governor and the General Assembly. After it is determined that M/WBEs participate in state contracts in a manner commensurate with their presence and capability in the state marketplace, the programs set forth in section 2 will be terminated.

6. Executive Order No. 98-21 (1998) and article II of Executive Order 94-03 (1994) are hereby superseded and replaced by this Executive Order.

IN WITNESS WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Missouri, in the City of Jefferson, on this 8th day of September, 2005.

Matt Blunt
Governor

ATTEST:

Robin Carnahan
Secretary of State

EXECUTIVE ORDER
15-06

WHEREAS, the State of Missouri is committed to enhancing the economic health and prosperity of Minority and Women Business Enterprises (M/WBEs) through the use of M/WBE contract benchmarks established in state contracts for supplies, services, and construction that are consistent with §§37.020 – 37.023, RSMo, and the findings of the most current disparity study; and

WHEREAS, upon funding being appropriated by the General Assembly in 2013, the Office of Administration (OA) commissioned a Disparity Study which was completed on October 24, 2014, that studied the utilization of M/WBEs in state contracts and the availability of M/WBEs in the applicable marketplace; and

WHEREAS, Executive Order 14-07 established the Disparity Study Oversight Review Committee to review the findings of the 2014 Disparity Study and to produce meaningful recommendations to assist the State of Missouri in developing a contracting process that is inclusive, promotes diversity, and provides greater opportunity for M/WBEs; and

WHEREAS, after conducting a thorough review and analysis of the findings of the 2014 Disparity Study, the Disparity Study Oversight Review Committee submitted its report to the Governor on January 27, 2015; and

WHEREAS, the Disparity Study Oversight Review Committee's report sets forth recommendations to help eliminate the lingering effects of discrimination to ensure a level playing-field for all Missouri business owners; and

WHEREAS, on September 14, 2015, the Ferguson Commission, created pursuant to Executive Order 14-15, released its final report which called for Missouri to implement a statewide M/WBE program "with outcomes measures that incorporate capacity building, mentoring, and education with respect to the state and local procurement system;" and

WHEREAS, the State of Missouri is dedicated to the compelling governmental interest of remedying race and sex based discrimination in a manner consistent with state and federal law.

NOW, THEREFORE, I, JEREMIAH W. (JAY) NIXON, GOVERNOR OF THE STATE OF MISSOURI, in recognition of the obligations of the State of Missouri and by virtue of the authority vested in me by the Constitution and the Laws of the State of Missouri, do hereby state that the following narrowly tailored policies and procedures shall be adopted by the Executive Branch of state government in procuring goods and services:

1. All state agencies shall make every feasible effort to increase the percentage of goods and services procured from certified M/WBEs in order to achieve the annual goals of 10% MBEs and 10% WBEs of all annual Executive Branch procurement funds. These efforts shall include participation in an Executive Branch Contract Compliance Council which shall, in cooperation with the Office of Administration, Office of Equal Opportunity (OEO), review procurement efforts to assist in meeting the requirements of this Executive Order.

2. Both the Division of Purchasing and Facilities Management, Design and Construction (FMDC) within the Office of Administration shall be authorized to implement the following program to increase M/WBE procurements:

   a. Division of Purchasing and FMDC shall encourage prime contractors to subcontract with M/WBEs on state contracts. Division of Purchasing and FMDC contracts are permitted to include a provision setting forth participation of M/WBEs as prime contractors or subcontractors who perform a commercially useful function. M/WBE participation requirements shall be determined by the Division of Purchasing and FMDC, in consultation with OEO and the user agency, by evaluating the availability of M/WBE vendors in the applicable commodity/service and geographical area as determined by the most recent disparity study and other applicable factors. Division of Purchasing and FMDC shall use individual contract percentages to help meet the

state's annual program goals. The M/WBE participation will be evaluated for responsiveness along with other criteria in the award of a bid. The participation can be met through the use of prime contractors, subcontractors, suppliers, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

b. Division of Purchasing and FMDC shall revise their policies and regulations to further implement this program which shall include a waiver provision for prime contractors who make a good faith effort to take all necessary and reasonable steps to attain such percentages but are otherwise unable to achieve them. Division of Purchasing and FMDC shall also establish enforcement procedures, in cooperation with OEO and the Contract Oversight Office within the Office of Administration, which shall include consequences for failure to meet percentage commitments unless a good faith waiver is obtained from the Division of Purchasing or FMDC, respectively.

c. Division of Purchasing and FMDC are authorized and directed to identify and consult with such other certifying entities as recommended by OEO in order to facilitate M/WBEs to participate in state procurements.

3. The Office of Administration shall also be authorized to:

a. Conduct a comprehensive review of OEO and determine the need for increased funding and personnel to enable OEO to carry out the work it has been assigned.

b. Evaluate the state's current M/WBE eligibility standards and determine what revisions, if any, should be considered to applicable statutes and regulations. This includes an evaluation of whether M/WBE eligibility should be capped based upon a firm's gross income and/or personal net worth. The Office of Administration should refer to the Disparity Study and the Committee's report as a reference regarding potential revisions to the program's eligibility standards.

c. Research existing bonding and financing programs for small vendors that enhance access to bonding and working capital in order to reduce barriers to business development and success, and determine the feasibility of developing such a program within OEO.

d. Evaluate the existing experience and surety bonding requirements and determine what adjustments, if any, should be considered to facilitate increased M/WBE participation.

e. Evaluate the possibility of lengthening solicitation periods for vendors, whenever possible, in an effort to increase M/WBE participation.

f. Research the feasibility and consider establishing a Mentor-Protégé Program within OEO, whereby a larger firm provides instruction and training to an emerging firm to increase the protégé's skills, capacities, and business areas.

g. Educate and advise state agencies on implementing internal procedures that ensure compliance with §8.690 RSMo.

h. Implement an electronic contracting system that provides access to state contracting information and collects measureable data to document the achievement of M/WBE goals.

4. OEO shall work with the Division of Purchasing and FMDC in the implementation of this Executive Order, and shall have the following responsibilities:

a. Actively recruit, certify, and serve as a clearinghouse for M/WBEs to participate in the program.

b. Partner with agencies and organizations that conduct similar services that can provide technical assistance and supportive services.

c. Cooperate with the Division of Purchasing, FMDC, and the Contract Oversight Office in the administration and enforcement of the M/WBE participation program and contract requirements.

d. Cooperate with the Division of Purchasing and FMDC in the development of policies, forms, and procedures to carry out the requirements of the M/WBE participation program.

e. Provide guidance to the Division of Purchasing and FMDC in the setting of M/WBE individual contract percentages.

f. Review and record the effectiveness of the state agencies' participation in the program in light of the availability and utilization of eligible M/WBEs on individual contracts, and make recommendations to the agencies for improvement and enforcement of the program.

g. Provide outreach to M/WBEs to educate firms about the program, the state's procurement process, and business elements such as obtaining bonding, lines of credit, or other related services. Outreach efforts shall also serve to foster enhanced working relationships between M/WBEs and prime contractors.

h. Recommend sanctions for contractors who fail to faithfully execute M/WBE participation requirements during the course of contract performance.

5. OEO shall review the program annually to monitor the level of M/WBE participation achieved in state contracting areas during the previous fiscal year. An assessment of the program and whether the continuation is necessary shall be prepared by OEO and delivered to the Governor and the General Assembly by March after the completion of the fiscal year. After it is determined by OEO that M/WBEs participate in state contracts at a level commensurate with their presence and capability in the state marketplace, then the program set forth in this Executive Order shall be terminated. If the program is still deemed to be necessary on March 1, 2019, a new Disparity Study should be conducted and a new Disparity Study Oversight Review Committee should be appointed to review the results of that study.

6. This Order shall take effect immediately and supersedes Executive Order 05-30.

IN WITNESS WHEREOF, I have hereunto set my hand and cause to be affixed the Great Seal of the State of Missouri, in the City of Jefferson, on this 21st day of October, 2015.

Jeremiah W. (Jay) Nixon
Governor

ATTEST:

Jason Kander
Secretary of State