CMT

MEMORANDUM

| | |
|---|---|
| TO: | Potential Bidders |
| FROM: | Timothy F. Sumner, PE – Project Manager |
| CC: | |
| DATE: | May 5, 2015 |
| SUBJECT: | City of Mattoon: Riley Creek CSO Satellite Treatment Facility – Contract 1 Bidding Documents |

There are two documents generated by the geotechnical consultant, Midwest Engineering and Testing, Inc., that provides information about the subsurface exploration and geotechnical investigation. The first report dated February 7, 2014 contains a summary of soil boring information and recommendations for design and construction of the foundation and pavement systems. A second investigation dated June 11, 2014 provides additional soil boring log information to supplement the first report since the site plan was shifted east to consolidate the facilities.

**Midwest Engineering and Testing, Inc.**
geotechnical - environmental - materials engineers
501 Mercury Drive
Champaign, IL 61822-9649
217-359-2128
FAX 217-359-8446
www.metgeotech.com

February 7, 2014

Mr. Timothy F. Sumner, P.E.
Crawford, Murphy & Tilly, Inc.
2750 West Washington Street
Springfield, Illinois 62702

Re: Subsurface Exploration and Geotechnical Evaluation
Proposed Riley Creek CSO
Satellite Treatment Facility
Mattoon, Illinois
MET Project No. 33075

Dear Mr. Sumner:

In accordance with your request, we have completed a subsurface exploration and evaluation of the foundation conditions at the above-referenced site. Enclosed are three (3) copies of the report that includes our findings and recommendations regarding design and construction of the foundation and pavement systems.

Midwest Engineering and Testing, Inc., (MET) appreciates the opportunity to be of service during this phase of the project. If there are any questions or comments you may have regarding the content of this report, or if we may be of any further service, please contact us at your convenience.

Sincerely,

**Midwest Engineering and Testing, Inc.**

Jeffrey W. Olson, P.E.
Project Engineer

Daniel E. Tappendorf, P.E.
President

# SUBSURFACE EXPLORATION
# AND
# GEOTECHNICAL EVALUATION

**Proposed Riley Creek CSO**
**Satellite Treatment Facility**
**Mattoon, Illinois**

**Prepared For:**

**Mr. Timothy F. Sumner, P.E.**
**Crawford, Murphy & Tilly, Inc.**
**2750 West Washington Street**
**Mattoon, Illinois**

**February 7, 2014**

**MET File No. 33075**

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# INTRODUCTION

## General

This report presents the results of a subsurface exploration and geotechnical evaluation for the proposed construction of sewers and a satellite treatment facility to convey and treat combined sewer overflow (CSO) on the northern edge of Mattoon, Illinois. The purpose of this study was to determine and evaluate the subsurface conditions existing at the subject site, and to establish related parameters for use by the design engineers and architects. Included herein are the results of the subsurface exploration, field and laboratory soil test data, and recommendations regarding design and construction of the foundation and pavement systems.

## Scope

The scope of services included a reconnaissance of the site, subsurface exploration, field and laboratory testing of the soil samples collected, and engineering analysis and evaluation of the data. In addition, geologic maps and literature relative to the general area of the site were reviewed.

## Authorization

Authorization to perform this subsurface exploration and analysis was in the form of a fully executed proposal agreement between Crawford, Murphy & Tilly, Inc. (CMT) and Midwest Engineering and Testing, Inc. (MET). The proposal, (MET Proposal No. 3155R1, dated November 14, 2013), contained the scope of service and conditions for performance of the work and was signed by Mr. Jeff Fickbohm, P.E. on November 27, 2013.

# PROJECT AND SITE DESCRIPTION

The proposed sewers and treatment facility are located north of the corporate limits of Mattoon, Illinois. A Vicinity Map, Figure 1, is included in the Appendix. It is understood that the project will include:

- Approximately 300 foot long boring and jacking of two (2) adjacent 42- inch diameter steel casing pipes below Illinois Route 45 and the CN Railway.
- One bar screen structure with preliminary dimensions of 33’ x 49’ x 19’ deep.
- One pump station with preliminary dimensions of 23’ x 51’ x 20’ deep.
- One first flush storage tank approximately 125 feet in diameter and 26 feet deep.
- One primary treatment structure approximately 40 feet in diameter and 26 feet deep.

- One disinfection structure with preliminary dimensions of 70’ x 46’ x 14’ deep.
- Three above grade buildings with slab on grade floor systems. Approximate dimensions are: 20’ x 20’, 25’ x 25’ and 20’ x 60’.
- Various equipment pads.

## GEOLOGY OF THE AREA

### General

The geology of the Mattoon, Illinois region has been greatly influenced by several major landforming factors. Bedrock and tectonic movements prior to the Pleistocene Period, continental glaciation during the Pleistocene Period, wind action, and man have all contributed to the geologic history of the area.

### Bedrock Geology

Bedrock in the Mattoon area is generally found at a depth of 50 to 100 feet below the ground surface and consists primarily of Pennsylvanian Age deposits associated with the Mattoon Formation. Shale, coal, sandstone and limestone are the predominant rock types comprising the formation in this area.

### Surficial Geology

The subject site is located on the northern edge of Mattoon, Illinois and the surficial geology likely consists of a thin layer of wind deposited and water worked loessial material overlying extensive deposits of glacial drift. The drift is comprised primarily of glacial till, a heterogeneous mixture of sand and pebbles bound in a compact clay to silt matrix, but can also contain inclusions of granular outwash material. Pockets, lenses, seams and tubes of water sorted gravels, sands, and silts are commonly found in these geologic formations.

### Seismic Considerations

Based upon the information from the borings and our past experience in the area, it is recommended that the default Site Classification, **Site Class D**, as defined in accordance with Table 1613.5.2 of the IBC – 2009, be utilized. That is, stiff soils having an undrained shear strength from 1000 to 2000 PSF.

## FIELD EXPLORATION

### Scope

In order to determine the significant engineering characteristics of the foundation soils, a field exploratory program was undertaken. A total of fourteen (14) soil borings were advanced for the project, twelve (12) each to a depth of 26.5 feet below surface grade and two (2) each to a depth of 41.5 feet below surface grade. The boring locations are shown on the Boring Location Diagrams, Figures 2 and 3, included in the Appendix. The following sections provide a description of field drilling and testing procedures utilized.

### Drilling and Sampling Procedures

The soil borings were performed with an ATV track-mounted drilling rig equipped with a rotary head. Conventional, continuous-flight, hollow-stem augers were used to advance the holes with representative samples obtained employing split-barrel sampling techniques in general accordance with ASTM Procedure D-1586.

### Field Tests and Measurements

**Standard Penetration Tests:** During the sampling procedure, Standard Penetration Tests (SPTs) were performed at regular intervals through the depth of the borings. The SPT value ("N", or blow counts) is defined as the number of blows required to advance a 2-inch O.D., split-barrel sampler a distance of one foot by a 140-pound hammer falling 30-inches. These values provide a useful preliminary indication of the consistency or relative density of most soil deposits and are included on the Soil Boring Logs.

**Water Level Measurements:** Groundwater level observations were made during and upon completion of the drilling process. Water level information is noted on the Soil Boring Logs in the Remarks column.

**Ground Surface Elevations:** The ground surface elevations shown on the Soil Boring Logs were provided by CMT.

## LABORATORY TESTING

### General

Additional significant characteristics of the foundation materials were determined in the laboratory to provide data on which to classify and quantitatively assess the engineering properties of the soil samples obtained. The types of soils encountered were identified and logged on the Soil Boring Logs in the Appendix. The results of the field and

laboratory tests are also presented in the Appendix. Representative samples of the soils encountered in the field were placed in clean, glass sample jars and are now stored in the laboratory for further analysis, if desired.

### Laboratory Tests and Measurements

**Visual Classification:** A soils engineer visually classified all samples in accordance with the Unified Soil Classification System (ASTM D-2488) terminology. An explanation of the symbols used in this system is included in the Appendix.

**Moisture Content Tests:** The natural moisture content of all samples was determined by ASTM method D-2216 and is recorded on the Soil Boring Logs as a percentage of the dry weight of the soil.

**Hand Penetrometer Tests:** Cohesive specimens extracted from the split-barrel sampler were tested in the laboratory with a calibrated soil penetrometer. This device provides an approximation of the unconfined compressive strength of the soils, and is useful, along with other soil parameters, in evaluating the soil strength characteristics. The results are listed on the Soil Boring Logs beneath the column labeled "Qp".

**Unconfined Compression Tests:** The undrained shear strength of the cohesive soils was determined from unconfined compression tests performed on specimens obtained from the split-barrel samplers. The strength values of soil samples obtained by the SPT method must also be considered, recognizing that this sampling technique provides a representative, but somewhat disturbed sample. The results are listed on the Soil Boring Logs beneath the column labeled "Qu".

**Dry Density Determination:** The dry density was determined on the cohesive soils where intact samples were available. The results are listed on the Soil Boring Logs beneath the column labeled "Dd".

## DESCRIPTION OF SUBSURFACE CONDITIONS

### General

The types of foundation materials encountered at the test boring locations are described on the Soil Boring Logs. The lines delineating the changes in strata on the logs represent an approximate boundary between the various soil classifications. These soil descriptions and delineations are representative for the specific test hole location. Variations in the soil profile and the engineering properties of the soil deposits may occur between boring locations. A summary of the major soil profile components is

described in the following paragraphs. A more detailed description and supporting data for each boring location can be found on the individual Soil Boring Logs.

### Soil Conditions

The ground surface at the boring locations was covered with a layer of surficial topsoil and vegetation with a thickness of 6 to 8". The surficial materials were generally underlain by brown and gray silty clay to clayey silt loessial and/or glacial drift soils that extended through depths varying from about 7 to 10 feet. Samples of these soils possessed medium stiff to stiff consistencies, moisture contents in the range of 13 to 30 percent and dry densities of 83 to 109 pcf. The soils were generally underlain by very stiff to hard silty clay glacial till deposits that continued through the remaining depth explored. In boring B-11, at a depth of about 20 feet below ground surface, an outwash inclusion consisting of sandy clay was encountered.

### Groundwater Observations

All holes were dry both during and upon completion of drilling operations. It must be recognized that groundwater levels fluctuate with time due to variations in seasonal precipitation, lateral drainage conditions, and soil permeability characteristics. Monitoring standpipes should be installed and periodically checked where it is necessary to more accurately assess prevailing water levels preceding or during construction. Based upon our past experience with the geology of the area, it would not be uncommon to for a small volume of water to be present in small discontinuous isolated outwash pockets present near the loessial soil/glacial till interface or with the glacial till soils.

## FOUNDATION DISCUSSION AND RECOMMENDATIONS

### General

In light of the subsurface conditions encountered, it is our opinion that a shallow foundation system could be considered for support of the proposed structures at the project site. Discussions of the foundation design parameters, as well as site preparation and construction considerations, are included in the following sections.

### Shallow Foundation System

<u>Bar Screen and Pump Station ( B-1 and B-2)</u>

Considering the proposed 19 to 20 ft. below grade bearing level for the bar screen and pump station structures, it is anticipated that the support conditions will consist primarily of stiff to hard gray silty clay soils. We recommend that footing or mat type foundations

supported at this level be designed utilizing a net allowable bearing pressure of 4000 psf.

Primary Treatment and First Flush Storage Tanks ( B-4, B-5, B-6, B-10, B-11 and B-12)

Considering the proposed 26 ft. below grade bearing level for the primary treatment and first flush storage tanks, it is anticipated that the support conditions will consist primarily of stiff to hard gray silty clay soils. We recommend that footing or mat type foundations supported at this level be designed utilizing a net allowable bearing pressure of 4000 psf.

Disinfection Structure ( B-11 and B-12)

Considering the proposed 14 ft. below grade bearing level for the disinfection structure, it is anticipated that the support conditions will consist primarily of stiff to hard gray silty clay to clayey silt soils. We recommend that footing or mat type foundations supported at this level be designed utilizing a net allowable bearing pressure of 4000 psf.

Small Above-Grade Buildings ( B-3, B-7, B-8, B-9 and B-12)

The proposed small above-grade buildings may be supported on shallow footings established on suitable natural soils or engineered structural fill. Exterior footings should be founded at least 3.0 feet below grade for frost protection purposes, while interior footings may be constructed immediately below floor slabs, if so desired. However, all footings must be protected from the effects of frost when construction is carried out during the winter months.

Based on the above development grade considerations, it is anticipated that the footings would be founded on brown and gray silty clay to clayey silt soils at approximately 3 to 4 feet below present exterior grade. It is recommended that net allowable bearing pressures of 2400 PSF and 2000 PSF be used for the design of conventional spread and continuous wall footings, respectively, subject to the minimum dimensions discussed below.

General Foundation Considerations

It is possible that pockets of soft, loose or otherwise marginal bearing soils may be encountered during excavation for shallow foundations. Such areas should be evaluated by the soils engineer when discovered to determine the appropriate remedial measures which may need to be taken. This may involve overexcavation down to underlying higher strength soils where available, or removal and replacement of the unsuitable materials with engineered fill.

Where replacement backfill is used in footing undercuts, the excavations should be widened at least 1 foot in all directions from the edge of the footing for each foot of excavation depth below the design footing base elevation. The replacement backfill should be a well-graded granular material placed in lifts of eight (8) inches or less in loose thickness and compacted to a minimum of 95 percent of the material's maximum Standard Proctor dry density (ASTM D-698). If lean concrete is utilized to reestablish the bearing level, bank-formed footing excavations need not be widened. However, excavations should be widened for formed footings to allow centering of forms and reduce the potential for eccentric loading

It is recommended that individual isolated spread footings have a minimum dimension of 30 inches and continuous footings have a minimum width of 18-inches. In order to lessen the effects of any slight differential movement that may occur due to variations in the character of the supporting soils and seasonal moisture contents, it is recommended that all footings be suitably reinforced.

In general, the performance of the foundation systems on this site is dependent on the various factors, which have been discussed. The above-recommended bearing pressures contain a safety factor of 3, which would theoretically keep potential total and differential settlements in the elastic range (calculated to be less than 1.0 inch and 0.5 inches, respectively) if the suggested design and construction criteria are followed. It is recommended that the preparation and installation of the foundations be monitored and tested by a representative of the soils engineer.

Jack and Bore Pipe Considerations (borings B-13 and B-14)

It is understood that the bore and jacking pit will extend through a depth of about 15 ft. Based upon the soils encountered in the borings and OSHA classification methodology, primarily Type A and B soils were found, which would require a minimum side slope of 1 to 1. If the pit walls cannot be sloped, then shoring of the sides of the excavation will be required to provide for worker safety. The bottom of the pit will likely be comprised of primarily stiff to hard clayey silt to silty clay soils, which should provide stable support for the boring equipment. No ground water was encountered either during or upon completion of the drilling. However, sump pits may be required to maintain reasonably dry conditions to prevent deterioration of the subgrade following rain events or should minor seepage occur. Several split-spoon samples from boring B-14 had "no recovery", which may indicate the presence of cobbles within the glacial till soils. It is difficult to assess the prevalence or size of the cobbles, but based upon past experience they are common to the geology of the area.

It is understood that two (2) adjacent 42-inch diameter pipes will be installed. Based upon our discussions with several boring contractors, there is not a generally accepted minimum spacing between adjacent pipes. Considering that the bore will likely extend

through primarily very stiff to hard silty clay, glacial till soils, it is our opinion that a minimum spacing of 2 ft. would be reasonable.

**Lateral Earth Pressures**

Below grade walls should be designed to resist lateral earth pressures. Because wall geometry and design will likely prevent sufficient movement to mobilize active pressures and the walls should be designed using at-rest conditions. For this condition, a lateral pressure coefficient of 0.5 is recommended for use.

Typically, design of below grade walls incorporates a perimeter drain system to alleviate the build-up of hydrostatic pressure. Considering that most of the structures with below grade walls will be used for water containment, such drainage systems would not appear to be necessary.

It is expected that most of the excavation zones behind the walls will be backfilled with the native inorganic clay and silt soils found below a depth of about 2 ft. For this backfill condition, it is recommended that an equivalent fluid pressure of 65 PCF be used for the design of the walls. This value does not include hydrostatic pressure or lateral pressures due to surcharge loads applied to the surface of the backfill.

For sliding resistance, a friction coefficient of 0.35 is recommended for concrete on the native silty clay soils. This value may be increased to 0.40 if the foundation elements are supported on a base course of crushed stone.

In areas where the wall backfill will provide partial support for overlying driveways, floor slabs or sidewalks, proper placement and compaction is critical to limit distress to the overlying structural elements. In these areas, we recommend that clean granular soils that can be categorized as GW, GP, SW or SP under the Unified Soil Classification System be utilized exclusively as backfill. These soils are more readily compacted in confined areas. However, unless the granular backfill limits extend to or beyond the active pressure envelope, the 65 PCF equivalent fluid pressure value should still be used.

**Floor Slabs**

Prior to placement of concrete slabs-on-grade, or before any slab supporting fill is placed, all existing topsoil materials should be removed. The exposed subgrade should be carefully inspected and proofrolled to detect any areas of excessive yielding, which may require additional undercutting and replacement.

It is recommended that small building floor slabs be supported on a base course consisting of at least six (6) inches of well-graded granular material such as IDOT

gradation CA-6. Proper subgrade preparation and adherence to recommendations regarding placement of the engineered fill will allow the use of a subgrade modulus of 125 psi/in for floor slab design.
The use of a plastic vapor barrier is left to the discretion of the architect. When a vapor barrier is used, proper curing conditions must be maintained to reduce the potential for differential curing and possible curling of the floor slabs.

The floor slabs should be suitably reinforced and, in the case of floating slabs, proper joints should be provided at the junctions of the slab and foundation system so that a small amount of independent movement can occur without causing damage. Large floor areas should be provided with joints at frequent intervals to compensate for concrete volume changes.

## CONSTRUCTION CONSIDERATIONS

### Site Preparation

It is recommended that all existing topsoil (6 to 8 inches) and vegetation be removed beneath the proposed building and site work areas prior to construction. The resulting subgrade should then be thoroughly inspected for areas of instability or that contain existing unsuitable fill materials that would require additional undercutting, and new engineered fill may be added, as necessary, to establish finished grade.

It is recommended that fill materials used for structural support consist of either granular or low plasticity cohesive soils, which can be categorized as SW, SP, SC, SM or CL under the Unified Soil Classification System (USCS). Most of the existing cohesive soils at the site, excluding the surficial topsoil, could be utilized as engineered fill material, subject to proper moisture control as discussed below. Backfill that will support overlying floor slabs should consist of granular soils that can be classified as GW, GP, SP or SW under the USCS. Likewise, site utilities under floor and pavement areas should also be backfilled with granular material such as IDOT designation FA-1, FA-6, CA-7 or CA-6.

All structural backfill and fill materials should be placed in lifts not exceeding 8 inches in thickness in a loose state at a moisture content within 3 percentage points of laboratory optimum. Structural fill and backfill materials should be compacted to 95 percent of the maximum dry density as determined by ASTM D-698 (Standard Proctor) method of test.

Proper moisture control is essential to reduce the amount of compactive effort necessary to achieve the desired densities. This is especially true of cohesive soils, where scarification and aeration may be required to achieve near-optimum moisture levels prior to compaction. A sheepsfoot roller is generally required for compaction of clayey soils, whereas a vibratory smooth drum roller is preferred for granular and silty

material. Granular backfill compacted with small, hand-operated equipment should be used in confined areas.

The evaluation of the subgrade and selection of fill materials for various applications should be done in consultation with the soils engineer. Similarly, the placement and compaction of fill for structural applications should be monitored and tested by a qualified representative of the soils engineer.

**Groundwater Control**

Based on the boring information, it is not anticipated that significant groundwater seepage will occur during the excavation for the structure. However, based upon the geology of the area, it would not be uncommon for water to be present where isolated sandy outwash pockets are penetrated. If seepage is encountered, filtered sump pumps or other dewatering devices should be made available to control the water and maintain reasonably dry conditions.

Because the foundation materials are subject to deterioration when exposed to free moisture, every effort should be made to keep the soils dry, during and after construction. Site runoff and discharge water from roof drains should be diverted away from the foundation and directed towards on-site retention areas, natural drainage ways or municipal sewer systems. Such measures reduce the potential for the softening and possible erosion of the foundation subgrade soils.

**General Pavement Considerations**

After final pavement grade has been established, we recommend that the subgrade be compacted to at least 95 percent of maximum Standard Proctor dry density. In general, past experience and research in this area indicates that subgrades compacted to at least 95 percent of Standard Proctor dry density will exhibit a California Bearing Ratio (CBR) of at least 6 percent, which is sufficient to support the loads exerted by paving equipment. However, over time the CBR typically drops to about 3 percent on these types of soils due to climatological factors.

Rigid pavements should have a maximum joint spacing of 15-feet. The joints should be sealed after cutting to retard the downward migration of water and incompressible matter. For drainage purposes, a minimum pavement slope of 1 percent is recommended. Likewise, at a minimum, subgrade finger drains should be included around catch basins in the pavement to limit the accumulation of water under the pavement.

Specifications for aggregate, asphalt and PCC pavement materials should reference the **Illinois Department of Highways (IDOT), Standard Specifications for Road and**

**Bridge Construction**, *2012 edition*, including all addenda. Bituminous concrete binder and surface course is included in Section 406. Portland Cement concrete pavement is referenced in Section 420. Aggregate base course is referenced in Section 351 and Section 1004.

It should be noted that if subgrade preparation is attempted in the early spring or late fall months, it may not be possible to adequately aerate the subgrade to achieve the required densities. In this case, the use of geotextile fabrics or lime modification, depending on the type of subgrade materials present, might be considered to facilitate construction. Such an evaluation should be made in consultation with the geotechnical engineer at the time of construction.

### Excavations

All excavations should be performed in accordance with the requirements detailed in the OSHA Excavation Regulations and Procedures, Section 1926 Subpart P. Based upon the soil boring data, primarily Type A and Type B soils were encountered through the depth explored.

The maximum allowable slopes for the different soil types are shown in the following table.

| Soil Type | Maximum Allowable Slopes for Excavations Less that 20 ft. deep Horizontal : Vertical (H:V) |
|---|---|
| A | ¾ : 1 |
| B | 1: 1 |
| C | 1½:1 |

All excavations should be monitored by a Competent Person, as defined by the OSHA standard, and appropriate shoring or sloping techniques used to prevent cave-ins.

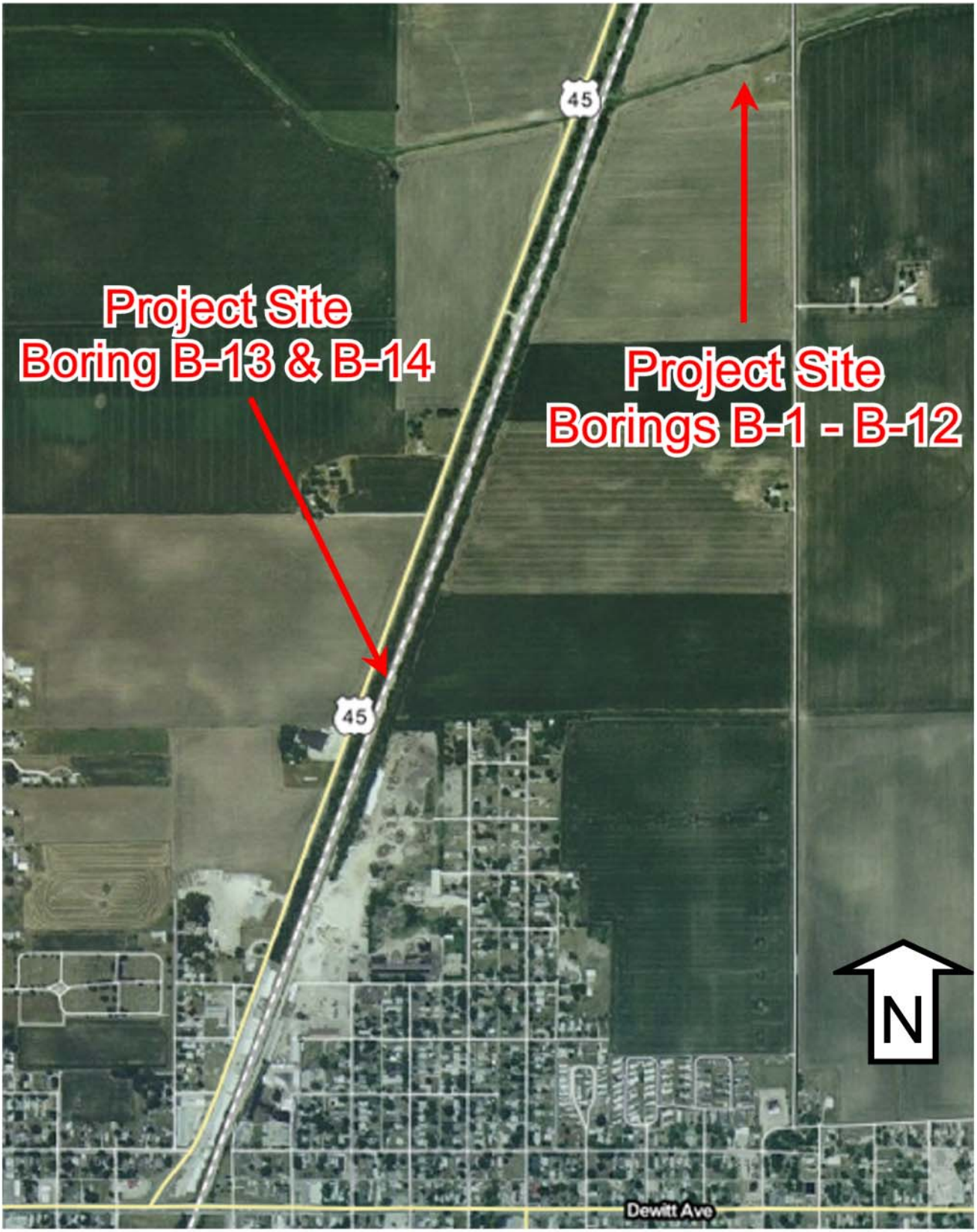
## GENERAL COMMENTS

This geotechnical exploration and foundation analysis has been conducted to aid in the evaluation of the foundation conditions for the proposed construction of sewers and a satellite treatment facility to convey and treat combined sewer overflow (CSO) at a site located north of the corporate limits of Mattoon, Illinois. The recommendations presented herein are based on the available soil information obtained and the design information provided. Any changes in the soil conditions encountered during construction or design should be brought to the attention of the soils engineer to determine if modifications in the recommendations are required. The final design plans and specifications should also be reviewed by the soils engineer to determine that the recommendations presented herein have been interpreted and implemented as

intended. It is recommended that the earthwork and foundation operations be monitored by the soils engineer in order that he/she may test and evaluate the bearing capacities and the selection, placement, and compaction of controlled fills.

This geotechnical study has been conducted in a manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The findings, recommendations, and opinions contained herein have been promulgated in accordance with generally accepted practice in the fields of foundation engineering, soils mechanics, and engineering geology.

# APPENDIX




MET

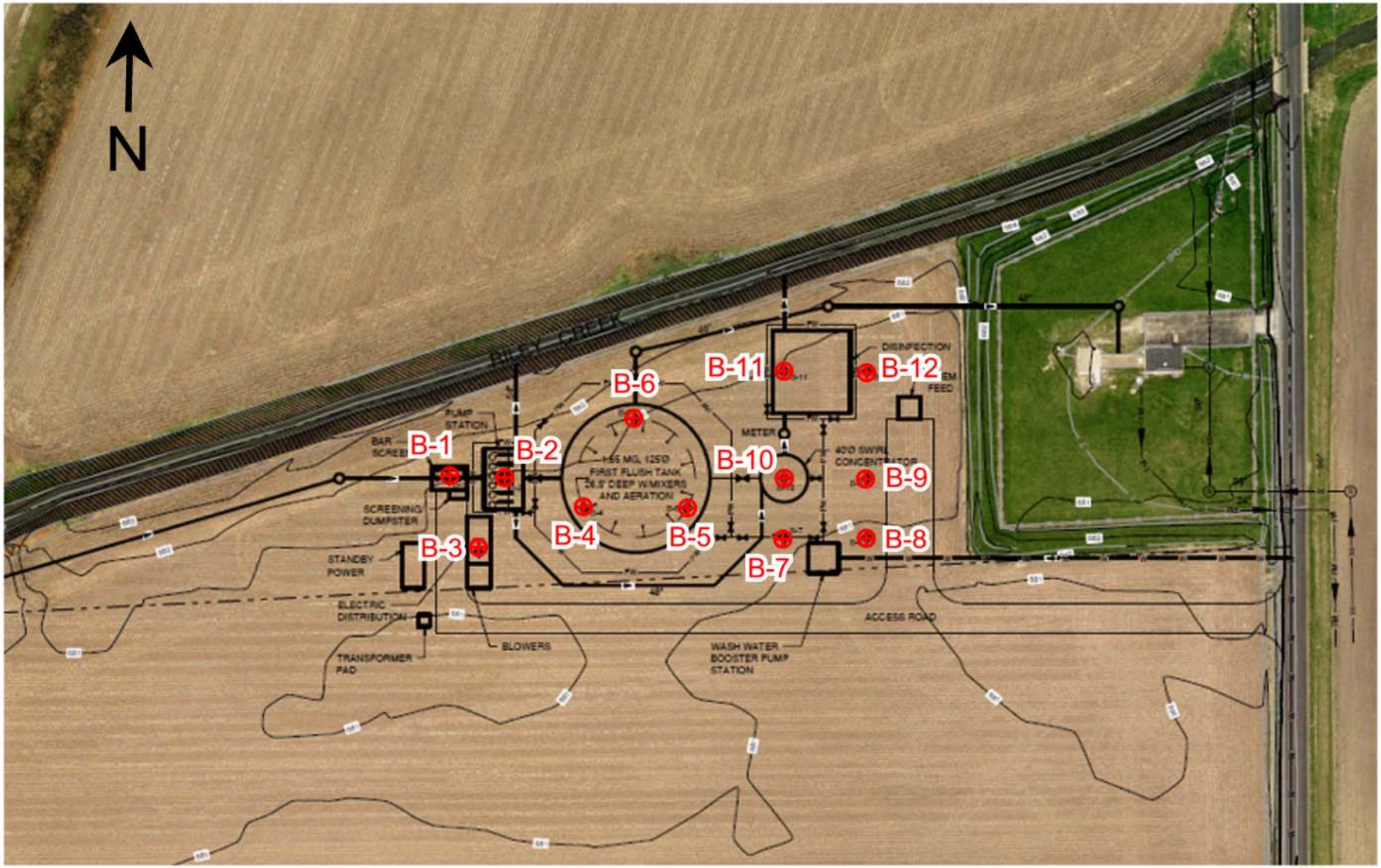
**Midwest Engineering and Testing, Inc.**

geotechnical*environmental*materials engineers

Figure 1
Vicinity Map

Proposed Riley Creek CSO
Satellite Treatment Facility
Mattoon, Illinois

| | |
|---|---|
| **SCALE:** | No Scale |
| **PROJECT NO.:** | 33075 |
| **DATE:** | January 21, 2014 |
| **DRAWN BY:** | JWO |




**Midwest Engineering and Testing, Inc.**

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Figure 2
Boring Location Diagram - B-1 through B-12

Proposed Riley Creek CSO
Satellite Treatment Facility
Mattoon, Illinois

**SCALE:** None

**PROJECT NO.:** 33075

**DATE:** January 15, 2014

**DRAWN BY:** JWO

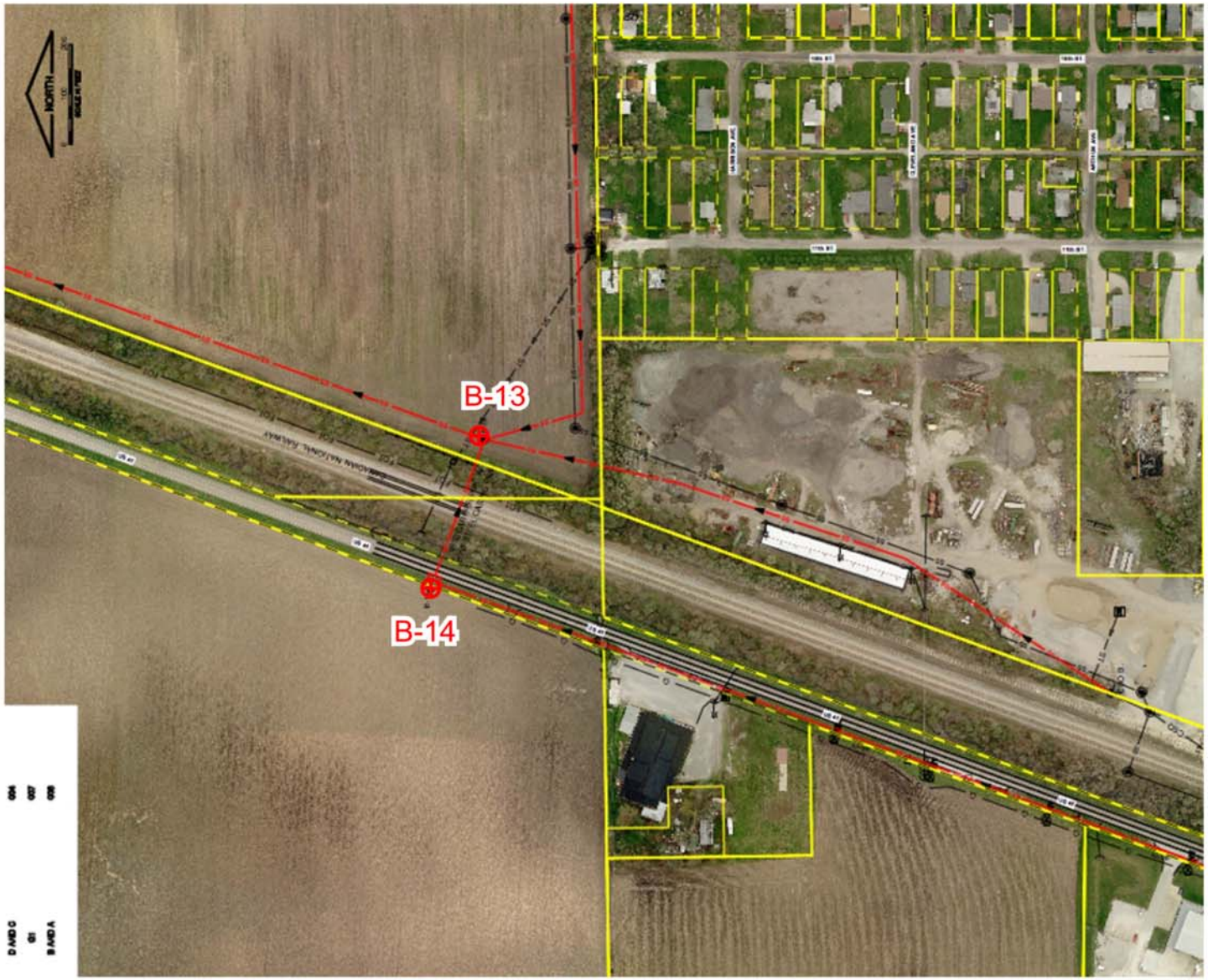


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Figure 3
Boring Location Diagram - B-13 & B-14

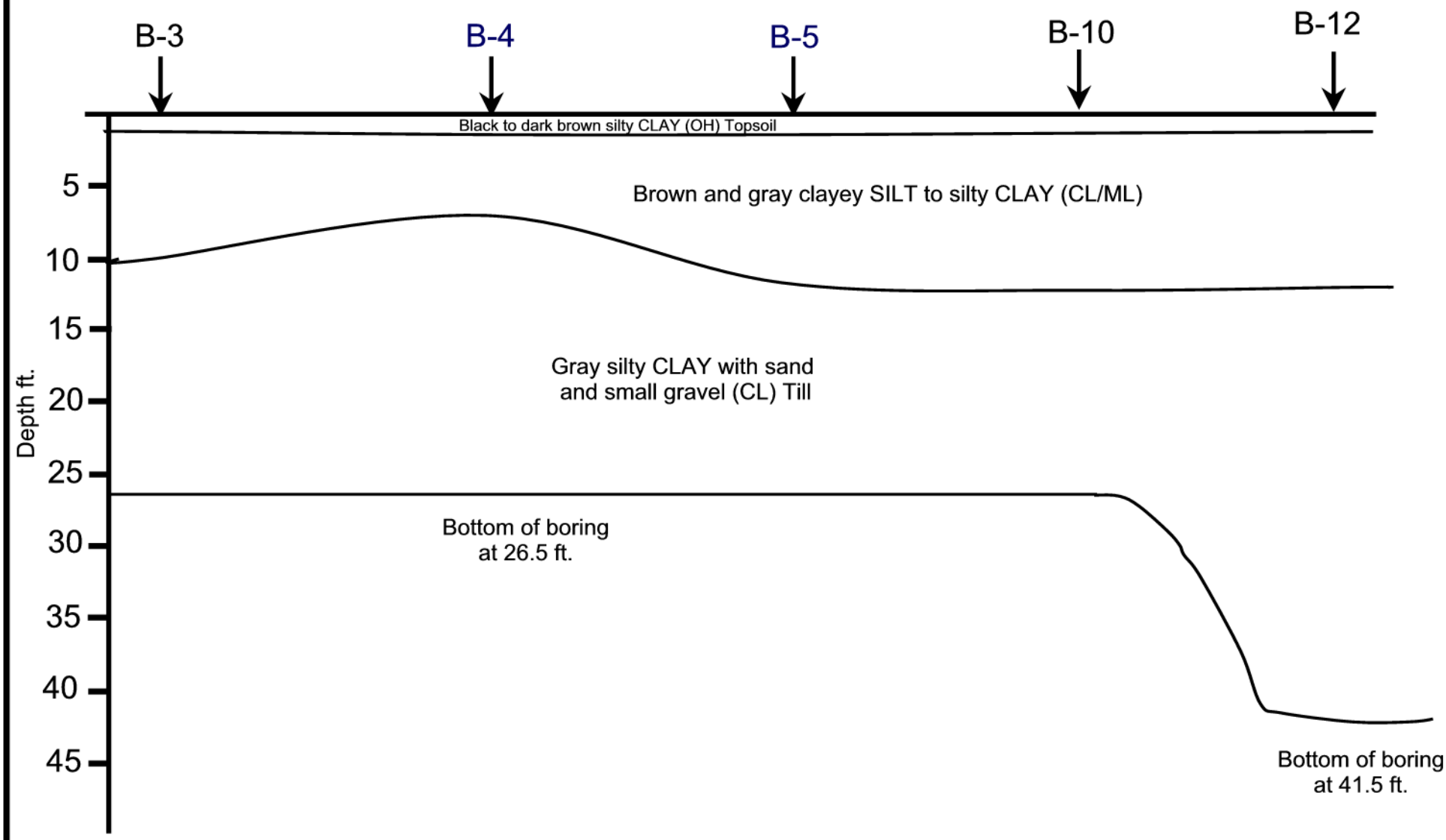
Proposed Riley Creek CSO
Satellite Treatment Facility
Mattoon, Illinois

**SCALE:** None

**PROJECT NO.:** 33075

**DATE:** January 15, 2014

**DRAWN BY:** JWO




**Midwest Engineering and Testing, Inc.**

geotechnical*environmental*materials engineers

Figure 4
General Soil Profile
Proposed Riley Creek CSO
Satellite Treatment Facility
Mattoon, Illinois

Horiz.1"=40 ft. / Vert. 1"=10 ft.

**PROJECT NO.:** 33075

**DATE:** January 31, 2014

**DRAWN BY:** DET

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-1
Project No. : 33075
Date of Boring: December 23, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 681.0 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 8" Dark brown silty CLAY (OH) Topsoil | | | | | | | | |
| Brown silty CLAY (CL) | | 1-SS | - | 1.5 | 3.0 | 28 | 83 | |
| | | 2-SS | 7 | 2.3 | 3.2 | 23 | 84 | Dry during and upon completion of drilling |
| Brown and gray clayey SILT (ML) | 5 | 3-SS | 9 | 4.0 | 1.2 | 21 | 90 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 4-SS | 9 | 2.0 | 2.4 | 14 | 106 | |
| | 10 | 5-SS | 12 | 1.3 | 2.4 | 14 | 113 | |
| | | 6-SS | 21 | 0.3 | - | 13 | - | |
| Brown and gray silty CLAY with small gravel (CL) Till | 15 | 7-SS | 19 | 4.5 | 8.0 | 10 | 124 | |
| | | 8-SS | 27 | 4.5 | 8.0 | 11 | 100 | |
| | 20 | 9-SS | 17 | 4.0 | 5.2 | 12 | 107 | |
| | | 10-SS | 19 | 3.3 | 4.0 | 12 | 119 | |
| | 25 | 11-SS | 18 | 3.3 | 3.6 | 13 | 109 | |
| **END OF BORING AT 26.5 FEET** | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-2
Project No. : 33075
Date of Boring: December 23, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.7 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 7" Black silty CLAY (OH) Topsoil | | | | | | | | |
| | | 1-SS | - | 2.3 | 3.4 | 29 | 87 | |
| | | 2-SS | 10 | 2.3 | - | 21 | - | Dry during and upon completion of drilling |
| Brown and gray clayey SILT with sand (ML) | 5 | | | | | | | |
| | | 3-SS | 6 | 2.8 | 2.8 | 13 | 109 | |
| | | 4-SS | 7 | 1.8 | 3.0 | 14 | 105 | |
| | 10 | | | | | | | |
| | | 5-SS | 11 | 2.3 | 4.0 | 14 | 115 | |
| | | 6-SS | 12 | 3.8 | 5.2 | 11 | 107 | |
| | 15 | | | | | | | |
| | | 7-SS | 20 | 3.3 | 6.2 | 12 | 121 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 8-SS | 15 | 3.5 | 4.0 | 10 | 97 | |
| | 20 | | | | | | | |
| | | 9-SS | 18 | 4.5 | 5.4 | 11 | 111 | |
| | | 10-SS | 17 | 3.8 | 5.4 | 12 | 119 | |
| | 25 | | | | | | | |
| | | 11-SS | 16 | 1.8 | 2.8 | 14 | 113 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-3
Project No. : 33075
Date of Boring: December 23, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.6 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 7" Black silty CLAY (OH) Topsoil | | | | | | | | |
| Brown and gray silty CLAY (CL) | | 1-SS | - | 3.8 | - | 23 | - | |
| | | 2-SS | 4 | 2.8 | 2.6 | 26 | 88 | Dry during and upon completion of drilling |
| | 5 | | | | | | | |
| Brown and gray clayey SILT (ML) | | 3-SS | 8 | 4.0 | - | 14 | - | |
| Brown and gray silty CLAY with sand (CL) | | 4-SS | 12 | 2.8 | 4.2 | 14 | 105 | |
| | 10 | | | | | | | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 5-SS | 13 | 1.8 | 3.4 | 13 | 124 | |
| | | 6-SS | 17 | 2.5 | 3.8 | 13 | 113 | |
| | 15 | | | | | | | |
| | | 7-SS | 19 | 4.3 | 5.4 | 12 | 120 | |
| | | 8-SS | 31 | 4.5 | 7.2 | 12 | 109 | |
| | 20 | | | | | | | |
| | | 9-SS | 15 | 3.0 | 5.4 | 12 | 109 | |
| | | 10-SS | 18 | 3.8 | 4.4 | 12 | 119 | |
| | 25 | | | | | | | |
| | | 11-SS | 19 | 2.8 | 3.2 | 13 | 112 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-4
Project No. : 33075
Date of Boring: December 10, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.3 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 6" Black silty CLAY (OH) Topsoil | | | | | | | | |
| | | 1-SS | - | 1.0 | 3.4 | 32 | 78 | |
| Brown and gray clayey SILT (ML) | | 2-SS | 7 | 2.3 | 2.2 | 22 | 92 | Dry during and upon completion of drilling |
| | 5 | 3-SS | 8 | 1.8 | - | 18 | - | |
| | | 4-SS | 9 | 1.8 | 4.2 | 19 | 97 | |
| | 10 | 5-SS | 11 | 3.3 | 3.6 | 12 | 112 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 6-SS | 11 | 3.8 | 3.7 | 13 | 118 | |
| | 15 | 7-SS | 14 | 4.5 | 6.5 | 11 | 111 | |
| 8-SS No Recovery | | 8-SS | 31 | - | - | - | - | |
| | 20 | 9-SS | 20 | 4.5 | - | 10 | - | |
| | | 10-SS | 18 | 2.5 | 4.0 | 13 | 117 | |
| | 25 | 11-SS | 15 | 1.8 | 2.4 | 13 | 113 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-5
Project No. : 33075
Date of Boring: December 23, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.2 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 6" Black silty CLAY (OH) Topsoil | | | | | | | | |
| Brown and gray clayey SILT (ML) | | 1-SS | - | 1.5 | 3.0 | 30 | 77 | |
| | | 2-SS | 6 | 2.3 | 2.4 | 28 | 88 | Dry during and upon completion of drilling |
| | 5 | 3-SS | 7 | - | - | 18 | - | |
| | | 4-SS | 9 | 2.5 | 4.4 | 26 | 95 | |
| | 10 | 5-SS | 9 | 1.8 | 3.2 | 35 | 95 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 6-SS | 11 | 1.5 | 4.6 | 13 | 120 | |
| | 15 | 7-SS | 9 | 1.8 | 3.6 | 13 | 111 | |
| | | 8-SS | 20 | 4.5 | 6.2 | 11 | 123 | |
| | 20 | 9-SS | 24 | 4.5 | - | 9 | - | |
| | | 10-SS | 17 | 4.3 | 4.0 | 12 | 117 | |
| | 25 | 11-SS | 18 | 3.3 | 3.4 | 13 | 106 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-6
Project No. : 33075
Date of Boring: December 23, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 681.0 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 7" Black silty CLAY (OH) Topsoil | | | | | | | | |
| | | 1-SS | - | 1.3 | - | 28 | - | |
| | | 2-SS | 11 | 4.5 | 7.2 | 19 | 97 | Dry during and upon completion of drilling |
| | 5 | | | | | | | |
| Brown and gray silty CLAY (CL) | | 3-SS | 8 | 2.5 | 1.4 | 18 | 94 | |
| | | 4-SS | 11 | 1.8 | 3.6 | 23 | 89 | |
| | 10 | | | | | | | |
| Gray clayey SILT (ML) | | 5-SS | 18 | 2.0 | - | 21 | - | |
| | | 6-SS | 10 | 2.8 | 3.4 | 13 | 108 | |
| | 15 | | | | | | | |
| | | 7-SS | 11 | 3.8 | 3.5 | 13 | 119 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 8-SS | 21 | 3.5 | 5.0 | 11 | 117 | |
| | 20 | | | | | | | |
| | | 9-SS | 25 | 4.5 | - | 10 | - | |
| | | 10-SS | 19 | 2.5 | 2.2 | 12 | 113 | |
| | 25 | | | | | | | |
| | | 11-SS | 17 | 1.8 | 3.4 | 13 | 106 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-7
Project No. : 33075
Date of Boring: December 23, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.7 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 7" Black silty CLAY (OH) Topsoil | | | | | | | | |
| Brown and gray clayey SILT with sand (ML) | | 1-SS | - | 0.8 | - | 31 | - | |
| | | 2-SS | 4 | 0.8 | - | 25 | - | Dry during and upon completion of drilling |
| | 5 | 3-SS | 6 | 0.8 | - | 15 | - | |
| Gray clayey SILT (ML) | | 4-SS | 6 | 1.8 | 3.2 | 24 | 99 | |
| | 10 | 5-SS | 13 | 2.5 | - | 28 | - | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 6-SS | 11 | 1.5 | 4.4 | 13 | 120 | |
| | 15 | 7-SS | 11 | 2.0 | 3.0 | 13 | 110 | |
| | | 8-SS | 18 | 2.5 | 6.1 | 12 | 121 | |
| | 20 | 9-SS | 19 | 4.0 | - | 10 | - | |
| | | 10-SS | 21 | 4.5 | 5.0 | 12 | 119 | |
| | 25 | 11-SS | 16 | 2.8 | 4.2 | 12 | 115 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-8
Project No. : 33075
Date of Boring: December 10, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 681.0 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 6" Black silty CLAY (OH) Topsoil | | | | | | | | |
| | | 1-SS | - | - | - | 27 | - | |
| | | 2-SS | 8 | 3.5 | 5.7 | 21 | 97 | Dry during and upon completion of drilling |
| Brown and gray silty CLAY (CL) | 5 | | | | | | | |
| | | 3-SS | 9 | 2.5 | - | 14 | - | |
| | | 4-SS | 9 | 4.0 | 5.2 | 23 | 90 | |
| | 10 | | | | | | | |
| | | 5-SS | 8 | 2.5 | 3.6 | 13 | 116 | |
| | | 6-SS | 10 | 4.0 | 4.7 | 12 | 112 | |
| | 15 | | | | | | | |
| | | 7-SS | 11 | 4.0 | 3.8 | 13 | 121 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 8-SS | 17 | 4.5+ | 8.2 | 10 | 123 | |
| | 20 | | | | | | | |
| | | 9-SS | 18 | 4.5+ | 6.4 | 12 | 106 | |
| | | 10-SS | 19 | 4.5+ | 6.0 | 12 | 120 | |
| | 25 | | | | | | | |
| | | 11-SS | 15 | 3.5 | 3.7 | 12 | 111 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-9
Project No. : 33075
Date of Boring: December 10, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.5 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 8" Black silty CLAY (OH) Topsoil | | | | | | | | |
| Brown and gray silty CLAY (CL) | | 1-SS | - | - | - | 31 | - | |
| | | 2-SS | 8 | 2.0 | - | 22 | - | Dry during and upon completion of drilling |
| | 5 | | | | | | | |
| Brown and gray clayey SILT (ML) | | 3-SS | 7 | 1.5 | - | 13 | - | |
| Gray silty CLAY (CL) | | 4-SS | 7 | 1.8 | 2.8 | 23 | 95 | |
| | 10 | | | | | | | |
| | | 5-SS | 7 | 2.0 | 3.0 | 23 | 101 | |
| Gray clayey SILT (ML) | | 6-SS | 15 | 4.0 | 3.8 | 26 | 100 | |
| | 15 | | | | | | | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 7-SS | 13 | 2.5 | 3.0 | 10 | 124 | |
| | | 8-SS | 17 | 4.5+ | 8.0 | 11 | 120 | |
| | 20 | | | | | | | |
| | | 9-SS | 15 | 4.5+ | 6.5 | 11 | 108 | |
| | | 10-SS | 12 | 4.5+ | 5.7 | 11 | 118 | |
| | 25 | | | | | | | |
| | | 11-SS | 13 | 4.0 | 4.1 | 12 | 107 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-10
Project No. : 33075
Date of Boring: December 10, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.3 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 6" Dark brown silty CLAY (OH) Topsoil | | | | | | | | |
| | | 1-SS | - | 2.5 | - | 28 | - | |
| Brown and gray clayey SILT (ML) | | 2-SS | 8 | 4.3 | - | 20 | - | Dry during and upon completion of drilling |
| | 5 | 3-SS | 10 | - | - | 13 | - | |
| Gray clayey SILT (ML) | | 4-SS | 7 | 2.0 | 3.6 | 24 | 101 | |
| | 10 | | | | | | | |
| Gray silty CLAY (CL) | | 5-SS | 13 | 3.0 | 3.8 | 19 | 93 | |
| | | 6-SS | 6 | 3.0 | 3.8 | 13 | 118 | |
| | 15 | 7-SS | 7 | 2.5 | 3.1 | 13 | 107 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 8-SS | 22 | 4.5+ | 13.6 | 10 | 121 | |
| | 20 | 9-SS | 22 | 4.5+ | 5.5 | 10 | 110 | |
| | | 10-SS | 17 | 4.5+ | 6.9 | 11 | 121 | |
| | 25 | 11-SS | 15 | 3.0 | 3.8 | 12 | 119 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-11
Project No. : 33075
Date of Boring: December 10, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.4 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 7" Black silty CLAY (OH) Topsoil | | | | | | | | |
| Dark brown silty CLAY (CL) | | 1-SS | - | 2.3 | 4.8 | 24 | 89 | |
| | | 2-SS | 10 | 4.0 | - | 23 | - | Dry during and upon completion of drilling |
| | 5 | | | | | | | |
| Brown and gray silty CLAY (CL) | | 3-SS | 6 | 2.5 | - | 21 | - | |
| | | 4-SS | 7 | 2.5 | 1.8 | 20 | 96 | |
| | 10 | | | | | | | |
| Gray clayey SILT (ML) | | 5-SS | 13 | 4.0 | 4.0 | 22 | 97 | |
| 6-SS No Recovery | | 6-SS | 11 | - | - | - | - | |
| | 15 | | | | | | | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 7-SS | 9 | 3.0 | 4.2 | 12 | 113 | |
| | | 8-SS | 32 | 4.3 | - | 10 | - | |
| | 20 | | | | | | | |
| Gray sandy CLAY (SC) | | 9-SS | 68 | - | - | 11 | - | |
| | | 10-SS | 26 | 4.5+ | 7.0 | 11 | 109 | |
| | 25 | | | | | | | |
| | | 11-SS | 23 | 4.5+ | 7.4 | 12 | 125 | |
| | 30 | | | | | | | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 12-SS | 23 | 4.5+ | 7.6 | 11 | 124 | |
| | 35 | | | | | | | |
| | | 13-SS | 13 | 1.5 | 2.0 | 23 | 105 | |
| | 40 | | | | | | | |
| | | 14-SS | 12 | 1.0 | 2.2 | 16 | 97 | |
| **END OF BORING AT 41.5 FEET** | | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-12
Project No. : 33075
Date of Boring: December 10, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 680.0 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 6" Dark brown silty CLAY (OH) Topsoil | | | | | | | | |
| | | 1-SS | - | 3.0 | 3.6 | 26 | 79 | |
| | | 2-SS | 9 | 4.3 | - | 17 | - | Dry during and upon completion of drilling |
| | 5 | | | | | | | |
| | | 3-SS | 7 | 2.0 | 2.0 | 20 | 102 | |
| Brown and gray clayey SILT (ML) | | | | | | | | |
| | | 4-SS | 7 | 4.0 | 3.4 | 22 | 102 | |
| | 10 | | | | | | | |
| | | 5-SS | 11 | 3.3 | 2.0 | 22 | 106 | |
| | | 6-SS | 9 | 3.5 | 4.4 | 12 | 117 | |
| | 15 | | | | | | | |
| | | 7-SS | 9 | 2.8 | 4.2 | 13 | 119 | |
| | | 8-SS | 27 | 4.5+ | 9.0 | 11 | 110 | |
| | 20 | | | | | | | |
| | | 9-SS | 19 | 4.5+ | 6.4 | 10 | 123 | |
| | | 10-SS | 20 | 3.0 | 5.2 | 12 | 109 | |
| Gray silty CLAY with sand and small gravel (CL) Till | 25 | | | | | | | |
| | | 11-SS | 15 | 4.0 | 3.8 | 12 | 122 | |
| | 30 | | | | | | | |
| | | 12-SS | 22 | 4.5+ | 10.6 | 11 | 123 | |
| | 35 | | | | | | | |
| | | 13-SS | 13 | 1.3 | 2.0 | 23 | 110 | |
| | 40 | | | | | | | |
| | | 14-SS | 11 | 1.5 | 1.6 | 20 | 95 | |
| **END OF BORING AT 41.5 FEET** | | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-13
Project No. : 33075
Date of Boring: December 26, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 687.6 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 6" Black silty CLAY (OH) Topsoil | | | | | | | | |
| Brown and gray silty CLAY (CL) | | 1-SS | - | 3.5 | - | 31 | - | |
| | | 2-SS | 7 | 2.3 | 2.8 | 25 | 83 | Dry during and upon completion of drilling |
| | 5 | | | | | | | |
| Brown and gray clayey SILT with sand (ML) | | 3-SS | 3 | 0.8 | 0.9 | 30 | 87 | |
| Gray clayey SILT (ML) | | 4-SS | 6 | 1.0 | 1.5 | 19 | 107 | |
| | 10 | | | | | | | |
| | | 5-SS | 9 | 2.0 | 2.9 | 14 | 108 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 6-SS | 10 | 3.3 | 4.2 | 13 | 123 | |
| | 15 | | | | | | | |
| | | 7-SS | 9 | 1.8 | 2.8 | 13 | 106 | |
| | | 8-SS | 18 | 4.5 | 6.4 | 10 | 104 | |
| | 20 | | | | | | | |
| | | 9-SS | 21 | 4.5 | 6.8 | 11 | 120 | |
| | | 10-SS | 22 | 4.5 | 9.1 | 10 | 121 | |
| | 25 | | | | | | | |
| | | 11-SS | 22 | 4.5 | 6.4 | 11 | 103 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
Mattoon, Illinois

Boring: B-14
Project No. : 33075
Date of Boring: December 26, 2013
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: 690.3 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 8" Black silty CLAY (OH) Topsoil | | | | | | | | |
| | | 1-SS | - | 1.3 | - | 25 | - | |
| | | 2-SS | 6 | - | - | 26 | - | Dry during and upon completion of drilling |
| Brown silty CLAY with sand (CL) | 5 | | | | | | | |
| | | 3-SS | 5 | 1.0 | 1.4 | 17 | 109 | |
| Brown clayey SILT (ML) | | 4-SS | 10 | 1.8 | 2.7 | 25 | 99 | |
| | 10 | | | | | | | |
| | | 5-SS | 8 | 2.0 | 3.1 | 14 | 109 | |
| Gray silty CLAY with sand and small gravel (CL) Till | | 6-SS | 11 | 3.8 | 5.2 | 12 | 119 | |
| | 15 | | | | | | | |
| | | 7-SS | 12 | 3.5 | 5.0 | 12 | 118 | |
| 8-SS No Recovery Possible Cobbles | | 8-SS | 19 | - | - | - | - | |
| | 20 | | | | | | | |
| | | 9-SS | 10 | 4.5+ | - | 13 | - | |
| 10-SS No Recovery Possible Cobbles | | 10-SS | 22 | - | - | - | - | |
| | 25 | | | | | | | |
| | | 11-SS | 15 | 4.5+ | 7.4 | 12 | 119 | |
| **END OF BORING AT 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

# GENERAL NOTES

## SAMPLE IDENTIFICATION

Visual soil classifications are made in general accordance with the Unified Soil Classification System on the basis of textural and particle size categorization, and various soil behavior characteristics. Visual classifications should be substantiated by appropriate laboratory testing when a more exact soil identification is required to satisfy specific project applications criteria.

PARTICLE SIZE ±

| | | |
|---|---|---|
| Boulders: 8 inches | Coarse Sand: 2 mm to 4 mm | Silt: 0.005 mm to 0.074 mm |
| Cobbles: 3 to 8 inches | Medium Sand: 0.42 mm to 2 mm | Clay: - 0.005 mm |
| Gravel: 5 mm to 3 inches | Fine Sand: 0.074 to 0.42 mm | |

## DRILLING & SAMPLING SYMBOLS

SS: Split-spoon, 2" O.D. by 1 3/8" I.D.
ST: Shelby Tube, 2" O.D. or 3" O.D., as noted in test
AU: Auger Sample
DB: Diamond Bit
CB: Carbide Bit
RB: Roller Bit
WS: Wash Sample
BS: Bag Sample
HA: Hand Auger

## SOIL PROPERTY SYMBOLS

N: Standard penetration count, indicating number of blows of a 140 lb. Hammer with a 30-inch drop, required to advance a split-spoon sampler one (1) foot.
Qu: Unconfined compressive strength, tons per square foot (tsf).
Qp: Calibrated hand penetrometer resistance, tsf.
MC: Moisture Content, %
LL: Liquid Limit PL: Plastic Limit PI: Plasticity Index
Dd: Dry density, pounds per cubic foot (pcf).
PID Photoionization Detector (Hnu meter) volatile vapor level, ppm

## SOIL RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

| NON-COHESIVE SOILS | | COHESIVE SOILS | | |
|---|---|---|---|---|
| Classifier | N-Value Range | Classifier | Qu Range (tsf) | N-Value Range |
| very loose | 0 – 3 | very soft | 0 – 0.25 | 0 – 2 |
| loose | 3 – 7 | soft | 0.25 – 0.5 | 2 – 5 |
| medium dense | 7 – 15 | medium stiff | 0.5 – 1.0 | 5 – 10 |
| dense | 15 – 38 | stiff | 1.0 – 2.0 | 10 – 14 |
| very dense | 38 + | very stiff | 2.0 – 4.0 | 14 – 32 |
| | | hard | 4.0 + | 32 + |

## GROUNDWATER

Approximate Groundwater level at time noted on soil boring log, measured in open bore hole unless otherwise noted. Groundwater levels often vary with time, and are affected by soil permeability characteristics, weather conditions, and lateral drainage conditions.

# UNIFIED SOIL CLASSIFICATION

| MAJOR DIVISIONS | | | SYMBOL | TYPICAL DESCRIPTION |
|---|---|---|---|---|
| COARSE GRAINED SOILS | Gravel and Gravelly Soils | Clean Gravels | GW | Well-graded gravels and gravel-sand mixtures |
| | | | GP | Poorly-graded gravels and gravel-sand mixtures |
| | | Gravels with Fines | GM | Silty gravels and gravel-sand-silt mixtures |
| | | | GC | Clayey gravels and gravel-sand-clay mixtures |
| | Sand and Sandy Soils | Clean Sands | SW | Well-graded sands and gravelly sands |
| | | | SP | Poorly-graded sands and gravelly sands |
| | | Sands with Fines | SM | Silty sands and sand-silt mixtures |
| | | | SC | Clayey sands and sand-clay mixtures |
| FINE GRAINED SOILS | Silts and Clays of Low Plasticity | | ML | Inorganic silts or clayey silts of slight plasticity |
| | | | CL | Inorganic clays of low to medium plasticity |
| | | | OL | Organic silts and organic silty clays of low plasticity |
| | Silts and Clays of High Plasticity | | MH | Inorganic silts of high plasticity |
| | | | CH | Inorganic clays of medium to high plasticity |
| | | | OH | Organic clays of medium to high plasticity |
| Highly Organic Soils | | | PT | Peat, humus and swamp soils with high organic contents |

***Note: Dual symbols are used to indicate borderline classifications.***

**Midwest Engineering and Testing, Inc.**
geotechnical · environmental · materials engineers
501 Mercury Drive
Champaign, IL 61822-9649
Phone 2173592128
FAX 217-359-8446
www.metgeotech.com

June 11, 2014

Mr. Timothy F. Sumner, P.E.
Crawford, Murphy & Tilly, Inc.
2750 W. Washington Street
Springfield, IL 62702

Re: Subsurface Exploration and Geotechnical Evaluation
Proposed Riley Creek CSO
Satellite Treatment Facility
New Conceptual Layout
Mattoon, Illinois
MET Project No. 33075.1R1

Dear Mr. Sumner:

In accordance with your request, six (6) additional soil borings, labeled B-15 through B-20, were completed by Midwest Engineering and Testing, Inc. (MET) for the above-referenced project. Fourteen (14) borings (B-1 through B-14) were originally advanced at the site in December 2013 with the results documented in MET Report 33075, dated February 7, 2014. The additional borings were requested because the conceptual site layout has changed, shifting the proposed structures eastward. This letter report includes our findings and recommendations regarding design and construction of the foundation systems, and should be considered in complete context with the original geotechnical report.

Authorization to perform this subsurface exploration was given by Crawford, Murphy & Tilly, Inc. (CMT) and considered to be an extension of a Subconsultant Agreement executed for the original geotechnical work.

## PROJECT AND SITE DESCRIPTION

The project site is located north of Mattoon, Illinois southwest of the CR 620E (N. 6$^{th}$ Street) bridge over Riley Creek. The proposed CSO complex has been shifted eastward such that most new structures will now be located in a grassy area presently occupied by the Riley Creek Pump Station. A Vicinity Map, Figure 1, and Boring Location Diagram showing the site layout, Figure 2, are included in the Appendix.

The proposed project includes the following structures:

- Screen Building and Diversion Structure
- First Flush Tank
- Blower Building
- Pump Station
- Swirl Concentrator
- Disinfection Structure and Chemical Feed Building
- Foul Sewer Pump Station

## FIELD EXPLORATION

Field exploration activities were similar to those described in the original geotechnical report, except boring depths for this project ranged from 26.5 to 51.5 feet. In addition, the borings were staked in the field by Upchurch and Associates and the ground surface elevations shown on the Soil Boring Logs were interpolated from contour lines superimposed onto the Conceptual Plan.

## LABORATORY TESTING

The laboratory testing program for this project was identical to that described in the original geotechnical report.

## DESCRIPTION OF SUBSURFACE CONDITIONS

In general, the soil stratigraphy encountered in borings B-15 through B-20 did not vary significantly from that described in the original geotechnical report. The ground surface at the boring locations was covered with 3 to 14 inches of surficial topsoil and vegetation. The topsoil was underlain by a stratum of stiff to very stiff, brown and gray mottled silty clay of loessial origin that extended through depths of about 5 to 7 feet. Below the loessial soils, glacial drift deposits were encountered that continued through the remaining depths explored. The drift was comprised primarily of very stiff to hard, silty clay glacial till with occasional inclusions of silt and sandy clay. In boring B-20, black organic silt was encountered in the sample obtained from a depth of 35 feet.

Groundwater level observations were made during the drilling process and the water levels are noted on the Soil Boring Logs in the Remarks column. Groundwater was encountered in borings B-15, B-16, B-18 and B-20 at depths of 15 and 25 feet during the drilling operations. On completion of the drilling activities, the water level was measured at a depth of 10 feet below surface grade in borings B-15, B-16 and B-20.

It must be recognized that groundwater levels fluctuate with time due to variations in seasonal precipitation, lateral drainage conditions, and soil permeability characteristics. At this site, the loessial and glacial deposits overlying the till will tend to store infiltrated precipitation and create “perched” groundwater conditions. The presence and depth of “perched” groundwater fluctuates seasonally and can disappear completely, but is subject to recharge from future precipitation. It would not be uncommon for a seasonally high water table to develop within 5 to 7 feet of surface grade.

## FOUNDATION DISCUSSION AND RECOMMENDATIONS

### General

On the basis of the subsurface conditions encountered in the borings, it is our opinion that shallow foundation systems consisting of footings or reinforced concrete mats could

be considered for support of the various structures. Discussions of the foundation design parameters and construction considerations are included in the following sections.

**Shallow Foundation Systems**

Screen Building and Diversion Structure

It is assumed that the Screen Building/Diversion Structure is the same as the Bar Screen Structure referred to in the original geotechnical report with a base elevation approximately 19 to 20 feet below grade. The nearest borings to this structure are B-11 and B-12, which appear to indicate the bearing soils will consist of very stiff to hard, silty clay glacial till. It is recommended that footing or mat type foundations supported on the soils at this level be designed using a net allowable bearing pressure of 4000 PSF.

Pump Station

The base of the Pump Station will reportedly be approximately 20 feet below surface grade. The soils encountered at this depth in boring B-15 consisted of hard, silty clay glacial till underlain by firm sandy clay. It is recommended that footing or mat type foundations supported on the soils at this level be designed using a net allowable bearing pressure of 4000 PSF.

Swirl Concentrator

The Swirl Concentrator will be a 21-ft. diameter by 15-ft. deep structure. The nearest borings are B-15 and B-18, which appear to indicate the bearing soils will consist of very stiff to hard, silty clay glacial till. It is recommended that footing or mat type foundations supported on the soils at this level be designed using a net allowable bearing pressure of 4000 PSF.

Disinfection Structure and Chemical Feed Building

The base of the Disinfection Structure will reportedly be approximately 14 feet below surface grade. At this depth, borings B-18 and B-19 indicate the bearing soils will consist of stiff to very stiff, silty clay glacial till. It is recommended that footing or mat type foundations supported on the soils at this level be designed using a net allowable bearing pressure of 4000 PSF.

The Chemical Feed Building will be a slab-on-grade, stand-alone structure constructed adjacent to the Disinfection Structure. The brown and gray mottled silty clays encountered in all borings immediately below the surficial topsoil are considered suitable for support of shallow footings or mat foundations using a net allowable bearing pressure of 3000 PSF. Depending on the separation distance from the Disinfection Structure, it is possible that some footings for the Chemical Feed Building will be

supported on backfill materials. Care must be taken to properly place and compact backfill that will provide partial support for foundations or floor slabs. It is typically our preference that such backfill materials consist of sand or gravel, which is easier to compact in confined conditions.

First Flush Tank

The First Flush Tank will be a 125-ft. diameter by 26-ft. deep structure. Boring B-16 indicates the bearing soils will consist of very stiff to hard, silty clay glacial till and it is recommended that footing or mat type foundations be designed using a net allowable bearing pressure of 4000 PSF.

It is understood that drilled piers, with or without enlarged bases, are being considered to hold the First Flush Tank down during periods of high groundwater or floods. Any pullout forces on drilled piers would be resisted by the dead weight of the concrete, the frictional resistance between the surface of the pier and the surrounding soil through its reinforced length and, if the pier is belled, the contribution from the enlarged base. In boring B-16, the average undrained shear strength between the depths of 25 and 50 feet was about 2.1 TSF, which would allow a skin friction value of 1.2 TSF using an adhesion factor of 0.55. In calculating pullout capacity, the adhesion around the upper 5 feet of the shaft and the 5 feet of shaft length above the top of the bell should be ignored. If the piers will have bell sizes at least two times the diameter of the shaft, the pullout resistance will be double the frictional resistance plus the pier weight.

Blower Building

The Blower Building will be a slab-on-grade structure and may be supported on shallow footings bearing on the brown and gray mottled silty clays encountered in boring B-17 immediately below the surficial topsoil. It is our recommendation that footings be designed using a net allowable bearing pressure of 3000 PSF.

Foul Sewer Pump Station

The base of the Foul Sewer Pump Station will reportedly be approximately 40 feet below surface grade. At this depth, boring B-20 indicates the bearing soils will consist of stiff, sandy clay glacial till. It is recommended that footing or mat type foundations supported on the soils at this level be designed using a net allowable bearing pressure of 3000 PSF.

**Lateral Earth Pressures**

The soil conditions encountered in borings B-15 through B-20 do not appear to require changes to the discussion of lateral earth pressures contained in the original geotechnical report.

**Floor Slabs**

The soil conditions encountered in borings B-15 through B-20 do not appear to require changes to the discussion of floor slabs or slabs-on-grade contained in the original geotechnical report.

**CONSTRUCTION CONSIDERATIONS**

No changes appear necessary to the **Site Preparation** section of the original geotechnical report. However, it is considered likely that groundwater seepage will be experienced in excavations extending below a depth of 10 feet. Above this level, seepage could also occur, depending on the time of year construction takes place.

This geotechnical study has been conducted in a manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The findings, recommendations, and opinions contained herein have been promulgated in accordance with generally accepted practice in the fields of foundation engineering, soils mechanics, and engineering geology. No other representations, expressed or implied, and no warranty or guarantee is included or intended in this report.

If there are any questions arise regarding the information presented or if we may be of any further service, please contact us at your convenience.

Sincerely,

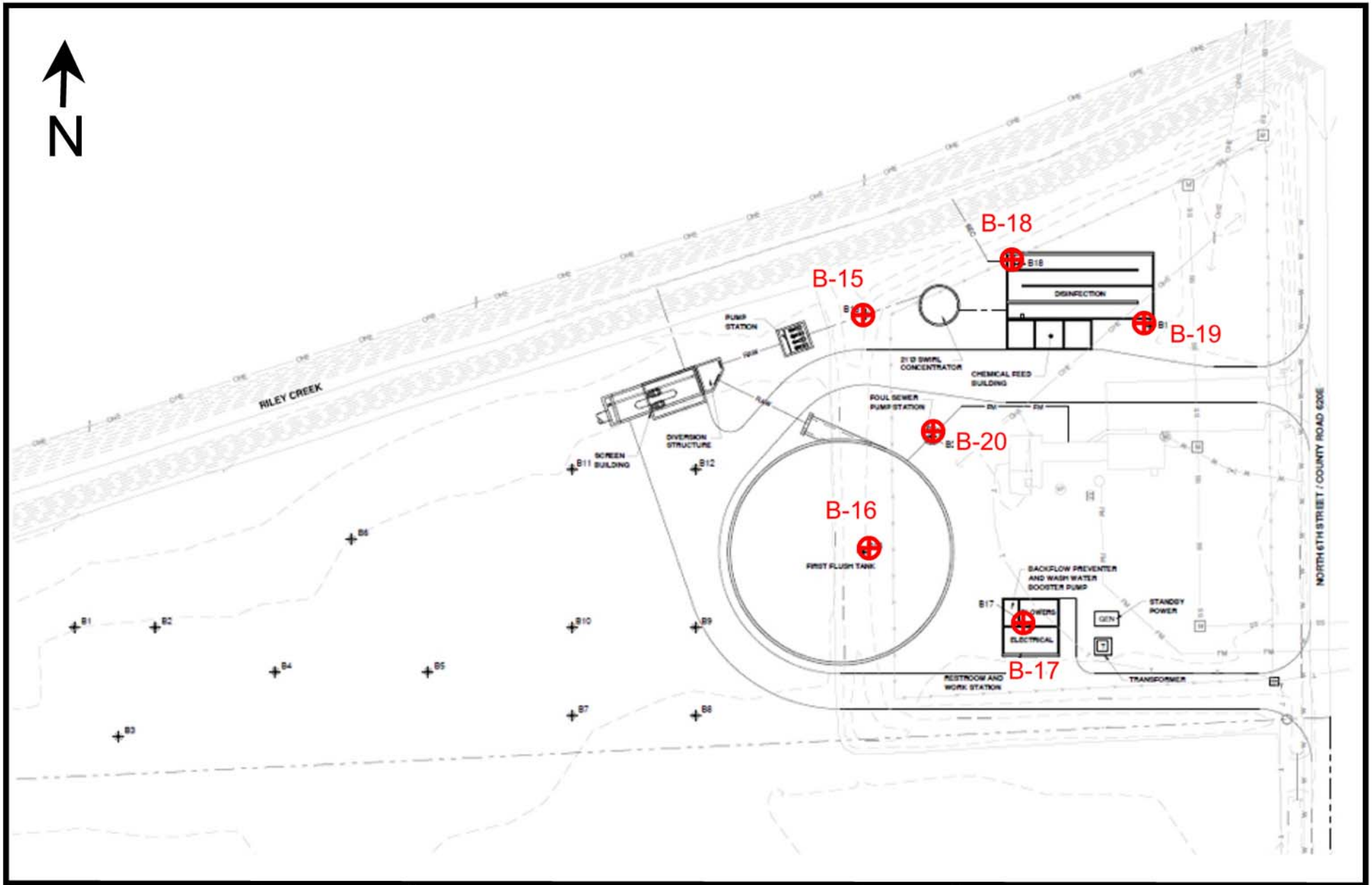
**Midwest Engineering and Testing, Inc.**

Robert W. Hahn, P.E.
Principal Engineer

Daniel E. Tappendorf, P.E.
President

Enclosures: Vicinity Map
Boring Location Diagram
Boring Logs (8)
General Notes (2)

| | | |
|---|---|---|
| **MET**<br>**Midwest Engineering and Testing, Inc.**<br>geotechnical*environmental*materials engineers | Figure 1 - Vicinity Map<br><br>Proposed Riley Creek CSO<br>Satellite Treatment Facility<br>New Conceptual Layout<br>Mattoon, Illinois | **SCALE:** No Scale<br>**PROJECT NO.:** 33075.1<br>**DATE:** May 20, 2014<br>**DRAWN BY:** JWO |




**MET**

**Midwest Engineering and Testing, Inc.**

geotechnical*environmental*materials engineers

Figure 2 - Boring Location Diagram
Proposed Riley Creek CSO
Satellite Treatment Facility
New Conceptual Layout
Mattoon, Illinois

**SCALE:** None

**PROJECT NO.:** 33075.1

**DATE:** May 20, 2014

**DRAWN BY:** JWO

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

| | | | |
|---|---|---|---|
| Project Name: | Proposed Riley Creek CSO | Boring: | B-15 |
| Location: | Satellite Treatment Facility<br>New Conceptual Layout<br>Mattoon, Illinois | Project No. : | 33075.1 |
| | | Date of Boring: | May 14, 2014 |
| | | Field Representative: | Zach Wilcoxen |

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: ±683.0 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 3" Black silty CLAY (OL), Topsoil | | 1-AU | - | - | - | 43 | - | |
| Brown and gray mottled silty CLAY (CL) | | 2-SS | 6 | 2.0 | 2.4 | 22 | 99 | |
| | 5 | 3-SS | 8 | 2.5 | 2.8 | 27 | 89 | |
| Brown and gray mottled clayey SILT (ML) | | 4-SS | 4 | 0.5 | 1.0 | 24 | 108 | |
| | 10 | 5-SS | 8 | 1.5 | 4.6 | 24 | 106 | Completion: 10 ft. |
| Brown clayey SILT (ML) with sand | | 6-SS | 17 | 1.5 | 4.8 | 21 | 123 | |
| | 15 | 7-SS | 13 | 3.5 | 4.8 | 14 | 118 | Drilling: 15 ft. |
| Gray silty CLAY (CL) with sand and small gravel, Till | | 8-SS | 12 | 1.5 | 2.8 | 13 | 117 | |
| | 20 | 9-SS | 19 | 4.5+ | 11.4 | 11 | 136 | |
| Gray sandy CLAY (SC) | 25 | 11-SS | 21 | - | - | 15 | - | |
| **END OF BORING @ 26.5 FEET** | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |
| | 45 | | | | | | | |
| | 50 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

| | | | |
|---|---|---|---|
| Project Name: | Proposed Riley Creek CSO | Boring: | B-16 |
| Location: | Satellite Treatment Facility<br>New Conceptual Layout<br>Mattoon, Illinois | Project No. : | 33075.1 |
| | | Date of Boring: | May 15, 2014 |
| | | Field Representative: | Zach Wilcoxen |

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: ±682.0 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 3" Black silty CLAY (OL), Topsoil | | 1-AU | - | - | - | 28 | - | |
| Brown and dark gray mottled silty CLAY (CL) | | 2-SS | 8 | 3.0 | 4.4 | 27 | 87 | |
| | 5 | 3-SS | 4 | 1.0 | 1.6 | 33 | 80 | |
| Brown and gray mottled silty CLAY (CL) | | 4-SS | 5 | 1.5 | 2.4 | 27 | 90 | |
| | 10 | | | | | | | |
| Brown silty CLAY (CL) with sand and small gravel, Till | | 5-SS | 9 | 3.0 | 4.0 | 15 | 112 | Completion: 10 ft. |
| | | 6-SS | 9 | 2.0 | 2.2 | 15 | 117 | |
| | 15 | 7-SS | 9 | 2.8 | 4.2 | 13 | 116 | |
| | | 8-SS | 15 | 3.5 | 4.4 | 12 | 120 | |
| | 20 | 9-SS | 19 | 4.5+ | 8.4 | 11 | 120 | |
| | | 10-SS | 20 | 4.5+ | 8.2 | 10 | 124 | |
| Gray silty CLAY (CL) with sand and small gravel, Till | 25 | 11-SS | 16 | 2.8 | 3.6 | 14 | 118 | Drilling: 25 ft. |
| | 30 | 12-SS | 17 | 3.5 | 5.0 | 13 | 119 | |
| | 35 | 13-SS | 20 | 2.5 | - | 54 | - | |
| Dark gray silty CLAY (CL) | 40 | 14-SS | 8 | 2.0 | 2.6 | 21 | 102 | |
| | 45 | 15-SS | 86 | 4.5+ | 6.2 | 9 | 127 | |
| Gray silty CLAY (CL) with sand and small gravel, Till | 50 | 16-SS | 50/4" | 4.5+ | 5.6 | 10 | 127 | |
| **END OF BORING @ 51.5 FEET** | | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

| | | | |
|---|---|---|---|
| Project Name: | Proposed Riley Creek CSO | Boring: | B-17 |
| Location: | Satellite Treatment Facility<br>New Conceptual Layout<br>Mattoon, Illinois | Project No. : | 33075.1 |
| | | Date of Boring: | May 13, 2014 |
| | | Field Representative: | Zach Wilcoxen |

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: ±681.2 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 8" Black silty CLAY (OL), Topsoil | | 1-SS | - | 3.3 | 3.7 | 27 | 84 | |
| Brown and gray mottled silty CLAY (CL) | | 2-SS | 6 | 2.3 | 2.6 | 26 | 85 | Dry during and on completion of drilling |
| | 5 | 3-SS | 4 | 0.8 | 2.4 | 30 | 84 | |
| Brown silty CLAY (CL) with sand | | 4-SS | 13 | 2.5 | 2.9 | 15 | 103 | |
| | 10 | 5-SS | 8 | 1.8 | 3.6 | 14 | 113 | |
| Gray silty CLAY (CL) with sand | | 6-SS | 9 | 2.5 | 3.2 | 13 | 116 | |
| | 15 | 7-SS | 13 | 2.8 | 4.4 | 12 | 112 | |
| | | 8-SS | 31 | 4.5+ | 8.1 | 11 | 112 | |
| | 20 | 9-SS | 16 | 4.5+ | 9.8 | 10 | 108 | |
| | | 10-SS | 15 | 4.3 | 4.5 | 10 | 114 | |
| | 25 | 11-SS | 22 | 3.3 | 4.5 | 13 | 110 | |
| Gray silty CLAY (CL) with sand and small gravel, Till | | | | | | | | |
| | 30 | 12-SS | 16 | 2.5 | 3.4 | 13 | 112 | |
| | 35 | 13-SS | 6 | 3.8 | 1.4 | 11 | 103 | |
| | 40 | 14-SS | 5 | 0.8 | 0.2 | 15 | 123 | |
| Gray sandy CLAY (SC) | | | | | | | | |
| | 45 | 15-SS | 98 | 4.5+ | - | 7 | - | |
| Gray silty CLAY (CL) with sand and small gravel, Till | | | | | | | | |
| | 50 | 16-SS | 107 | 4.5+ | 4.2 | 7 | 121 | |
| **END OF BORING @ 51.5 FEET** | | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

| | | | |
|---|---|---|---|
| Project Name: | Proposed Riley Creek CSO | Boring: | B-18 |
| Location: | Satellite Treatment Facility<br>New Conceptual Layout<br>Mattoon, Illinois | Project No. : | 33075.1 |
| | | Date of Boring: | May 13, 2014 |
| | | Field Representative: | Zach Wilcoxen |

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: ±681.8 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 14" Black silty CLAY (OL), Topsoil | | 1-SS | - | 1.8 | 2.0 | 22 | 89 | |
| Brown and gray mottled silty CLAY (CL) | | 2-SS | 7 | 3.3 | 3.3 | 27 | 91 | |
| | 5 | 3-SS | 5 | 1.3 | 2.5 | 26 | 88 | |
| Brown clayey SILT (ML) | | 4-SS | 6 | 1.0 | 2.6 | 24 | 107 | |
| | 10 | 5-SS | 15 | 1.3 | 1.8 | 16 | 128 | |
| | | 6-SS | 9 | 2.3 | 2.8 | 14 | 111 | |
| | 15 | 7-SS | 10 | 2.0 | 2.6 | 14 | 116 | |
| Gray silty CLAY (CL) with sand and small gravel, Till | | 8-SS | 16 | 2.3 | 2.2 | 15 | 122 | Drilling: 17.5 ft. |
| | 20 | 9-SS | 22 | 4.0 | 5.3 | 11 | 115 | |
| | | 10-SS | 30 | 4.0 | 8.4 | 10 | 124 | |
| | 25 | 11-SS | 28 | 3.5 | 6.6 | 12 | 120 | |
| **END OF BORING @ 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |
| | 45 | | | | | | | |
| | 50 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

Project Name: Proposed Riley Creek CSO
Location: Satellite Treatment Facility
New Conceptual Layout
Mattoon, Illinois

Boring: B-19
Project No. : 33075.1
Date of Boring: May 13, 2014
Field Representative: Zach Wilcoxen

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: ±681.1 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 8" Black silty CLAY (OL), Topsoil | | 1-AU | - | 2.8 | 4.0 | 25 | 93 | |
| Brown and gray mottled silty CLAY (CL) | | 2-SS | 6 | 3.3 | 3.8 | 23 | 90 | Dry during and on completion of drilling |
| | 5 | | | | | | | |
| Brown and gray mottled clayey SILT (ML) | | 3-SS | 3 | 1.3 | 1.6 | 20 | 98 | |
| Brown and gray mottled silty CLAY with sand (CL) | | 4-SS | 15 | 1.8 | 1.2 | 15 | 109 | |
| | 10 | | | | | | | |
| Gray silty CLAY (CL) with sand and small gravel, Till | | 5-SS | 6 | 1.3 | 2.2 | 13 | 122 | |
| | | 6-SS | 7 | 2.0 | 2.6 | 14 | 114 | |
| | 15 | | | | | | | |
| | | 7-SS | 15 | 3.0 | 3.8 | 12 | 119 | |
| | | 8-SS | 30 | 4.5+ | 12.8 | 9 | 119 | |
| | 20 | | | | | | | |
| | | 9-SS | 51 | 3.8 | 6.0 | 13 | 110 | |
| | | 10-SS | 28 | 4.5+ | 8.5 | 8 | 124 | |
| | 25 | | | | | | | |
| | | 11-SS | 15 | 3.5 | 4.9 | 12 | 116 | |
| **END OF BORING @ 26.5 FEET** | | | | | | | | |
| | 30 | | | | | | | |
| | 35 | | | | | | | |
| | 40 | | | | | | | |
| | 45 | | | | | | | |
| | 50 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

SOIL BORING LOG

**MET Midwest Engineering and Testing, Inc.**

| | | | |
|---|---|---|---|
| Project Name: | Proposed Riley Creek CSO | Boring: | B-20 |
| Location: | Satellite Treatment Facility<br>New Conceptual Layout<br>Mattoon, Illinois | Project No. : | 33075.1 |
| | | Date of Boring: | May 15, 2014 |
| | | Field Representative: | Zach Wilcoxen |

| VISUAL SOIL CLASSIFICATION<br>GROUND SURFACE ELEVATION: ±681.5 ft. | Feet | Sample No. | N | $Q_p$ (tsf) | $Q_u$ (tsf) | MC (%) | Dd (pcf) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 9" Dark brown silty CLAY (OL), Topsoil | | 1-AU | - | - | - | 24 | - | |
| Brown and gray mottled silty CLAY (CL) | | 2-SS | 7 | 2.3 | 2.5 | 28 | 89 | |
| | 5 | 3-SS | 3 | 1.5 | 1.6 | 36 | 80 | |
| Brown clayey SILT (ML) with sand | | 4-SS | 8 | 2.8 | - | 22 | - | |
| | 10 | 5-SS | 9 | 3.0 | 3.4 | 16 | 127 | Completion: 10 ft. |
| | | 6-SS | 11 | 2.8 | 4.5 | 14 | 120 | |
| | 15 | 7-SS | 14 | 4.0 | 5.5 | 13 | 120 | |
| Gray silty CLAY (CL) with sand and small gravel, Till | | 8-SS | 20 | 4.5+ | 8.0 | 11 | 125 | |
| | 20 | 9-SS | 21 | 2.0 | - | 12 | - | Drilling: 20 ft. |
| | | 10-SS | 30 | No Recovery | | | | |
| | 25 | 11-SS | 24 | 2.0 | 2.6 | 12 | 124 | |
| Gray sandy CLAY (SC) with small gravel, Till | 30 | 12-SS | 15 | 1.3 | 1.2 | 15 | 113 | |
| Black organic SILT (OH) | 35 | 13-SS | 16 | 2.5 | - | 56 | - | |
| Gray sandy CLAY (SC) with small gravel, Till | 40 | 14-SS | 15 | 1.5 | 1.9 | 22 | 100 | |
| **END OF BORING @ 41.5 FEET** | 45 | | | | | | | |
| | 50 | | | | | | | |

Lines of Demarcation represent an approximate boundary between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.

# GENERAL NOTES

## SAMPLE IDENTIFICATION

Visual soil classifications are made in general accordance with the Unified Soil Classification System on the basis of textural and particle size categorization, and various soil behavior characteristics. Visual classifications should be substantiated by appropriate laboratory testing when a more exact soil identification is required to satisfy specific project applications criteria.

PARTICLE SIZE ±

| | | |
|---|---|---|
| Boulders: 8 inches | Coarse Sand: 2 mm to 4 mm | Silt: 0.005 mm to 0.074 mm |
| Cobbles: 3 to 8 inches | Medium Sand: 0.42 mm to 2 mm | Clay: - 0.005 mm |
| Gravel: 5 mm to 3 inches | Fine Sand: 0.074 to 0.42 mm | |

## DRILLING & SAMPLING SYMBOLS

SS: Split-spoon, 2" O.D. by 1 3/8" I.D.
ST: Shelby Tube, 2" O.D. or 3" O.D., as noted in test
AU: Auger Sample
DB: Diamond Bit
CB: Carbide Bit
RB: Roller Bit
WS: Wash Sample
BS: Bag Sample
HA: Hand Auger

## SOIL PROPERTY SYMBOLS

N: Standard penetration count, indicating number of blows of a 140 lb. Hammer with a 30-inch drop, required to advance a split-spoon sampler one (1) foot.
Qu: Unconfined compressive strength, tons per square foot (tsf).
Qp: Calibrated hand penetrometer resistance, tsf.
MC: Moisture Content, %
LL: Liquid Limit PL: Plastic Limit PI: Plasticity Index
Dd: Dry density, pounds per cubic foot (pcf).
PID Photoionization Detector (Hnu meter) volatile vapor level, ppm

## SOIL RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

| NON-COHESIVE SOILS | | COHESIVE SOILS | | |
|---|---|---|---|---|
| Classifier | N-Value Range | Classifier | Qu Range (tsf) | N-Value Range |
| very loose | 0 – 3 | very soft | 0 – 0.25 | 0 – 2 |
| loose | 3 – 7 | soft | 0.25 – 0.5 | 2 – 5 |
| medium dense | 7 – 15 | medium stiff | 0.5 – 1.0 | 5 – 10 |
| dense | 15 – 38 | stiff | 1.0 – 2.0 | 10 – 14 |
| very dense | 38 + | very stiff | 2.0 – 4.0 | 14 – 32 |
| | | hard | 4.0 + | 32 + |

## GROUNDWATER

Approximate Groundwater level at time noted on soil boring log, measured in open bore hole unless otherwise noted. Groundwater levels often vary with time, and are affected by soil permeability characteristics, weather conditions, and lateral drainage conditions.

# UNIFIED SOIL CLASSIFICATION

| MAJOR DIVISIONS | | | SYMBOL | TYPICAL DESCRIPTION |
|---|---|---|---|---|
| COARSE GRAINED SOILS | Gravel and Gravelly Soils | Clean Gravels | GW | Well-graded gravels and gravel-sand mixtures |
| | | | GP | Poorly-graded gravels and gravel-sand mixtures |
| | | Gravels with Fines | GM | Silty gravels and gravel-sand-silt mixtures |
| | | | GC | Clayey gravels and gravel-sand-clay mixtures |
| | Sand and Sandy Soils | Clean Sands | SW | Well-graded sands and gravelly sands |
| | | | SP | Poorly-graded sands and gravelly sands |
| | | Sands with Fines | SM | Silty sands and sand-silt mixtures |
| | | | SC | Clayey sands and sand-clay mixtures |
| FINE GRAINED SOILS | Silts and Clays of Low Plasticity | | ML | Inorganic silts or clayey silts of slight plasticity |
| | | | CL | Inorganic clays of low to medium plasticity |
| | | | OL | Organic silts and organic silty clays of low plasticity |
| | Silts and Clays of High Plasticity | | MH | Inorganic silts of high plasticity |
| | | | CH | Inorganic clays of medium to high plasticity |
| | | | OH | Organic clays of medium to high plasticity |
| Highly Organic Soils | | | PT | Peat, humus and swamp soils with high organic contents |

***Note: Dual symbols are used to indicate borderline classifications.***