ADDENDUM NUMBER ONE – NOVEMBER 12, 2020

Metropolitan Park District of the Toledo Area
6101 Fallen Timbers Lane
Maumee OH 43537

PROJECT: Metroparks Toledo – Riverside Trail East, 1001 Front St., Toledo, Ohio 43608

BID DUE DATE: UNCHANGED – FRIDAY, NOVEMBER 20, 2020, 3 PM LOCAL TIME

Metroparks of the Toledo Area would like to issue Addendum #1 related to the above indicated project.

The following items to be changed in the bid documents shall hereinafter become part thereof and shall supersede all other specifications wherein there may be a conflict. The contractor shall perform all work in connection with said items or change as required to integrate the change with all related work under this project bid specification in a manner as to maintain the project schedule of and the continuity of quality work.

GENERAL:

Item No. 1: CHANGE

Question: *On page 75 of the proposal under Note 12 - Sequencing and Work Schedule, it states "Project construction is allotted 120 calendar days commencing from the date of execution of the construction contract and must end by the date of Substantial Completion - October 31, 2021. Since the proposal defines a substantial completion date of 10/31/2021, please remove the 120 calendar days as the two will likely conflict.*

Response: Bidders are to disregard the 120 calendar day clause. Construction may commence upon contract execution, and end by the substantial completion date.

Item No. 2: CLARIFICATION

Question: *On page 4 of the plans under General Notes Item 10 states "The soil profile and/or structure foundation exploration sheets contain all available soil and bedrock available from Metroparks Toledo." There are no soil profile and/or structure foundation exploration sheets provided in the bid documents. Could you please provide any and all geotechnical and soil profile documents pertaining to this project?*

Response: Geotechnical Investigation Report attached herein.

Item No. 3: CLARIFICATION

Question*: Sheet 4 of the plans discusses potential for encountering contaminated soils. Will this work be paid as extra work in the event contaminated materials are encountered? If not, please provide an Item Special – Contaminated Soils for contingency.*

Response: Contractor to assume soils below the 2' POC does not meet applicable direct contact standards. It is up to the contractor to sequence construction to provide a 2' soil cap or other approved method per notes on page 4. Sampling is not needed unless soil from below the 2' POC is to be used within the 2' POC per note on page 4.

Item No. 4: CLARIFICATION

Question*: Sheet 5 of the plans state "Main Street will be closed for no more than one (1) weekend." Sheet 4 of the plans state "Detours and complete road closure for Main Street shall occur during the installation of abutment walls and placement of the pedestrian bridge." Construction of the abutments and installation of the bridge will require a longer period of time than one (1) weekend. Please revise the Main Street closure time frame to allow for longer road closure parameters.*

Response: Full closure of Main Street is only anticipated when the bridge is lifted into place on the abutments. The bridge is prefabricated. Construction of the abutments can close lanes as coordinated with the City of Toledo Transportation Department & Emergency Services, but will not require full closure.

Item No. 5: CHANGE

Question*: The project details driven HP10x49 piles. This is not a common or stocked h-pile size. Please review and revise the required h-pile size/section.*

Response: The piles should be HP10x42

Item No. 6: CLARIFICATION

Question*: The project documents do not provide any information regarding required driven h-pile capacity or required pile tip elevation. It appears each pile is 70' in length based on bid quantity and number of piles. Are the piles to be driven 70' from proposed pile cutoff? If piles cannot be driven 70' in length due to hard driving what is considered pile refusal?*

Response: By the geotechnical report, the minimum factored pile resistance shall be 310 kips and estimated tip depth is 74 feet.

Item No. 7: CLARIFICATION

Question*: Does the contractor need to provide a PE stamped design of the prefabricated modular retaining walls/segmental walls?*

Response: Yes. As shown on page 41 of the drawings, engineering is the responsibility of the modular wall manufacturer and submittals are required to be stamped by a qualified engineer.

Item No. 8: CLARIFICATION

Question*: On page 51 of the plans under Deck System it states "Form deck shall be field attached to floor beams via self-drilling fasteners or power actuated fasteners." It also states "The attachment of the form deck to the floor beams is only necessary to keep the form deck in place during transportation and during the concrete placement." Can the metal deck plans be installed by the supplier prior to delivery or must they be attached in the field?*

Response: Due to the size of the bridge, the floor system has to be shipped knocked down. The bridge and the form decking will need to be attached in the field by the contractor.

Item No. 9: CLARIFICATION

Question*: Where is the reinforcing steel in the concrete items to be paid? If the reinforcing steel is incidental to the concrete items, could you please provide the actual weights or reinforcing steel bar list? Otherwise, please provide separate bid items for the reinforcing steel.*

Response: Reinforcing steel items are incidental to the concrete items. The reinforcing steel quantities are shown on updated page 6, general summary attached.

Item No. 10: CLARIFICATION

Question*: Please provide the proposed rebar details and sections for the QC1 Concrete Retaining/Wingwall sections of Alternate 3 and Alternate 4.*

Response: Reinforcing steel items are incidental to the concrete items. The reinforcing steel quantities are shown on updated page 7, general summary (add alternates) attached.

Item No. 11: CLARIFICATION

Question*: Could you please provide the engineer's bid item quantity calculations for base bid and alternate designs?*

Response: Alternate quantities are shown on page 7 of plans.

Item No. 12: CLARIFICATION

Question*: Please provide the required paint coating system to be applied to the steel planters (Alternate 2) and the arched trellis (Alternate 5).*

Response: Paint coating system to match bridge's 3-coat paint system specified under "FINISH" on page 50.

Item No. 13: CLARIFICATION

Question*: The EPS geofoam material comes in different densities and compressive resistance. We typically see a geomembrane placed over top and around the sides of the blocks to protect the blocks from breaking down. Could the designer please clarify material requirements for the EPS Geofoam blocks and clarify if geomembrane is required?*

Response: EPS geofoam shall be ASTM D6817 EPS 39. Provide separation fabric between geofoam fill and soils.

Item No. 14: CLARIFICATION

Question*: The general summary references sheet 9 for the Geofoam fill however there is no indication of this item on said sheet. Will the owner clarify how the volume of GeoFoam is calculated and the locations where it is to be installed?*

Response: Geofoam is shown to extend 8' behind the abutment walls on detail 4, page 40. The quantity on the west abutment is 115 CY and the east abutment is 145 CY for a total of 260 CY as shown on sheet 6 in the general summary.

Item No. 15: CLARIFICATION

Question*: What type of ODOT catch basin is to be used for CB 100 at station 404+87.65 and what is the elevation of bottom of the basin?*

Response: Provide catch basin with 6" sump per detail 3 on sheet 22. Invert is 581.95 per sheet 9 which gives a bottom of basin of 581.45.

Item No. 16: INFORMATIONAL

The current project Plan-Holder List is attached herein.

Item No. 17: INFORMATIONAL

Bidder inquiries will not be addressed after 12:00 pm Monday, November 16, 2020 in order to maintain the bid due date of Friday, November 20, 2020, 3 PM Local Time.

Attachments:

- Geotechnical Investigation Report
- Updated Plan Page 6 General Summary
- Updated Plan Page 7 General Summary (Add Alternates)
- Current Plan-Holder's List

Jon Zvanovec
Project Manager
The Metropolitan Park District of the Toledo Area

END OF ADDENDUM NUMBER ONE, NOVEMBER 12, 2020

NOTE: Bidders must acknowledge receipt of this Addendum on the proposal form.

GEOTECHNICAL INVESTIGATION REPORT

PROPOSED URBAN METRO PARK
ARENA AND MARINA DISTRICT PROPERTIES
TOLEDO, OHIO

JANUARY 2019
UPDATED FEBRUARY 2019

PREPARED FOR:
SMITHGROUP
201 DEPOT STREET, SECOND FLOOR
ANN ARBOR, MICHIGAN 48104

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.
1800 INDIAN WOOD CIRCLE
MAUMEE, OHIO 43537

GEOTECHNICAL INVESTIGATION REPORT

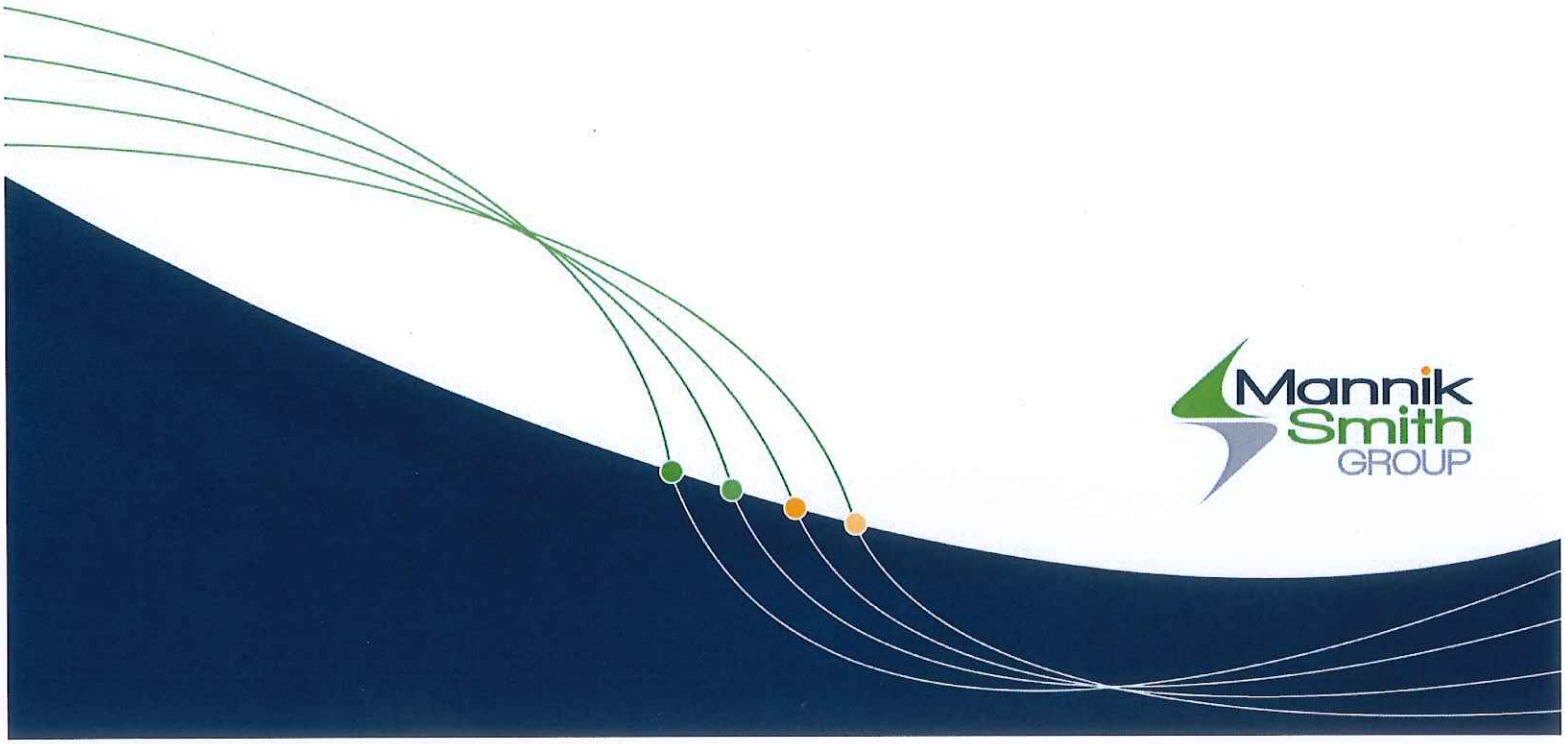
PROPOSED URBAN METRO PARK
ARENA AND MARINA DISTRICT PROPERTIES
TOLEDO, OHIO

PREPARED BY: _____

GREGORY A. BUHOVECKEY, PE
GEOTECHNICAL ENGINEER

REVIEWED BY: _____

CHRISTOPHER A. RIHARB, PE
GEOTECHNICAL ENGINEER



February 1, 2019

Ms. Emily McKinnon, PE, LEED AP BD + C
Principal / Ann Arbor Director of Operations
SmithGroup
201 Depot Street, Second Floor
Ann Arbor, Michigan 48104

Re: Geotechnical Investigation Report
Proposed Urban Metro Park
Arena and Marina District Properties
Toledo, Ohio
MSG Project Number: S2950002

Dear Ms. McKinnon:

The Mannik & Smith Group, Inc. has finalized the field investigation, the geotechnical analyses, and completed the Geotechnical Investigation Report for the proposed urban metro park to be located in Toledo, Ohio. Laboratory testing results for sulfates and corrosivity/resistivity, previously underway, have been completed and added to the report Appendix C. Sections 2.2, 4.2 and 4.9 of the report have been updated accordingly.

Currently the site is vacant and consists mostly of undeveloped land with crushed concrete remnants from the previous buildings spread across the site. The proposed development includes construction of pavilions, an elevated overlook, a sled hill with a hilltop overlook, pedestrian bridge across Main Street and associated parking lots and driveways. This Geotechnical Investigation Report presents our field geotechnical investigation, laboratory test results, and our geotechnical recommendations and construction considerations for the proposed new structures and associated parking lots and access drives.

The soil samples collected during our field investigation will be retained in our laboratory for 30 days from the date of this final report, at which time these samples will be discarded unless otherwise directed by you. A sample storage charge will apply for samples requested to be stored beyond 30 days.

We trust that this report addresses your project needs. We appreciate the opportunity to work with you on this very important project. Please contact us if you have any questions or if we can be of further assistance.

Sincerely,

Gregory A. Buhoveckey, PE
Geotechnical Engineer

Michael J. Momenee, CP
Senior Project Manager

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APPENDICES

1.0 INTRODUCTION

1.1 General

The Mannik & Smith Group, Inc., (MSG) was retained by SmithGroup to conduct a geotechnical investigation for the proposed urban metro park and associated parking lot and driveways that will be constructed at what are known as the Arena and Marina District properties in Toledo, Ohio. The approximate site location is depicted in Figure 1 Site Location Map in Appendix A. This geotechnical investigation was performed in general accordance with MSG Proposal No. OP181538, dated October 26, 2018 and revised on November 6, 2018.

1.2 Project Information

The planned urban metro park consisting of approximately 30 acres will include a pavilion (building), roadways, parking lots, trails, walks and plazas. Extensive earthmoving is anticipated to construct an approximately 20 to 30-foot high sled hill as well as shallow storm water management areas. Shoreline stabilization and restoration is also included with an elevated overlook near the Maumee River's edge that is anticipated to be pile supported.

A new pedestrian bridge spanning Main Street will connect the exiting trail located on an earthen berm within International Park to a new berm landing on the north side of the street. The pedestrian bridge is anticipated to be supported on either concrete abutments and/or piles. The pedestrian bridge will be designed in accordance with AASHTO Guide Specification for Design of Pedestrian Bridges for pedestrian live loading and an H10 design vehicle.

The building is anticipated to be a single-story flexible use pavilion with a portion roof plaza. The preliminary structural system is assumed to be a steel frame with approximate column loads of 40 kips dead load and 50 kips live load. The exterior of the building will be a mixture of materials, including masonry and glass curtain walls. Adjacent to the building will be a built-up lawn/plaza with reinforced concrete retaining walls that provide access to the roof plaza.

1.3 Site Conditions

The Arena and Marina District properties that were evaluated are comprised of approximately 30 acres. The site is situated on the northwest side of Front Street within the City of Toledo, Ohio and is bounded by the Maumee River to the northwest, Front Street to the southeast, Main Street to the southwest and vacant land to the northeast. A former Toledo Edison electrical generation plant and associated ancillary buildings along with the former Sports Arena building on the site have been demolished. Riverside Drive presently traverses the northern portion of the site from Main Street roughly paralleling the Maumee River. The site is currently vacant and consists mostly of undeveloped land with some concrete remnants from the previous building scattered across the site.

2.0 SUBSURFACE INVESTIGATION

2.1 Field Exploration

The geotechnical subsurface investigation consisted of the installation of seventeen (17) soil borings numbered SB-1 to SB-19. Please note that as part of MSG's alternate drilling scope, borings SB-4 and SB-7 were omitted. Borings were extended to the following planned termination depths:

- Pavement and roadway borings SB-1, SB-2, SB-3. SB-5, SB-8, SB-10 and SB-11 were extended to the planned boring termination depth of 7.5 feet, and continuously sampled;
- Storm water and proposed wetland area borings SB-9 and SB-12 were extended to the planned boring termination depth of 10 feet below existing grade, and sampled at 2.5-foot depth intervals;

- Sledding hill boring SB-6 was extended to a planned boring termination depth of 20 feet below existing grade, and sampled at 2.5-foot depth intervals to 10 feet, and then at every 5 feet thereafter;
- Structure (building) borings SB-13, SB-14, SB-15, SB-16 and SB-17 were extended to the planned boring termination depth of 25 feet below existing grade, and sampled at 2.5-foot depth intervals to 10 feet, and then at every 5 feet thereafter; and,
- Structure (pedestrian bridge) borings SB-18 and SB-19 were extended to a boring termination depth of approximately 74 feet below existing grade, and sampled at 2.5-foot depth intervals to 10 feet, and then at every 5 feet thereafter.

Boring types designated above were performed in the general vicinity of the anticipated site improvements according to the proposed site plan provided at the time of this investigation. The number of borings and the approximate locations were determined by SmithGroup and the boring depths and sampling intervals were confirmed by MSG. The boring locations were field marked by MSG personnel using a hand held Global Positioning Survey (GPS) unit. Confirmatory survey of the boring locations by an Ohio-licensed surveyor was not completed as a part of this investigation. A Site Location Map and a Soil Boring Location Plan are presented in Figures 1 and 2 in Appendix A.

2.1.1 Drilling

The drilling operations for this investigation were performed from November 12 to November 15, 2018. The soil borings were installed using a track-mounted Geoprobe® 3230 DT drill rig. The borings were advanced by hydraulically pushing 3.25-inch inner diameter steel casing into the soil. Upon completion, all the boreholes were backfilled to the surface with bentonite mixed with cuttings.

2.1.2 Standard Penetration Test (SPT)

The Standard Penetration Test (SPT) was conducted in accordance with the procedures outlined in ASTM D1586 and was completed at 2.5 feet intervals for the first 10 feet, and at 5-foot intervals thereafter for the building borings and continuously for the parking lot borings. During the SPT testing, soil samples were obtained with a 2-inch outer diameter split spoon sampler driven 18 inches into the soil with blows of a 140-pound hammer falling 30 inches. The sampler is generally driven in three successive 6-inch increments with the blows for each 6-inch increment being recorded. The number of blows required to advance the sampler through 12 inches after an initial penetration of 6 inches is termed as the SPT resistance (N-value) and is presented graphically on individual Soil Boring Logs in Appendix B.

2.1.3 Sampling

Soil samples were recovered using a split-spoon sampling procedure in general accordance with ASTM D1586 (“Standard Method for Penetration Tests and Split Barrel Sampling of Soils”). In general, samples were obtained at a regular interval of 2.5 feet for the upper 10 feet of the boreholes, then at 5-foot intervals to the termination of the soil borings, except for the parking lot and driveway borings which were continuously sampled to boring completion. The sampling intervals are noted in Section 2.1 above. All collected samples were labeled with the soil boring designation and a unique sample number. The samples were sealed in glass jars in the field to protect the soil and maintain the soil’s natural moisture content. All samples were transferred to MSG’s laboratory for further classification and testing.

The soil samples collected during our field investigation will be retained in our laboratory for 30 days from the date of this final report, at which time these samples will be discarded unless otherwise directed by you. A sample storage charge will apply for samples requested to be stored beyond 30 days.

2.1.4 Groundwater Level Observation Procedures

Whenever possible, groundwater level observations were made during the drilling operations and are shown on the Soil Boring Logs. In addition, prior to backfilling, each open borehole was observed for the presence of groundwater. During drilling, the depth at which free water was observed, where drill cuttings became saturated or where saturated samples were collected, was indicated as the encountered groundwater level. In more pervious soils (i.e., granular soils), the indicated water levels are considered relatively reliable when solid or hollow-stem augers are used for drilling. However, in more cohesive soils (i.e., clays), groundwater observations may not necessarily be indicative of the static water table due to the relatively low permeability rates of the soils, or resultant from the inadvertent sealing-off of natural paths of groundwater during drilling operations. It should be noted that seasonal variations and recent rainfall conditions may also influence the groundwater table.

2.2 Laboratory Testing

Each split-spoon recovered from the soil borings was examined and visually classified. This examination was performed to verify conditions identified within field boring logs, to select samples for further laboratory evaluation, and to perform visual-manual classification of samples not subject to further laboratory testing. During the examination process, the geotechnical engineer approved and/or edited descriptions identified in the soil boring logs.

Representative soil samples were subjected to laboratory tests consisting of the pocket penetrometer test; Atterberg limits (ASTM D4318); sieve and hydrometer analysis (ASTM D422); unconfined compression test (ASTM D2166); natural moisture content (ASTM D2216); sulfate content in soils (ODOT Supplement 1122); organic content (ASTM D2974); and corrosivity and resistivity testing (EPA 120.1, ASTM C1580, ASTM G200 and ASTM D2213). A brief description of each test is provided in Appendix C (Laboratory Test Procedures).

All soil samples were classified in general conformance with the Unified Soil Classification System (USCS). The USCS group symbol determined from the visual-manual classification is shown in parentheses at the end of the sample description for each layer shown on the Soil Boring Logs.

The results of the soil classification and the laboratory test results are included on the Soil Boring Logs and soil laboratory test data, which are presented in Appendices B and C, respectively. Also included in Appendix B are General Soil Sample Notes and a Boring/Well Log Key that illustrates the soil classification criteria and terminology used on the Soil Boring Logs.

3.0 SUBSURFACE CONDITIONS

3.1 Subsurface Classification

The subsurface soil and groundwater conditions encountered in the borings drilled at the site are presented in the Soil Boring Logs and the Generalized Soil Profile Sheet contained in Appendix B. Notes and symbols illustrating the soil classification criteria and terminology used in the boring logs are also included in Appendix B.

The following sections describe the subsurface conditions in terms of major soil strata for the purposes of geotechnical exploration. The soil boundaries indicated are inferred from non-continuous sampling and observations of the drilling operations and/or sampling resistance. The subsurface conditions discussed in the following sections and those shown on the boring logs represent an evaluation of the subsurface conditions based on interpretation of the field and laboratory data using normally accepted geotechnical engineering judgement and common engineering practice standards. The subsurface conditions described herein may vary beyond that encountered at specific soil

boring locations and at different times of the year. A generalized soil profile of the subsurface conditions encountered across the site of the proposed urban metro park, beginning at the ground surface and extended downward is as follows:

Surficial Materials – Topsoil

The near surface material consisted of 4 to 18 inches of topsoil or topsoil-like (soils with high organic content) material in all of the soil borings.

Stratum 1 – Fill

This stratum was encountered below the existing surficial materials at all boring locations except SB-19 and extended to depths from 13.5 to 23.5 feet below existing grade. This stratum consisted of clay, sand, gravel, fill material with various amounts of coal, brick, tile, fly ash and concrete fragments. The consistency of this fill layer varied throughout the site. The color of this material was observed to be brown, gray, and/or black. The moisture content of this material was recorded as damp to wet.

Stratum 2 – Fly Ash Fill

This stratum was encountered in borings SB-3, SB-6, SB-10, SB-11, SB-13 and SB-14 from depths ranging from 3.0 to 23.5 feet below existing grade. This stratum consisted of very loose to dense fly ash with varying amounts of sand, trace amounts of gravel, organics and coal fragments. The color of this stratum was observed to be dark gray and black. The moisture content of this material was recorded as damp to wet.

Stratum 3 –Medium Dense to Dense Sand or Silty Sand (SW, SW-SM, SP-SM)

This stratum was encountered in borings SB-13, SB-14, SB-17, SB-18 and SB-19 from depths ranging from 8.5 to 25 feet below existing grade. In boring SB-18, this stratum was encountered from 43.5 to 48.5 feet below existing grade. In boring SB-19, this stratum was encountered from 43.5 to 48.5 feet below existing grade. This stratum consisted of medium dense to dense sand or silty sand with various amounts of gravel, silt, clay, and shells. The color of this stratum was observed to be gray. The moisture content of this material was recorded as wet.

Stratum 4 – Loose Sand or Silty Sand (SW, SW-SM, SP-SM)

This stratum was encountered in borings SB-15, SB-16 and SB-18 from depths ranging from 19.5 to 25 feet below existing grade. This stratum consisted of loose sand or silty sand with various amounts of gravel, silt, clay, and shells. The color of this stratum was observed to be gray. The moisture content of this material was recorded as wet.

Stratum 5 – Stiff to Hard Silty Clay (CL)

This stratum was encountered in borings SB-18 and SB-19. In boring SB-18, this stratum was encountered from 13.5 to 19.5 feet, from 23.5 to 43.5 feet, and from 48.5 feet to the refusal depth of 74.2 feet below existing grade. In boring SB-19, this stratum was encountered from the surficial material to 43.5 feet below existing grade and from 48.5 feet to the refusal depth of 74.2 feet below existing grade. This stratum consisted of stiff to hard silty clay with various amounts of sand, gravel, and shells. The color of this stratum was observed to be brown and/or gray (occasionally mottled). The moisture content of this material was recorded as damp to moist.

3.2 Groundwater Observations

Groundwater was only encountered in boring SB-6 at a depth of 15 feet below the existing surface. Typically, the level where soil color changed from brown to gray is generally indicative of the long term groundwater level. Water levels reported are accurate only for the time and date the borings were drilled. The borings were backfilled and sealed the same day that they were completed. Long term monitoring (i.e. monitoring wells) of the boreholes was not included as part of the scope of our subsurface investigation.

It should be noted that the elevation of the natural groundwater, and the elevation and quantity of the perched groundwater, is likely to vary throughout the year depending on the amount of precipitation, runoff, evaporation and percolation in the area, as well as on the water level in the surface water bodies in the vicinity affecting the groundwater flow pattern. Long term monitoring with monitoring wells or piezometers would be necessary to accurately assess the groundwater levels and fluctuation patterns at the site.

4.0 ANALYSES AND RECOMMENDATIONS

The Arena and Marina District properties are located at the former site of a Toledo Edison electrical generation plant and the former Sports Arena. MSG understands that historically this site was within the Maumee River and that an estimated 20 to 25 feet of fill has been placed at the site in an uncontrolled manner. Some areas of fill consist of fly ash. Other fill at the site consists of hard debris (concrete and brick remnants, slag, coal fragments, etc.) mixed with native site material and also appears to have been placed in an uncontrolled manner across this site.

The existing uncontrolled cohesive or granular fill soils (fly ash) are not considered suitable for support of shallow foundations due to the potential for excessive settlement and differential settlement. In addition, relatively low SPT-N values of 0 to 3 were noted in the split-spoon samples collected at SB-13 and SB-14 from 6.0 feet to 20 feet below existing grade. Uncontrolled fill material consisting of silt, clay, concrete fragments with trace amounts of coal, slag, gravel and brick fragments was encountered to a depth of 23.5 feet below the existing ground surface at boring locations SB-15 and SB-16. Beneath the uncontrolled fill, loose to medium dense native non-cohesive soils were encountered at boring locations SB-13, SB-14, SB-15 and SB-16.

In general, shallow foundation and slab footprint areas should be undercut a minimum of 7 feet below the bottom of the proposed footing and backfilled with engineered fill. In general, excavated native soils (excluding high plasticity clay, silt and fly ash) are suitable for re-use as engineered fill so long as it is placed and compacted accordance with Section 4.5 of this report.

The following sections discuss in detail the results of our analyses and geotechnical recommendations with respect to the construction of the proposed site improvements.

4.1 Structure Recommendations

Limited structural information was not available at the time this report was prepared. Once detailed foundation design drawings available, MSG should be allowed to review such information and their effects to our recommendations in this report.

MSG has developed the foundation recommendations presented herein based on the above project's background information, the loading provided and the anticipated loading requirements of a single story steel frame flexible use pavilion building, the subsurface conditions encountered during our field investigation, the results of our laboratory testing, and the results of our geotechnical analyses.

4.1.1 Shallow Foundations for the Exterior Walls and Interior Columns

Based upon our review of the existing soil conditions in the planned foundation areas for the pavilion, it is recommended that foundation subgrades be undercut a minimum of 7 feet and the shallow foundations bearing within well-placed and compacted engineered fill be designed for an allowable soil bearing capacity of 2,000 pounds per square foot (psf). We recommend the existing soils at the base of the foundation excavations be moisture conditioned and re-compacted as a part of site preparation activities. It is strongly recommended that the exposed foundation subgrades be evaluated by a geotechnical engineer or their designated representative to identify suitability of existing soils for foundation support and areas that will require undercutting and backfilling with engineered fill.

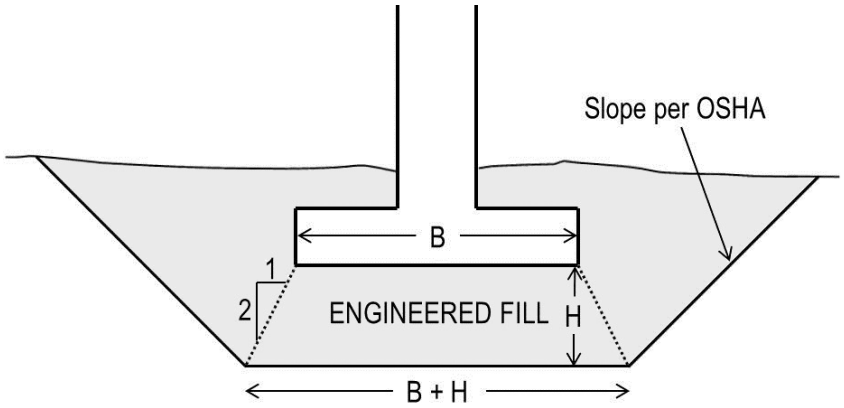
By utilizing proper construction techniques and the undercuts recommend above, the total settlement underneath the proposed shallow foundations in the cohesive fill soil layers is anticipated to be less than 1-inch and the differential settlement is expected to be ¾ of the total settlement. Please note that in areas containing Stratum 2 (Fly Ash Fill) excessive total and differential settlements are expected. Laboratory consolidation testing of Stratum 2 was not performed as a part of this study. Therefore, the time and amount of consolidation of this layer when subjected to loading is not fully understood. Due to the observed nature of the fly ash layer and without an understanding of the consolidation parameters, it is recommended that structures not be located in areas containing Stratum 2, such as the area in the vicinity of soil borings SB-13 and SB-14. If possible, the flexible use pavilion should be relocated slightly southward to avoid inducing foundation loading in the area of Stratum 2 or additional geotechnical foundation design is warranted.

If a higher allowable bearing pressure is desired, then soil improvements using vibro-stone columns (VSCs), rammed aggregate piers (RAPs) or controlled modulus columns (CMCs) could be installed. Such soil reinforcement elements can improve the allowable bearing pressures to 3,000 to 6,000 psf depending on the spacing and configuration of the reinforcing elements. If such reinforcement is to be considered, it is recommended that firms like Geopier Foundation Company and/or Menard USA be contacted for design recommendations for these subgrade improvement methods. MSG should be retained to provide geotechnical consultation services through the design and construction of subgrade reinforce

The aforementioned recommended soil bearing capacity and the associated settlement estimation are based on footing elevations with regard to existing site elevations. The required footing sizes are dependent on the column and wall loads in comparison to the above recommended allowable bearing capacity of the bearing soil. However, wall footings should be a minimum of 18 inches wide and column footings should have a minimum dimension of 30 inches in width. Exterior footing bottoms and footings in unheated areas should be no less than 42 inches (typical frost depth per local codes for this region of Ohio) below final exterior grade for protection against possible frost damage. Interior footings, which should not be subject to frost action, may bear at shallower depths, provided they are supported on native compact soil or engineered fill capable of supporting the design load.

Prior to the placement of reinforcing steel and concrete, a geotechnical engineer or his/her designated representative should evaluate foundation excavations to verify that an adequate bearing material is present and that all debris, mud, very loose, frozen or water-softened soils, and unsuitable soils and uncontrolled fill are removed. All footings should bear in the undisturbed or recompacted soils, or in well-compacted engineered fill. In addition, MSG recommends that a DCP test, Housel Penetrometer Test, or similar field testing, be performed by the geotechnical engineer's representative to assure a suitable bearing capacity for all foundations prior to concrete placement.

Where foundation subgrade undercutting and replacement is required, the undercuts should extend laterally at a slope of 1(Horizontal dimension):2(Vertical dimension) from the edge of the footing as shown in the typical undercutting diagram below:



Foundations should be constructed as soon as is practical after foundation excavation activities. If the foundation excavations will be left open for an extended period of time, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation. Foundation concrete should not be placed on frozen or flooded subgrade.

The final grade adjacent to the building exterior should be sloped at a minimum 2 percent grade away from the building foundations and roof drains should be routed away from the foundation soils. Foundation drains will assist in ensuring the foundation subgrade soils are not adversely impacted by moisture changes that could result in differential settlement of the foundations. To prevent moisture against the exterior footings, a perforated matted edge drain should be used around the perimeter of the footings and placed at the base of the footings and should be placed in accordance with Ohio Building Code requirements. The underdrain should be backfilled with free draining material. A waterproofing membrane with a protection layer should extend from the top to the base of the footings along the exterior edge where the concrete is in direct contact with the natural or backfilled material.

If a two pour system is used for footings and slabs, the cold joint at the interface of the exterior footings and the slab should be located at least 4 inches above the adjacent finish exterior grade. As an alternative, the use of a waterstop between the two pours will minimize the moisture penetration through the cold joint and migration of water under the slab is recommended. For this reason, a monolithic pour would eliminate the recommendation to use a waterstop.

4.1.2 Deep Foundations (Pedestrian Bridge)

MSG recommends driven piles to support the abutments for the pedestrian bridge across Main Street. Given the relatively low blow counts in the upper 25 feet and the depth to penetration refusal (50 blows over 6 inches or less), end-bearing H-piles would efficiently and economically transfer loads to the underlying hard soils or bedrock. The pile tips are anticipated to encounter refusal in hardpan or on the bedrock surface at a depth of approximately 74 feet below the existing surface.

MSG recommends the H piles will be driven to refusal in hardpan or bedrock. Per Section 202.2.3.2.a of the current Ohio Department of Transportation (ODOT) "Bridge Design Manual", refusal is met during driving when the pile penetration is an inch or less after receiving at least 20 blows from the pile hammer. The factored resistance for piles driven to refusal in bedrock is usually governed by the structural resistance. Per Section 202.2.3.2.a of the ODOT BDM, MSG has provided the maximum factored structural resistance (RR max) and estimated tip elevations for HP10X42 and HP12X53 pile sections in Table 4.1 using the following assumptions:

- The piles are axially loaded with negligible moment;
- Loss of section due to deterioration throughout the life of the structure is not appreciable;
- The steel yield strength is 50 ksi;
- The pile is fully braced along its entire length; and
- Using a structural resistance factor (φc) of 0.5 per Article 6.5.4.2 the 2012 AASHTO LRFD.

Bridge Design Specifications (6th Edition).

Table 4.1 Capacities, Tip Depths, and Lengths for Various Top Driven Piles

Pile Size and Type	Max. Factored Structural Resistance (kips)	Estimated Tip Depth (ft)
HP 10 x 42	310	74
HP 12 x 53	380	74

Other pile sizes and load combinations are possible depending on the type of pile, pile-driving equipment used, and the final bridge design. However, it is advisable to specify only one pile size and design capacity.

As previously discussed, hardpan and SPT refusal was encountered at a depth of approximately 74 feet below existing grade. Due to the varying driving behavior of the piles in hardpan and/or very hard soils, it is recommended that a tip depth of 74 feet be used as the estimated pile tip elevation for cost estimating purposes. However, there should be a contingency in the plans, specifications and bid documents should the foundations be required to bear at lower elevations if subsurface conditions at actual foundation locations warrant deeper foundations.

ODOT specifies the maximum center-to-center spacing of driven piles should be 8 feet for capped pile abutments, integral abutments, and the front row of stub abutments. Piles should be spaced no closer than 3 pile diameters apart. With piles being driven to refusal and bearing in hardpan or bedrock material, the settlements of the pile foundations are anticipated to be limited to the elastic compression of the steel.

At the time of this report, detailed design information for the bridge abutments was not available. It is anticipated that piles will be subject to lateral loading conditions. As such, a detailed lateral analysis of the piles should be performed. The lateral resistance of the vertical piles alone may be sufficient to resist the lateral loading conditions; however, depending on loading conations and pile configurations, battered piles may be warranted.

4.1.3 Negative Skin Friction

Negative skin friction, or down drag, occurs in piles installed through compressible materials or when additional fill (embankment) is placed on top of soft soils. As soils consolidate, additional downward drag

force is transferred to the driven pile. The Federal Highway Administration (FHWA) mandates the consideration of down drag when individual soil layers will settle more than 0.39 inches.

By maintaining the existing profile grade, the effects of down-drag do not need to be considered when sizing the piles. However, should additional embankment be placed for the northeast ramp and the piles driven before settlement has had time to occur, downward drag should be evaluated by the structural engineer.

As design plans were not available at the time of this report, an analysis of the settlement of the native soils due to the construction of an embankment on the northeast side of Main Street was not performed as a part of this report. If an embankment is constructed and the construction schedule will not allow less than 0.39 inches of settlement to occur after driven pile installation, then a detailed settlement and downward drag force analysis should be performed.

4.1.4 Driven Pile Construction Recommendations

Piles should be driven to achieve the required maximum factored structural bearing resistance value, using a hammer selected to be compatible with the pile driving conditions and with sufficient rated energy to achieve capacity as determined by criteria identified in ODOT's Construction and Material Specifications (CMS) Items 507.04, 507.05, and 507.06.

Prior to commencement of pile driving operations, the contractor should be required to submit equipment specifications to the Structural and/or Geotechnical Engineer to allow for the proposed pile hammer, along with induced stresses in the pile, to be evaluated using wave equation analyses. FHWA limits compressive or tensile driving stresses to 90 percent of the yield strength (Fy). If this stress limit is anticipated to be exceeded with the wave equation analysis, investigation of alternative pile hammers or cushions should be performed to reduce the possibility of damaging the piles during driving operations. Pile driving may result in slight heave of previously driven piles. To avoid detrimental effects, all of the piles should be re-tapped at the end of the pile driving activities. Steel pile points are not required as the piles will be driven through more than 50 feet of soft cohesive soil and will be driven into hard pan or bedrock.

The existence of cobbles or boulders within the alluvial sub-soils is not unusual for this area. These conditions, if encountered, could hamper pile-driving operations and possibly damage some piles. If some piles are observed to meet refusal at depths markedly less than that indicated above, boulder obstruction or pre-mature "fetching" may be indicated. If these conditions are indicated, a pile load test should be performed to evaluate the capacity of the pile. Alternately, one or more replacement piles could be driven, probably at less expense than the cost of a load test.

A geotechnical engineer or a qualified soil technician under supervision of a geotechnical engineer should monitor driven pile installations in order to confirm the installation process, driving criteria, and review the procedures and acceptance criteria, if necessary.

4.1.5 Slab-on-Grade

Based on the existing subsurface conditions and subgrade preparation as outlined below, an estimated modulus for subgrade reaction on top of the existing subgrade of 125 pounds per cubic inch (pci) may be used for slab-on-grade design. The final design thickness of the floor slabs, the joint spacing and slab reinforcement should be determined by the structural engineer based on the above-recommended subgrade modulus, the floor loading conditions, and local building code requirements.

The subgrade below areas of slab-on-grade construction should be inspected and tested to ensure proper preparation. The building pad shall be proof rolled as described in Section 4.3 and soft/yielding areas should be undercut and backfilled as described in Sections 4.3 and 4.4. The subgrade soils should be protected against frost action if construction takes place during the winter. Frozen soils should be thawed, moisture conditioned and recompacted or undercut and replaced prior to commencement of slab-on-grade construction. We recommend that the floor slabs-on-grade bear directly on a minimum of 6 inches of capillary resistant granular engineered fill (ODOT Item 304 granular material or engineered approved equivalent) compacted to 95 percent of the Modified Proctor maximum dry density.

A waterproof membrane (vapor retarder) should be placed directly beneath the concrete to minimize infiltration of moisture and delamination of the concrete floor slab. The moisture condition of the floor slab should be tested prior to placement of floor coverings to verify they are within tolerable limits for the floor coverings. Precautionary measures such as concrete mixture with low water-cement ratio of no more than 0.50 should be implemented to reduce the residual moisture in the slab. The vapor retarder should be sealed at all seams and pipe penetrations and connected to all footings. Water reducing admixtures may be used to obtain workability of the concrete. Sufficient time should be provided to moist cure the slabs for a minimum of 3 days or use other equivalent curing methods identified by the structural engineer.

In order to minimize the potential impacts caused by differential settlement, any slabs-on-grade should be kept structurally separate from walls and columns, and saw cut control joints should be provided at suitable intervals. A minimum of 6 inches of engineered fill should be placed between the slab bottom and the top of the footings below.

4.2 Subgrade Stabilization Recommendations

At SB-1, SB-3, SB-5, SB-9, SB-10, SB-11 and SB-12, unstable material was encountered within proposed subgrade elevations. ODOT standards indicate that global stabilization should be considered if 30 percent or more of the subgrade area requires stabilization. During our investigation, 70 percent of the on-site roadway borings (Borings SB-1, SB-3, SB-5, SB-9 and SB-10 through SB-12) will require subgrade stabilization due to the presence of unstable material. Global stabilization should be anticipated for the on-site roadway and parking lot subgrades as unstable soils with low strength (low blow counts and low hand penetrometer readings) and high moisture contents are present throughout the site according to the borings.

Measures will be required to stabilize the unstable subgrades. Depending on the severity of distress encountered during proof rolling, undercutting of 18 to 24 inches below subgrade and backfilling with engineered fill as outlined in Section 4.5 may be performed. If an undercut and replacement of the top 18 to 24 inches fails to stabilize the subgrade, use of granular backfill with geogrid stabilization may be required. Undercuts may be reduced to 12 to 18 inches if geogrid and granular backfill is utilized. Conditions promoting poorly performing pavement subgrade should be anticipated throughout the site during construction.

High plasticity clay has a high shrink/swell potential and is generally considered an unsuitable subgrade material in its native form. Silt has a high frost heaving potential and is also considered unsuitable in its native form. High plasticity clay was not encountered during our .investigation; however frost heaving silt was encountered. Both these soil types are common in the area and could be exposed at the roadway and parking lot subgrade surface elevation during excavation. Please note that at the time of our investigation, no detailed site grading plan was available.

Where high plasticity clays or silts are encountered in the pavement areas, it is recommended these materials be removed to at least 36 inches below proposed subgrade elevation and replaced with engineered fill. Partial undercutting of high plasticity clays and frost heaving silts is acceptable provided the underlying soil materials are

stable. If partial undercutting of high plasticity clay or silt is performed (i.e., the layer is not completely removed after a 36-inch undercut), the engineered backfill should consist of ODOT Item 204 embankment material.

Chemical stabilization may be a suitable alternative to undercutting and replacement of high plasticity clay (unsuitable), frost heaving soils (unsuitable) and soft or unstable soils. Due to the low plasticity and granular soils encountered at the site, cement should be considered for chemical treatment. The typical application for cement stabilization consists of a minimum treatment depth of approximately 16 inches and a cement content of 5 percent by weight. Note that typically chemical stabilization is not recommended for soils with SPT blow counts of 4 or less as it can become difficult to operate stabilization equipment on such soft soils. If soils with SPT blow counts of 4 or less are encountered in the future at the site, special consideration should be given for chemical stabilization. Also neither a stabilization mix design nor final ODOT GB1 subgrade analysis has been performed at this time. Once final roadway alignments and profiles are established, a geotechnical should be retained to finalize a GB1 analysis and stabilization mix design, if necessary. Additional laboratory testing may also be required in conjunction with the GB1 analysis and stabilization mix design.

Chemical stabilization is not recommended if the amount of sulfates present in the subgrade soils exceeds 5,000 parts per million (ppm). MSG performed sulfate tests per ODOT Supplement 1122 on three samples taken from the anticipated subgrade elevation. Sample SS-2 taken from SB-8 at the 1.5 to 3.0 foot interval has a sulfate concentration of 9,493 ppm. All other samples tested were below the 5,000 ppm concentration limit set by ODOT. Due to the presence of a high concentration of sulfates observed at the SB-8 location at the anticipated subgrade elevation, MSG does not recommend chemical stabilization of the subgrade without additional testing of the final design subgrade surface elevation for sulfates to assess the expansion risk associated with stabilizing these soils.

It should also be noted that soils classified as organic soils, if encountered during roadway excavation, cannot be remediated using chemical stabilization. The only acceptable method of remediation of organic soils is excavation and replacement to a depth of 36 inches below the proposed subgrade. Engineered backfill should consist of ODOT Item 204 embankment material. Laboratory organic content testing was performed on select samples from the site. Test results indicate slight organic content at boring location SB-9, SS-3 and moderate organic content at boring location SB-6, SS-4. Neither of these two soil samples would be classified as an “organic” soil by ODOT and will not require an undercut.

The actual depths and limits of subgrade stabilization should be determined during proof rolling operations (see section 4.4 below) and should be performed under the direction of the project geotechnical engineer or his/her designated on-site representative. Final proof rolling of the subgrade surface can be used to determine acceptability and the lateral limit of undercutting. For global stabilization, only final proof rolling shall be performed after the stabilization has been implemented. Proof rolling in areas where spot stabilization is planned should be performed prior to conducting stabilization efforts along with a final proof roll. Subgrade remediation should extend at least 18 inches beyond the proposed edge of pavement, paved shoulders, or paved medians, including new curbs and gutters.

MSG recommends that construction traffic be minimized once the proposed subgrade level has been attained. If construction traffic is allowed to traverse exposed subgrades, the quantity of soil identified as requiring removal or other remediation based on proof rolling operations may increase.

4.3 Pavements

Subgrade recommendations presented in Section 4.2 and site preparation recommendations presented in Section 4.4 shall be followed to provide subgrade conditions suitable for pavement support. Adequate drainage should be provided to the pavement structure to ensure a successful pavement service life is achieved. MSG recommends that

underdrains be utilized around catch basins with weep holes and in other low areas of the proposed pavements to limit the accumulation of water below the pavement structures. Surface edge drains should also be used at curbs.

Laboratory California Bearing Ratio (CBR) testing was not performed. Based on the soil characteristics from the geotechnical investigation and anticipated proposed elevations, a CBR value of 7 is assumed for the prepared subgrade. The pavement design input parameters are established based on the procedures contained in the 1993 Guide for Design of Pavement Structures by AASHTO. For the basis of the design, MSG assumed the following input parameters:

Table 4.2 Assumed Pavement Design Parameters

Design Life	20 Years
Design ESAL	50,000 (Light Duty); 500,000 (Heavy Duty)
Reliability	80 %
Original Serviceability Index	4.2 (Flexible Paving); 4.5 (Rigid Paving)
Terminal Serviceability Index	2.0
Overall Standard Deviation	0.45 (Flexible Paving); 0.35 (Rigid Paving)

For flexible pavement design, MSG assumed structural number coefficients of 0.42 and 0.14 for asphalt concrete and aggregate base, respectively. Based on the above assumptions, recommended flexible pavement sections are provided in the following table.

Table 4.3 Recommended Flexible Pavement Sections

Pavement Materials*	Light Duty	Heavy Duty	Multi-Use Trail
Surface Course	1.5”	2.5”	1.25”
Intermediate Course	2.5”	4.0”	1.75”
Aggregate Base (ODOT Item 304)	8.0”	10.0”	8.0”

* Use pavement materials as outlined above, or engineer/owner approved equivalent.

For rigid pavement design, MSG assumed a concrete elastic modulus (E_c) of 5,000,000 psi, a concrete rupture modulus (S'_c) of 700 psi and a load transfer coefficient (J) of 2.7. Based on the above assumptions, recommended rigid pavement sections are provided in the following table.

Table 4.4 Recommended Rigid Pavement Sections

Pavement Materials*	Light Duty	Heavy Duty
Portland Cement Concrete	4.0”	6.0”
Aggregate Base (ODOT Item 304)	6.0”	6.0”

* Use pavement materials as outlined above, or engineer/owner approved equivalent.

It should be noted that traffic loading estimates for the proposed roadways were provided by Smith Group. The above recommended sections were based off of the estimated traffic loads provided and conservative design life

parameters estimated by MSG. If traffic loading estimates are revised or more accurate design life parameters become available, then the recommended pavement sections should be re-evaluated.

4.4 Site Preparation

The following are our recommendations for the site soil preparation based on the geotechnical investigation performed for this project. These recommendations should be incorporated into the project specifications.

Before proceeding with construction, surface soils, vegetation, topsoil, root systems, refuse, asphalt, concrete including any existing abandoned buried foundations, existing uncontrolled fill (in foundation and building slab footprints) and other deleterious materials should be stripped from the proposed development/construction areas. Depending on the time of year of construction and the Contractor's Means and Methods at controlling surface water, it may be possible that portions of the upper 6 to 12 inches of the site material within development/construction areas will be considered unsuitable and will be required to be stripped during site preparation activities. Some of the on-site soils are moisture sensitive and could become unstable if proper site water controls are not implemented and/or if they are subject to construction traffic. Every effort should be taken to minimize disturbance during compaction or over excavation and where possible, free standing water should be diverted away from the construction perimeters or pumped out using a sump to accommodate the proper compaction techniques.

Generally, areas exposed by stripping operations on which subgrade preparations are to be performed should be compacted in place to 98 percent of Standard Proctor or 95 percent of Modified Proctor. If there are areas where the building floor slabs will be located partially on a fill area and partially on a cut area, it is recommended that the depth of subgrade compaction in the cut area be increased to 18 inches, in order to provide uniform support of the rigid slab.

It is recommended that the prepared subgrade for pavement and slab-on-grade areas be proof-rolled to detect any unstable areas. Proof rolling should be accomplished by making a minimum of two complete passes in each of two perpendicular directions with a fully-loaded tandem-axle dump truck, or other approved pneumatic-tired vehicle, with a minimum weight of 20 tons.

Existing abandoned utilities or underground structures within the proposed location were not identified but may be present. If such utilities are present, they should be removed and relocated or abandoned in place. If abandoned in place, it is recommended that the utility pipe be filled with cement grout to mitigate the potential for collapse in the future. Should the utility lines be removed from the site, the resultant trench excavations should be backfilled with well-compacted granular material, placed and compacted in accordance with the recommendations of Section 4.5.

4.5 Fill Placement and Engineered Fill Requirements

Any fill placed in areas which will support new foundations, slabs-on-grade and pavement should be free of organics, debris, frozen soils or any other deleterious materials. The existing cohesive and granular fill soils, crushed concrete fill and native cohesive soils (with the exception of high plasticity clay, if encountered, frost heaving silt soils and fly ash) are generally considered suitable for reuse as fill provided they are free of organics. Moist conditions were observed in most samples collected from the borings. Hence, the soils may require moisture conditioning effort prior to recompaction efforts.

The proposed engineered fill material should be verified by an approved testing laboratory or by a geotechnical engineering firm. All fine grained fill soils should be checked for plasticity index and liquid limit before placement. Cohesive fill materials should have a liquid limit less than 40 percent and plasticity index less than 20 percent (i.e., non-expansive).

Coarse crushed granular material is recommended as fill for utility trench backfill, replacement of undercut areas and as aggregate base material for pavement and slab-on-grade areas. The granular material shall consist of natural aggregate materials that meet the gradation requirements of ODOT Item 304, or engineer approved equivalent. Typical lift thickness utilized for this material is 8 inches. In utility trenches, granular backfill material should extend at least two pipe diameters above the pipe's crown. Suitable on-site materials compacted to 98 percent of the Standard Proctor or 95 percent of Modified Proctor maximum dry density can be used as a backfill for the balance of the trench excavation.

Fill should be compacted to 98 percent of the Standard Proctor or 95 percent Modified Proctor maximum dry density and should be compacted at ±2 percent of optimum moisture content. Fill materials should be placed in horizontal lifts and adequately keyed into stripped and scarified subgrade soils and adjacent fill. Proper drainage should be maintained during and after fill placement to prevent water from impacting compaction efforts or long-term fill integrity. A qualified geotechnical consultant should be retained to monitor fill placement in order to ensure compaction requirements are achieved. Soil density testing should be performed during fill placement activities to ensure proper fill compaction. A commonly used testing criterion is one test per 2,500 square feet per lift in areas to support proposed structures and one test per 5,000 square feet in parking lots, drive ways, exterior slabs, etc., with a minimum of three tests per lift. Areas that do not achieve compaction requirements after initial placement should be recompacted to meet project requirements.

The actual lift thickness suitable for fill placement is dependent upon the soil type, compaction equipment, and the compaction specification. In general fill should be placed in 9-inch loose thickness lifts; assuming appropriately weighted and ballasted compaction equipment is utilized. In confined areas where hand operated compaction equipment is required, 4-inch and 6-inch loose thickness lifts should be employed for hand operated vibratory plate compactors and hand operated vibratory drum rollers weighing at least 1,000 pounds, respectively. Sand fill should be compacted using smooth vibratory rollers. Clay fill should be compacted using a sheep foot compactor. The geotechnical engineer, as part of the construction monitoring, should review the equipment utilized for compaction to confirm suitability relative to the specified loose lift thickness. If necessary, the geotechnical engineer will recommend a revised lift thickness suitable to the equipment performing compaction.

If a working platform for the new building construction is needed, and prior to footing excavation, it is recommended that at least 6 inches of granular base material meeting the gradation requirements of ODOT Item 304 aggregate should be placed and compacted to 98 percent of Standard Proctor or 95 percent of Modified Proctor maximum dry density.

It is assumed that the sledding hill will be constructed from on-site material excavated during the construction of storm water wetlands and imported material. The top two feet of material should be stripped from the sledding hill area and stockpiled for re-use. Material placed for the sledding hill fill should be compacted to 85 percent of the Modified Proctor maximum dry density and should be compacted at ±2 percent of optimum moisture content. Fill materials should be placed in 12-inch thick (maximum) loose horizontal lifts. No staged construction analysis was performed for the sledding hill as a part of this investigation.

It should be noted that the sledding hill is proposed to be in a location containing Stratum 2 in the subsurface. Consolidation of Stratum 2 is expected due to the sledding hill loading. A detailed settlement analysis for the sledding hill was not performed as a part of this investigation.

4.6 Excavation and Slope

Familiarity with applicable local, state and federal safety regulations, including current OSHA excavation and trench safety is vital. Therefore it should be a requisite for both the Owner and Contractor to be responsible for worker safety at the site. Activities at the site, such as utilities or building demolition and site preparation, may require excavations at significant depths below the ground surface. Slope height, slope inclination, and excavation depth (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations (OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926 Subpart P). Such regulations are strictly enforced and, if not followed, the Owner, Contractor, or earthwork or utility Subcontractors could be liable for substantial penalties. Maximum allowable slopes for excavations less than 20 feet based on soil type and angle to horizontal are reflected in Table 4.6.1.

The overburden soils encountered during our investigation were generally composed of medium stiff to hard silty clay soils occasionally interlayered with very loose to medium dense granular (fill) material. Based upon the data obtained, we anticipate OSHA will classify the soils as Type C. Flatter slopes will be required if seepage conditions occur during construction. For permanent excavations and slopes, the grades should be no steeper than 4(Horizontal dimension):1(Vertical dimension) without further geotechnical review of the finalized grading plan. If any excavation, including a utility trench, is extended to a depth of more than 20 feet, OSHA requires that a Professional Engineer design the side slopes of such excavations.

Table 4.5 Allowable Slopes

Soil Type	H:V	Slope Angle
Stable Rock	Vertical	90°
Type A	¾:1	53°
Type B	1:1	45°
Type C	1 ½ : 1	34°
Type A (Short-Term) for a maximum excavation depth of 12 ft.	½:1	63°

The side slopes for the sledding hill are not recommended exceed 1(Vertical dimension):4(Horizontal dimension) slope and the height should be maintained at 20 feet or less without additional analysis. No detailed stability analysis of the sledding hill was performed as a part of this investigation. If steeper slopes or a higher hill are proposed in the final design, then a detailed stability analysis including bearing capacity, settlement and slope stability modeling should be performed to ensure that the sledding hill will remain stable during construction and afterward.

4.7 Retained Soils

Lateral earth pressures (horizontal stresses) are developed during soil displacements (strains). Lateral earth pressure for design is determined using an earth pressure coefficient to relate horizontal stress to vertical stress. Three separate earth pressure coefficients are utilized to determine lateral earth pressure: at-rest; active; and passive. Active earth pressure addresses displacement of a vertical soil face away from the retained soil. Passive earth pressure addresses displacement against the retained soil. At-rest earth pressure addresses a negligible displacement scenario. Retaining walls that are restrained at the top and bottom such that negligible movement is allowed to occur, such as basement walls, should be designed using at-rest earth pressures. Retaining walls that are allowed to move laterally (at least 0.001 times the total height of the wall) such as retaining walls in loading docks, receiving areas or other unrestrained retaining walls necessary to accommodate site grade modifications should be designed using active earth pressures.

Applied horizontal stress can be determined by multiplying the appropriate earth pressure coefficient by the applied vertical stress. Earth pressure coefficients are a direct function of the internal friction of a soil. Laboratory testing to determine internal friction angles for soil was not performed. However, index laboratory and field data obtained can be utilized to approximate earth pressure coefficients based upon empirical relationships.

To minimize lateral earth pressures, MSG recommends the zone adjacent to any walls be backfilled with granular fill. To provide effective drainage, a zone of free-draining gravel (open graded crushed aggregate similar to AASHTO No. 57 stone) should be used directly adjacent to the walls with a minimum thickness of 18 inches. This granular zone should drain to weepholes or a pipe drainage system to prevent hydrostatic pressures from developing against the walls.

The type of backfill beyond the free-draining granular zone will govern the magnitude of the pressure to be used for structural design. Clean granular soil is recommended as the backfill material against retaining structures to minimize lateral earth pressures. Lateral earth pressure coefficients for granular and clay engineered fill are provided in Table 4.6 The equivalent fluid pressure can be determined by multiplying the total unit weight by the appropriate pressure coefficient.

Table 4.6 Recommended Lateral Earth Parameters

Soil Parameters	Engineered Fill	
	Clean Granular Soil	Clay
Total Unit Weight (pcf)	125	130
Internal Friction Angle (°)	30	25
At-rest Pressure Coefficient, K_o	0.5	0.6
Active Pressure Coefficient, K_a	0.3	0.4
Passive Coefficient, K_p	3.0	2.5
Concrete/Soil Friction Coefficient	0.50	0.30

The coefficients of friction between concrete and soil subgrade were also provided in the table above. These friction coefficients can be used for evaluating the factor of safety against sliding of foundations. The recommended minimum safety factor against sliding is 1.5. Passive pressure resistance of the top 3.5 feet below final grade should generally be neglected in designing the retaining walls to resist sliding failure due to the freeze-thaw cycle that can significantly weaken soils and the potential for the material to be removed at a future date for installation of utilities or other construction-related activities.

Any additional lateral earth pressure due to surcharge loading conditions including, but not limited to, floor loads, column loads, sloping backfill, traffic loading, and construction loads, should be incorporated into the wall design.

It is recommended that a geotechnical engineer be retained to perform additional geotechnical evaluations for retaining walls, as necessary, including but not limited to bearing capacity, settlement, and global stability. A geotechnical evaluation of retaining walls is beyond the scope of this report.

4.8 Site Seismic Classification

According to ASCE 7-10 Table 20.3-1, the proposed site is designated as “Site Class D” based on the average number of the Standard Penetration Test N values and the soil shear strength for the upper 74 feet of soil (the maximum depth the borings were advanced for this investigation) and assumed subsurface conditions to a depth of 100 feet.

It should be noted that Statum 2 may be liquefiable with potential for failure or collapse under seismic loading. Additional laboratory testing of Stratum 2 is required to fully determine if it is a liquefiable soil. If Stratum 2 were determined to be liquefiable, then the site could be designated as "Site Class F" and a site response analysis in accordance with Section 21.1 of ASCE 7-10 would be required. However, the proposed steel frame building at the site will have a fundamental period of vibration less than 0.5 so long as it is less than 36 feet tall (at the tallest point) and will not require a site response analysis. In this case, the property will be designated as "Site Class D" (even with the presence of a potentially liquefiable soil) and the corresponding values of F_a and F_v from Tables 11.4-1 and 11.4-2 can be used. If the proposed design of the steel frame building exceeds 36 feet in height, then additional laboratory testing of Stratum 2 should be conducted to determine if a site response analysis will be required.

4.9 Soil Resistivity and Corrosivity

One fly ash sample obtained from boring location SB-14, SS-4 (8.5-10.0 foot interval) during the subsurface investigation was analyzed for corrosivity testing. The testing included pH, resistivity, sulfate content, chloride content and reduction-oxidation potential determination. The analysis identified a resistivity of 56 Ω-m, a pH of 8.3, reduction oxidation potential of 118mV, sulfate content of 820 ppm and chloride was not detected. The analytical report is included in Appendix C.

Based on the 10-point Soil Evaluation Procedure by the Cast Iron Pipe Research Association (CIPRA), corrosion potential series rating of 10.0 or greater indicates that corrosion protection is warranted for iron pipe. The sample tested scored 5.5 on this scale, indicating that the material at this location (fly ash) represented by this sample is not corrosive to iron pipe. Furthermore, the guideline provided by Caltrans, which utilizes the chloride concentrations and pH to determine the corrosivity of soil, indicates the soil is non-corrosive. The relatively high resistivity of the soil also reduces the potential risk of corrosion of buried elements.

It should be noted that due to the history placement of fill materials of various types at the site, other areas containing different fill types may be corrosive. If corrosion of underground utilities and/or structures at the site becomes a concern, then a detailed corrosivity and resistivity testing program may be warranted or High Density Polyethylene (HDPE) piping could be used in lieu of ductile iron.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Groundwater Control

The location of the level of groundwater is of importance in shallow foundations for a number of reasons. Most importantly, the bearing capacity of the soil is affected by the presence of a high water table, decreasing the bearing capacity. The project civil engineer is also responsible for designing all surface drainage improvements.

Groundwater was encountered in boring SB-6 at 15 feet below the surface during and at the end of the drilling operations. Moist conditions were occasionally encountered during our field investigation. Typically, the groundwater elevation fluctuates and is higher during the winter and spring and lower in summer and early fall.

The amount and type of dewatering required during construction will depend on the weather, groundwater levels at the time of construction, and the effectiveness of the Contractor's techniques in preventing surface water runoff from entering open excavations and lowering the groundwater table. The Contractor should be prepared to address general water infiltration and be prepared to pump water from prepared sumps, if needed. The use of perimeter drains and/or sub-drains may also be used to address groundwater on approval of the site civil design engineer.

To minimize surface water run-on and ponding, pavement areas should consist of 1.5 percent slopes toward inlets or drainage structures, building exteriors should have minimum 2 percent slopes away from the buildings and discharge points (i.e., roof drains) should consist of closed conduits and be diverted away from the buildings to inlets or drainage structures.

6.0 GENERAL QUALIFICATIONS AND LIMITATIONS

The evaluations, conclusions and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the geotechnical investigation, our understanding of the project and our experience during previous work, with similar sites and subsurface conditions. Data used during this exploration included:

- Seventeen (17) exploratory borings performed during this investigation;
- Observations of the project site by our staff;
- Published historical soil and geologic data for the project area;
- Results of laboratory soil testing; and
- Results of the geotechnical analyses.

The subsurface conditions discussed in this report and those shown on the boring logs represent an estimate of the subsurface conditions based on interpretation of the soils data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the soil boring locations on the dates shown, they may not be indicative of subsurface conditions at other locations or at other times. MSG is not responsible for independent conclusions, opinions or recommendations made by others based upon information presented in or attached to this report.

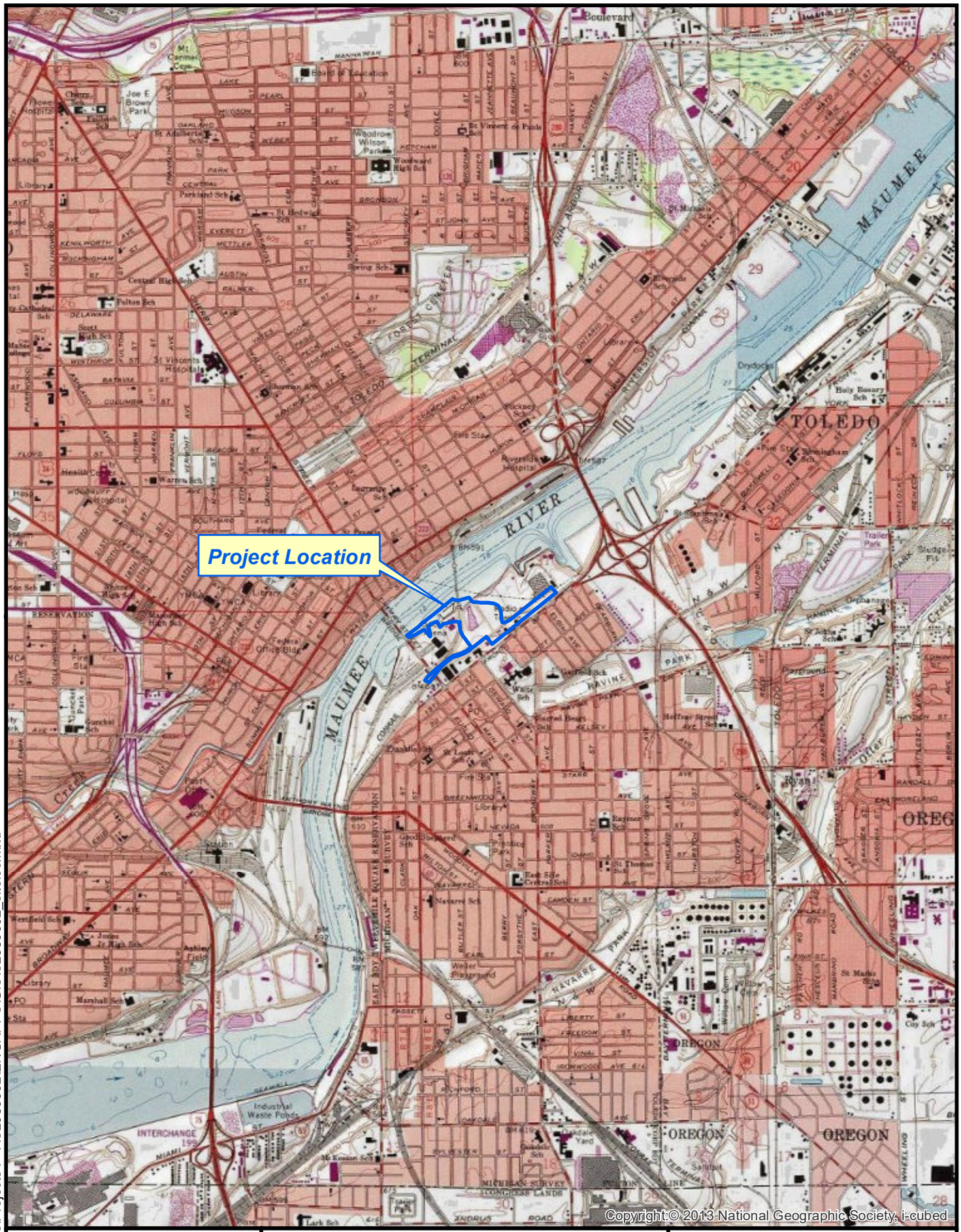
We strongly recommend the final project plans and specifications be reviewed by MSG's geotechnical engineer to confirm that the geotechnical aspects are generally consistent with the recommendations of this report. In particular, the specifications for demolition, excavation and foundation construction should be prepared and/or reviewed by the Geotechnical Engineer of Record. In addition, we recommend site subgrade preparation, fill compaction activities, and foundation installation activities should be monitored by a geotechnical engineer or his/her representative.

This report and evaluation reflects only the geotechnical aspects of the subsurface conditions at the site. Review and evaluation of environmental aspects of subsurface conditions are beyond the scope of this report.

APPENDIX A

FIGURE 1 – SITE LOCATION MAP

FIGURE 2 – SOIL BORING LOCATION PLAN



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Path: W:\Projects\Projects P-T\S2950002\ENGAPPS\GIS\S2950002_siteloc.mxd

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Figure 1: Site Location
Proposed Urban Metro Park
Toledo, Ohio

Notes
USGS Quadrangle, 7.5' Series Topographic
Toledo, OH-MI 1965 Revised 1980

Feet
0 1,000 2,000

N

Path: W:\Projects\Projects P-T\S2950002\ENGAPPS\GIS\S2950002_bores.mxd

Date Saved: 2/1/2019 2:10:05 PM

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Figure 2: Boring Locations
Proposed Urban Metro Park
Toledo, Ohio

Notes

The Lucas county imagery, dated April 2017, is provided by OGRIP as part of the Statewide Imagery Program.

Feet
0 200 400

APPENDIX B
SOIL BORING LOGS & GENERALIZED SOIL PROFILE

GENERAL SOIL SAMPLE NOTES

Unless noted, all terms utilized herein refer to the Standard Definitions presented in ASTM D653.

Standard Penetration Test (ASTM D1586): A 2.0-inch outside-diameter (O.D.), 1-3/8-inch inside-diameter (I.D.) split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).

COHESIVE SOILS			COHESIONLESS SOILS	
Consistency	Approximate Range of N	Unconfined Compressive Strength (psf)	Density Classification	Approximate Range of N
Very Soft	0 – 1	Below 500	Very Loose	0 – 4
Soft	2 – 4	500 – 1,000	Loose	5 – 10
Medium Stiff	5 – 8	1,000 – 2,000	Medium Dense	11 – 30
Stiff	9 – 15	2,000 – 4,000	Dense	31 – 50
Very Stiff	16 – 30	4,000 – 8,000	Very Dense	Over 50
Hard	31 – 50	8,000 – 16,000		
Very Hard	Over 50	Over 16,000		

CLASSIFICATION

The major soil constituent is the principal noun, i.e. sand, silt, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituents (percent by weight)
Trace – 1% to 11%	Trace – 1% to 11%
Adjective – 12% to 35% (clayey, silty, etc.)	Little – 12% to 22%
	Some – 23% to 33%
And – Over 35%	

PARTICLE SIZES

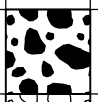
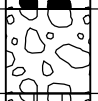
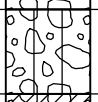
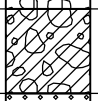
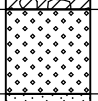
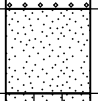
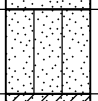
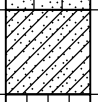
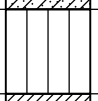
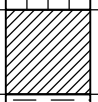
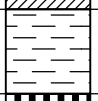
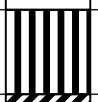
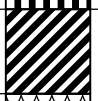
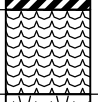
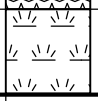
Boulders		- Greater than 12 inches (305 mm)
Cobbles		- 3 inches (76.2 mm) to 12 inches (305 mm)
Gravel:	Coarse	- ¾ inches (19.05 mm) to 3 inches (76.2 mm)
	Fine	- No.4 (4.75 mm) to ¾ inches (19.05 mm)
Sand:	Coarse	- No. 10 (2.00 mm) to No. 4 (4.75 mm)
	Medium	- No. 40 (0.425 mm) to No. 10 (2.00 mm)
	Fine	- No. 200 (0.074 mm) to No. 40 (0.425 mm)
Silt		- 0.005 mm to 0.074 mm
Clay		- Less than 0.005 mm

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier: i.e., silty clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils: i.e., silty clay, trace sand, little gravel.

If sand particle size is greater than 11% by weight of the total sample weight, the adjective (i.e., fine, medium or coarse) is added to the soil description for the sand portion of the sample, provided sand is the major or second major constituent.

SAMPLE DESIGNATIONS

AS	Auger Sample - directly from auger flight	ST	Shelby Tube Sample - 3-inch diameter unless otherwise noted
BS	Miscellaneous Samples - Bottle or Bag	PS	Piston Sample - 3-inch diameter unless otherwise noted
MC	Macro-Core Sample - 2.25-inch O.D., 1.75-inch I.D., 5 feet long polyethylene liner	RC	Rock Core - NX core unless otherwise noted
LB	Large-Bore (Micro-Core) Sample - 1-inch diameter, 2 feet long polyethylene liner	CS	CME Continuous Sample - 5 feet long, 3-inch diameter unless otherwise noted
SS	Split Spoon Sample - 1-inch or 2-inch O.D.	HA	Hand Auger
LS	Split Spoon (SS) Sampler with 3 feet long liner insert	DP	Drive Point
NR	No Recovery	CM	Coring Machine

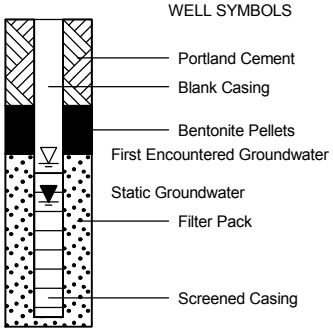
MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LESS THAN 15% FINES	GW		WELL-GRADED GRAVELS WITH OR WITHOUT SAND
			GP		POORLY-GRADED GRAVELS WITH OR WITHOUT SAND
		GRAVELS WITH 15% OR MORE FINES	GM		SILTY GRAVELS WITH OR WITHOUT SAND
			GC		CLAYEY GRAVELS WITH OR WITHOUT SAND
	SANDS MORE THAN HALF COARSE FRACTION IS FINER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 15% FINES	SW		WELL-GRADED SANDS WITH OR WITHOUT GRAVEL
			SP		POORLY-GRADED SANDS WITH OR WITHOUT GRAVEL
		SANDS WITH 15% OR MORE FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML		INORGANIC SILTS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			OL		ORGANIC SILTS OR CLAYS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH		INORGANIC SILTS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			CH		INORGANIC CLAYS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			OH		ORGANIC SILTS OR CLAYS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
HIGHLY ORGANIC SOILS			PT		PEAT AND OTHER HIGHLY ORGANIC SOILS

SYMBOLS KEY

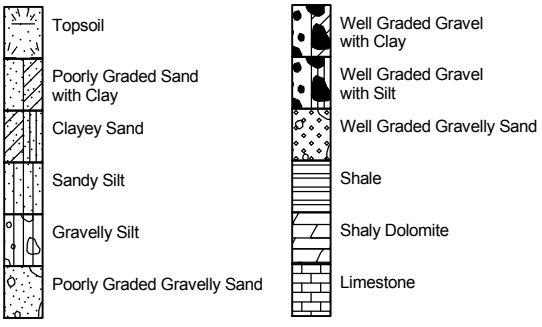
SAMPLE TYPES

Split Spoon sample, 1 inch or 2 inch outer-diameter.

WELL SYMBOLS



OTHER MATERIAL SYMBOLS



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BORING / WELL LOG KEY

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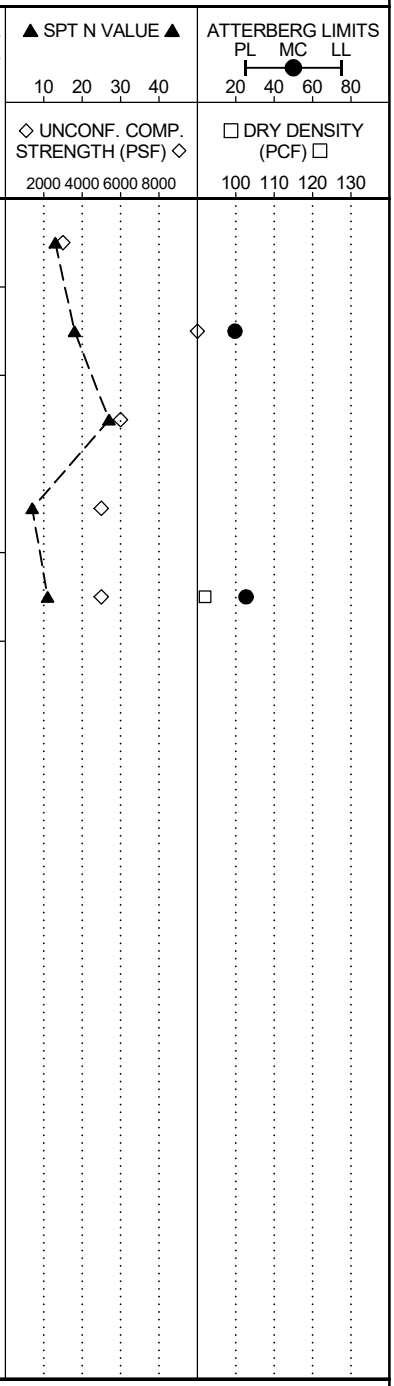
www.manniksmithgroup.com

BORING ID: SB-1

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 725723.9 N;1691029.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 605.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 7.5 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
604.5		Topsoil (6 inches)	0							
		Stiff to hard, brown silty CLAY, little gravel and asphalt fragments, trace brick fragments and organics, moist (FILL)		SS 1	6-6-7	13	78		3000^{P}	
602.0				SS 2	9-9-9	18	67		9000+^{P}	20
		Very stiff to hard, brown silty CLAY, little sand and gravel, moist (CL)		SS 3	9-13-14	27	89		6000^{P}	
			5	SS 4	3-4-3	7	89		5000^{P}	
597.5				SS 5	3-5-6	11	100	92	5000^{D}	25
		Bottom of borehole at 7.5 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

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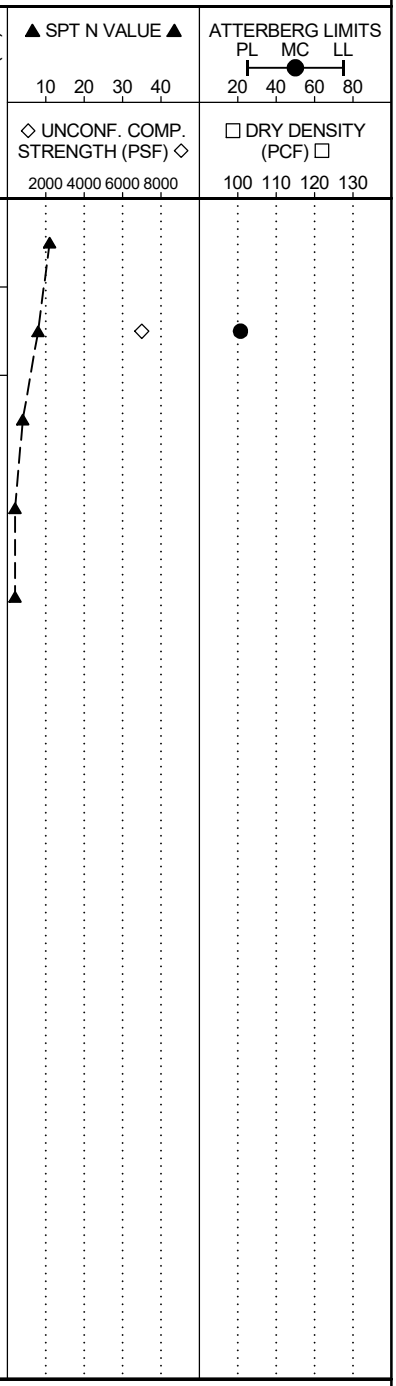
BORING ID: SB-2

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 725283.7 N;1690491.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 601.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 7.5 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
600.7		Topsoil (4 inches)	0							
599.5		Medium Dense GRAVEL and ASPHALT mix, trace organics, damp (FILL)		SS 1	14-8-3	11	67			
598.0		Very stiff, brown silty CLAY, little sand and gravel, trace brick and asphalt fragments, moist (FILL)		SS 2	3-3-5	8	67		7000[P]	21
593.5		Very loose, red BRICK FRAGMENTS and black SLAG mixture, wet (FILL)	5	SS 3	2-2-2	4	55			
				SS 4	1-1-1	2	33			
				SS 5	1-1-1	2	28			
		Bottom of borehole at 7.5 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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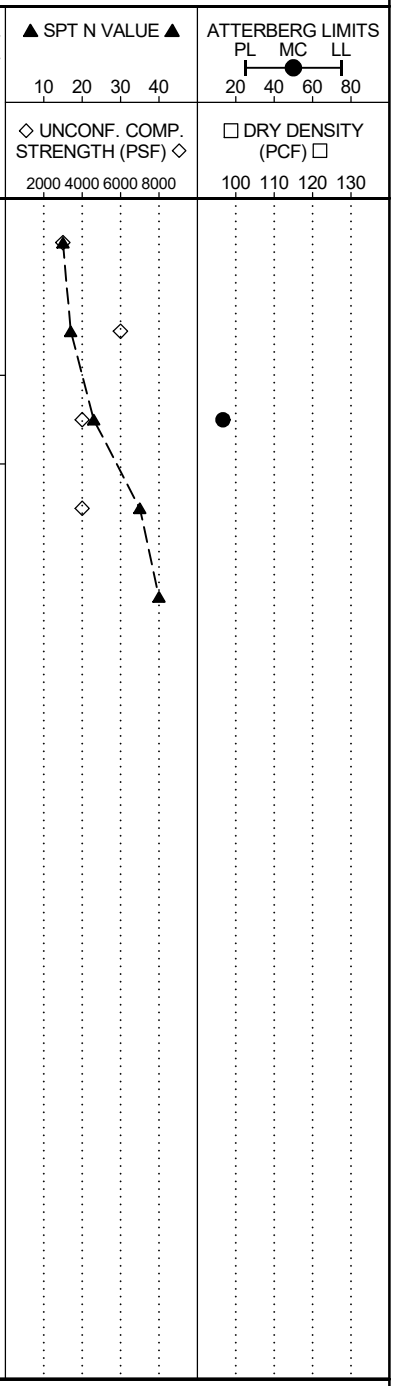
BORING ID: SB-3

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 725000.0 N;1689960.3 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 600.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 7.5 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
599.5		Topsoil (6 inches)	0	SS 1	1-4-11	15	50		3000^{P}	
		Stiff to very stiff, brown silty CLAY, trace sand, gravel, brick, tile, and asphalt fragments, and organics, damp (FILL)		SS 2	12-8-9	17	61		6000^{P}	
				SS 3	9-12-11	23	45		4000^{P}	13
		Becomes moist	5	SS 4	10-20-15	35	78		4000^{P}	
594.0		Dense, dark gray and black FLY ASH, damp (FILL)		SS 5	20-20-20	40	78			
592.5		Bottom of borehole at 7.5 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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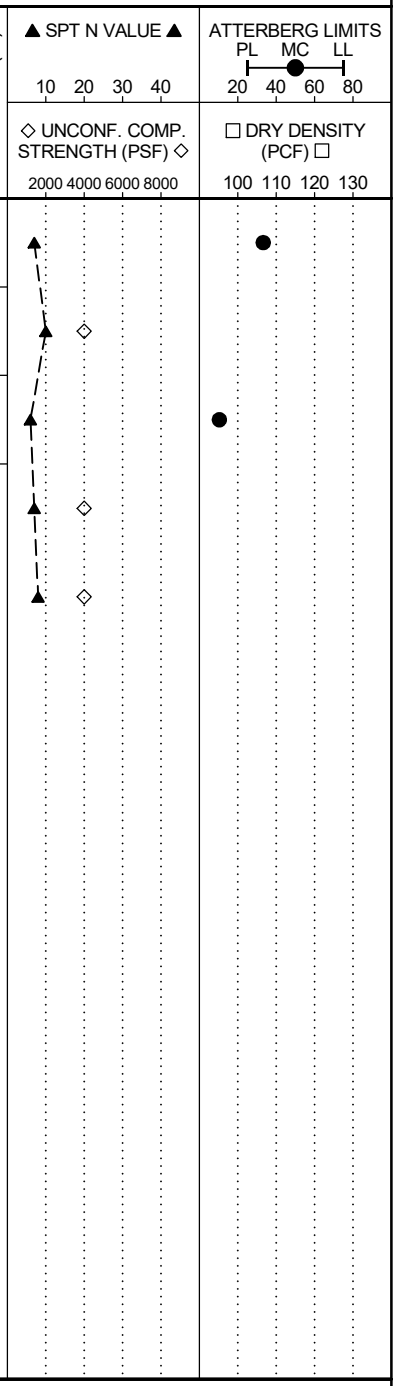
www.manniksmithgroup.com

BORING ID: SB-5

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/15/18 **COMPLETED** 11/15/18
BORING COORDINATES 724375.6 N;1689199.4 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 644.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 7.5 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
643.5		Topsoil (18 inches)	0							
642.5		some organics, damp		SS 1	1-3-4	7	61			33
641.0		Stiff, brown silty CLAY, trace sand, gravel, and organics, moist (FILL)		SS 2	3-5-5	10	78		4000^{P}	
639.5		Loose, dark brown SAND, some silt, little clay, trace gravel and asphalt fragments, damp (FILL)		SS 3	3-3-3	6	39			10
636.5		Stiff , brown silty CLAY, little sand, gravel, and brick fragments, damp (FILL)	5	SS 4	2-3-4	7	78		4000^{P}	
				SS 5	2-2-6	8	89		4000^{P}	
		Bottom of borehole at 7.5 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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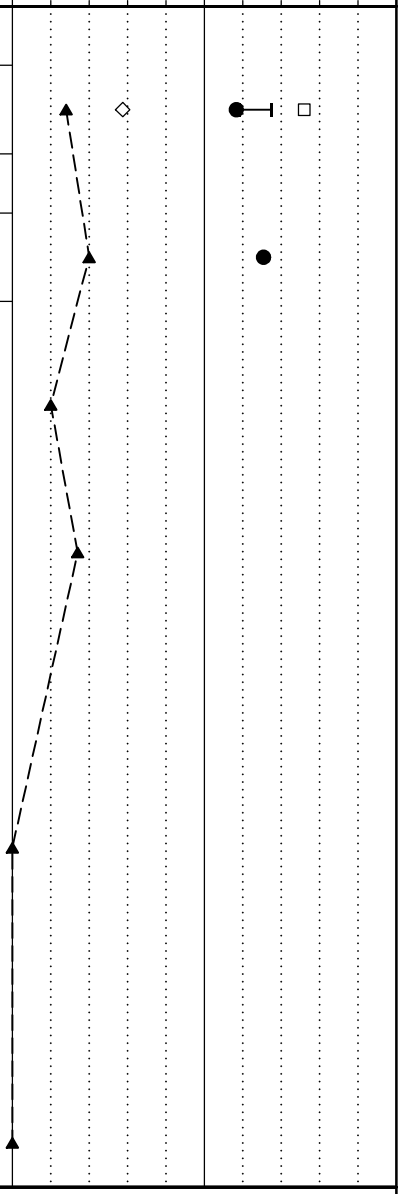
BORING ID: SB-6

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 725243.4 N;1689872.3 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 600.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 20.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
599.5		Topsoil (6 inches)	0							
		Very stiff, brown silty CLAY, little sand, trace gravel and asphalt fragments, moist (FILL)		SS 1	2-7-7	14	67	116	5750[D]	17
596.5		Medium dense, gray and black FLY ASH, trace gravel and organics, moist (FILL)	5	SS 2	7-10-10	20	72			31
		Becomes loose		SS 3	6-5-5	10	55			
591.5		Medium dense, dark gray SAND and FLY ASH, trace gravel and coal fragments, damp (FILL)	10	SS 4	8-10-7	17	78			
586.5		Very loose, dark gray and black FLY ASH, wet (FILL)	15	SS 5	1-0-0	0	100			
580.0		Bottom of borehole at 20.0 feet.	20	SS 6	0-0-0	0	100			



LEGEND:

WATER LEVEL AT TIME OF DRILLING 15 FEET
WATER LEVEL AT END OF DRILLING 15 FEET
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

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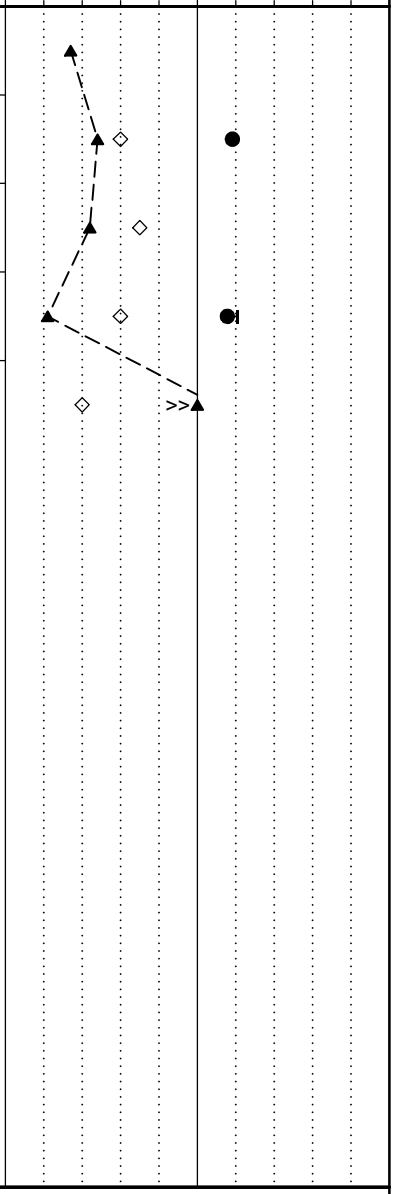
BORING ID: SB-8

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 725024.9 N;1689482.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 600.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 7.3 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
599.5		Topsoil (6 inches)	0							
598.5		Medium dense, brown gravelly SAND, little asphalt fragments, damp (FILL) (SW)		SS 1	4-8-9	17	45			
		Very stiff, brownish-gray silty CLAY, little sand and gravel, trace brick and asphalt fragments, damp (FILL)		SS 2	9-14-10	24	67		6000^{P}	18
595.5				SS 3	9-10-12	22	55		7000^{P}	
594.0		Very stiff, gray silty CLAY, some sand, trace gravel, damp (FILL)	5	SS 4	10-6-5	11	67		6000^{P}	16
592.5		Stiff, brown silty CLAY, little sand, gravel, brick and asphalt fragments, contains petroleum odor, damp (FILL)		SS 5	6-5-50	55	67		4000^{P}	
		Refusal at 7.3 feet. Bottom of borehole at 7.3 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

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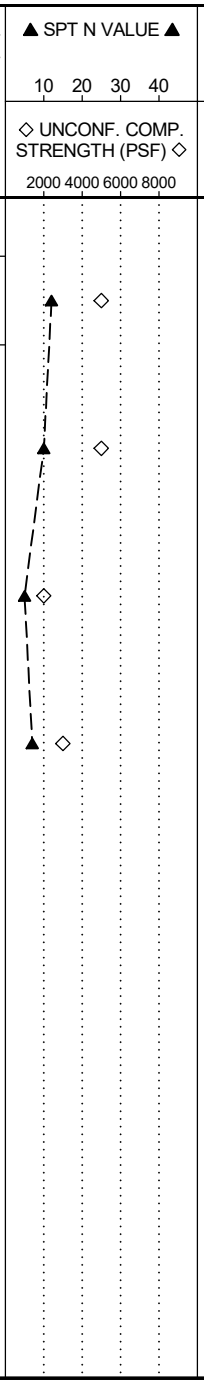
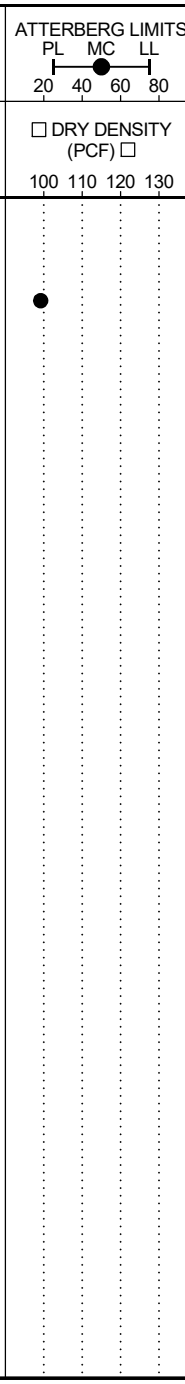
BORING ID: SB-9

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 724880.4 N;1689238.4 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 599.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 10.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
598.5		Topsoil (6 inches)	0							
		Very stiff, dark gray and black silty CLAY, little sand, gravel, brick, asphalt, and coal fragments, trace shells and slag, damp (FILL)		SS 1	5-7-5	12	89		5000[P]	18
				SS 2	5-5-5	10	95		5000[P]	
		Becomes stiff	5	SS 3	2-3-2	5	100		2000[P]	
589.0				SS 4	2-3-4	7	100		3000[P]	
		Bottom of borehole at 10.0 feet.	10							





LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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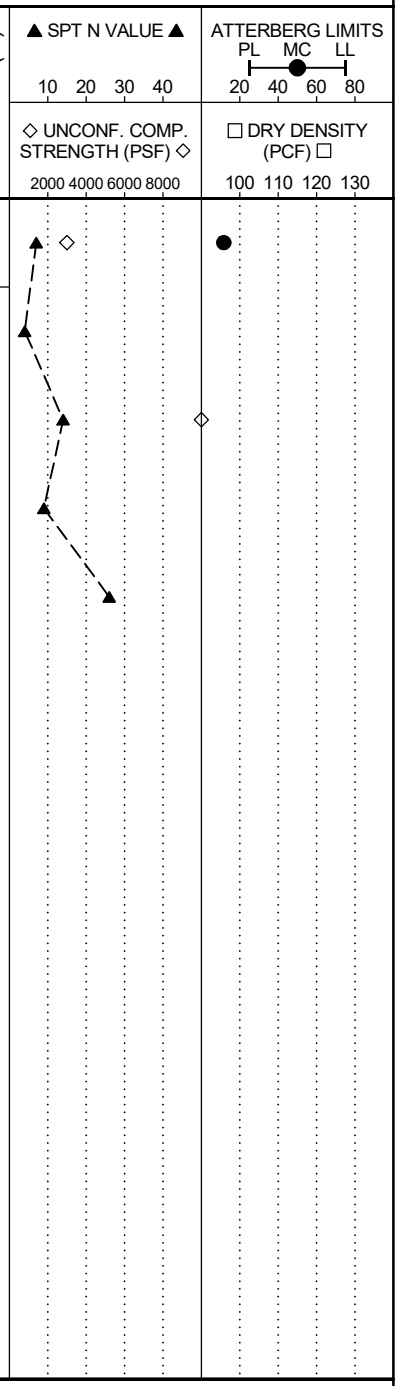
BORING ID: SB-10

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 725124.3 N;1689366.8 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 602.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 7.5 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
601.5		Topsoil (6 inches)	0							
600.5		Stiff, brown silty CLAY, little gravel, trace sand and organics, damp (FILL)		SS 1	2-5-2	7	83		3000[P]	12
		Very loose, dark gray and black FLY ASH, damp (FILL)		SS 2	2-2-2	4	100			
598.5				SS 3	2-7-7	14	89		9000+[P]	
597.5		Hard, brown and gray silty CLAY, little sand and gravel, damp (FILL)								
		Loose to medium dense, dark gray and black FLY ASH, damp (FILL)	5	SS 4	4-4-5	9	100			
594.5				SS 5	7-13-13	26	89			
		Bottom of borehole at 7.5 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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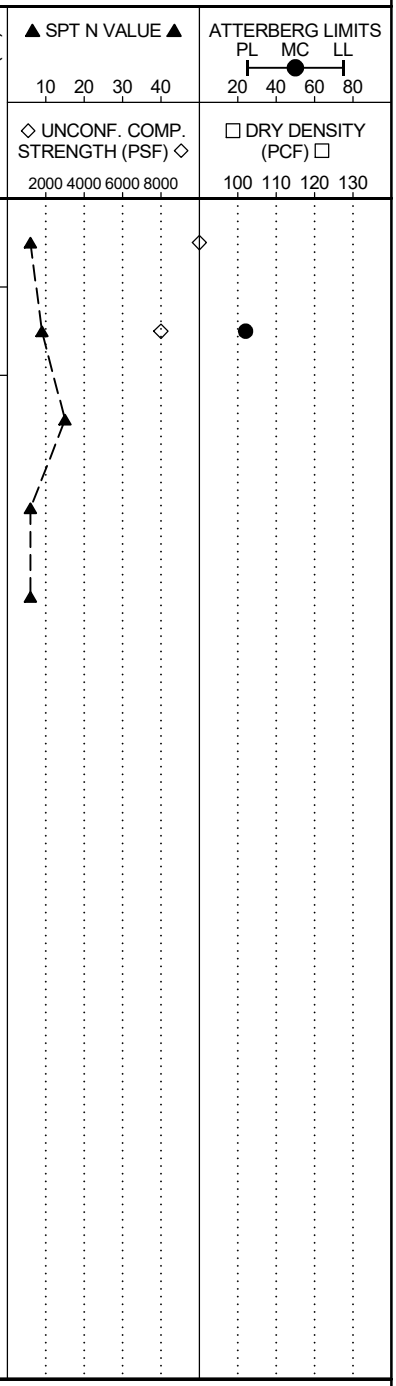
BORING ID: SB-11

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/12/18 **COMPLETED** 11/12/18
BORING COORDINATES 725415.7 N;1689400.3 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 599.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 7.5 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
598.5		Topsoil (6 inches)	0	SS 1	2-3-3	6	95		9000+^{P}	
		Hard, brown silty CLAY, trace sand, gravel, and organics, moist (FILL)		SS 2	2-3-6	9	100		8000^{P}	24
596.0		Medium dense to loose, gray and black FLY ASH, damp (FILL)	5	SS 3	7-7-8	15	95			
				SS 4	4-3-3	6	100			
591.5				SS 5	3-3-3	6	100			
		Bottom of borehole at 7.5 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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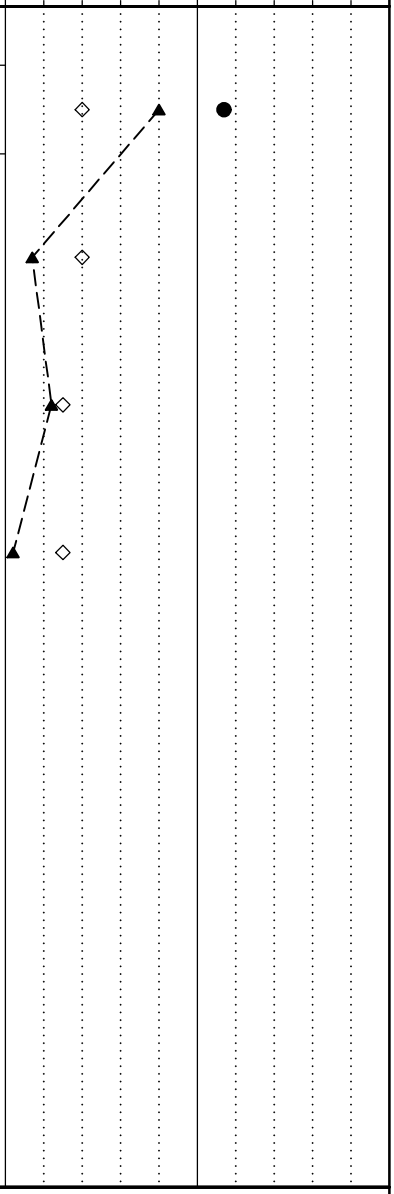
BORING ID: SB-12

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725145.3 N;1688834.5 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 583.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 10.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
582.5		Topsoil (6 inches)	0							
		Stiff, brown silty CLAY and SAND, trace gravel, organics, and brick fragments, damp (FILL)		SS 1	4-20-20	40	45		4000^{P}	14
579.5		Stiff, gray silty CLAY, little sand and gravel, trace coal and shell fragments, damp (FILL)	5	SS 2	2-4-3	7	83		4000^{P}	
577.0		Medium dense, CONCRETE FRAGMENTS, little asphalt and coal fragments, trace gravel, damp (FILL)		SS 3	4-6-6	12	33		3000^{P}	
574.5		Stiff, gray silty CLAY and CONCRETE FRAGMENTS, little sand and gravel, wet (FILL)	10	SS 4	0-1-1	2	11		3000^{P}	
573.0		Bottom of borehole at 10.0 feet.								



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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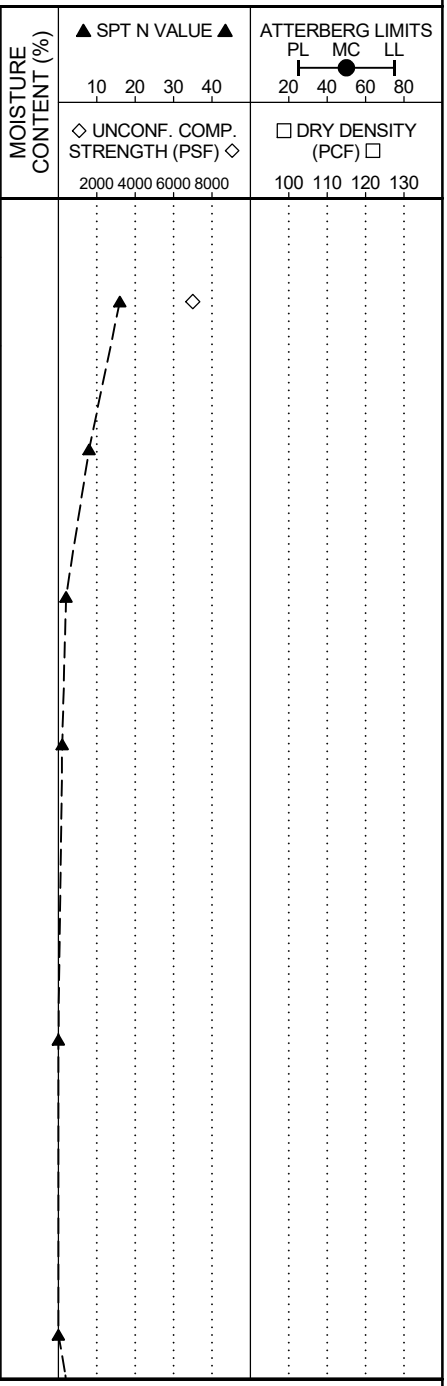
BORING ID: SB-13

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725433.1 N;1689280.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 596.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
595.5		Topsoil (6 inches)	0							
		Very stiff, brown silty CLAY, coat of coal and fly ash residue, damp (FILL)		SS 1	3-7-9	16	28		7000[P]	
592.5		Loose, gray and black FLY ASH, damp (FILL)	5	SS 2	4-4-4	8	78			
				SS 3	2-1-1	2	100			
		Becomes very loose and wet	10	SS 4	1-1-0	1	67			
			15	SS 5	0-0-0	0	22			
			20	SS 6	0-0-0	0	100			



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

(Continued Next Page)

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BORING ID: SB-13

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725433.1 N;1689280.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 596.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
572.5		Loose, gray and black FLY ASH, damp (FILL) *(continued)*	20							
571.0		Medium dense, gray SAND, little gravel, trace clay and silt, wet (SW)	25	SS 7	8-7-6	13	39			11
		Bottom of borehole at 25.0 feet.								

▲ SPT N VALUE ▲ (10 20 30 40)
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
☐ DRY DENSITY (PCF) ☐ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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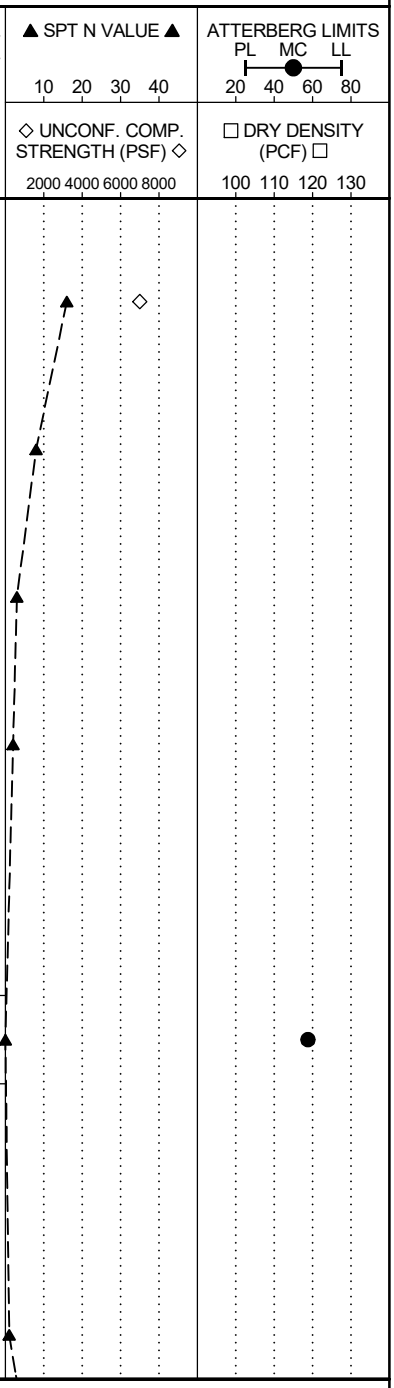
BORING ID: SB-14

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725383.9 N;1689246.5 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 594.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
593.5		Topsoil (6 inches)	0							
		Very stiff, brown silty CLAY, trace organics, coal and fly ash residue, damp (FILL)		SS 1	4-6-10	16	33		7000[P]	
590.5		Loose, gray and black FLY ASH, moist (FILL)	5	SS 2	4-5-3	8	89			
				SS 3	1-2-1	3	100			
		Becomes very loose and wet	10	SS 4	1-1-1	2	67			
			15	SS 5	0-0-0	0	17			58
			20	SS 6	0-0-1	1	100			



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

(Continued Next Page)

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BORING ID: SB-14

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725383.9 N;1689246.5 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 594.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Loose, gray and black FLY ASH, moist (FILL) *(continued)*	20							
570.5										
569.0		Medium dense, gray silty SAND, some clay, trace gravel and shells, wet (SW-SM)	25	SS 7	7-6-8	14	33			
		Bottom of borehole at 25.0 feet.								

▲ SPT N VALUE ▲ (10 20 30 40)
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
☐ DRY DENSITY (PCF) ☐ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

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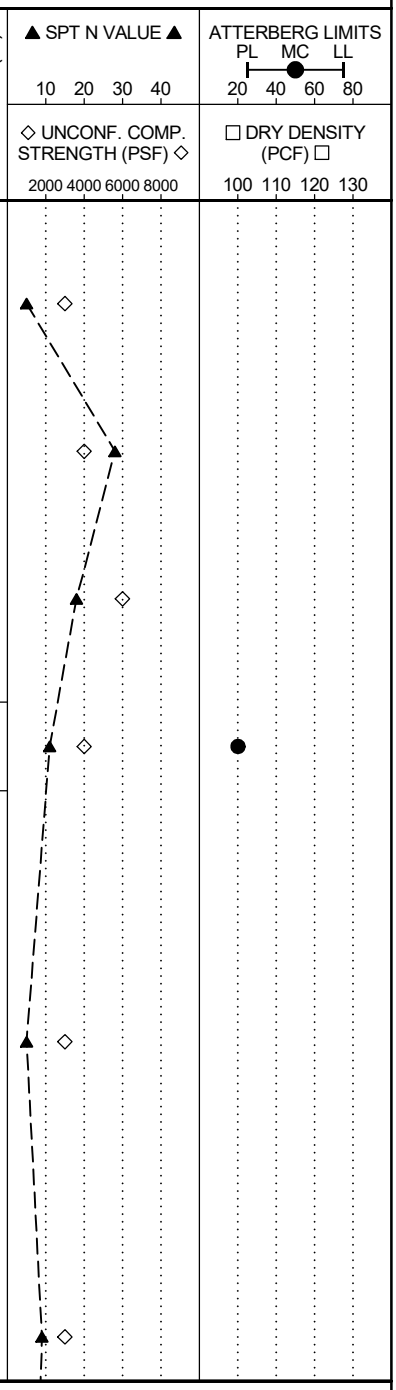
BORING ID: SB-15

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725299.6 N;1689229.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 593.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
592.5		Topsoil (6 inches)	0							
		Stiff, grayish-brown silty CLAY, little sand and gravel, damp (FILL)		SS 1	2-2-3	5	83		3000[P]	
589.5		Very stiff, gray and brown silty CLAY, little sand, gravel, and concrete fragments, damp (FILL)	5	SS 2	2-3-25	28	33		4000[P]	
587.0		Very stiff, gray and brown silty CLAY, little fly ash, trace coal and brick fragments, damp (FILL)		SS 3	4-8-10	18	100		6000[P]	
			10	SS 4	4-5-6	11	45		4000[P]	20
579.5		Stiff, gray silty CLAY, trace sand and gravel, trace brick and coal fragments, contains petroluem odor, damp (FILL)	15	SS 5	2-3-2	5	89		3000[P]	
			20	SS 6	3-3-6	9	95		3000[P]	



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

(Continued Next Page)

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1800 Indian Wood Circle, Maumee, OH 43537
ph: (419) 891-2222 fax: (419) 891-1595
www.manniksmithgroup.com

BORING ID: SB-15

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725299.6 N;1689229.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 593.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Stiff, gray silty CLAY, trace sand and gravel, trace brick and coal fragments, contains petroluem odor, damp (FILL) *(continued)*	20							
569.5		Loose, gray silty SAND, little silt, trace gravel, clay, and shells, wet (SP-SM)	25	SS 7	2-3-4	7	100			24
568.0		Bottom of borehole at 25.0 feet.								

▲ SPT N VALUE ▲ (10 20 30 40)
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
☐ DRY DENSITY (PCF) ☐ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

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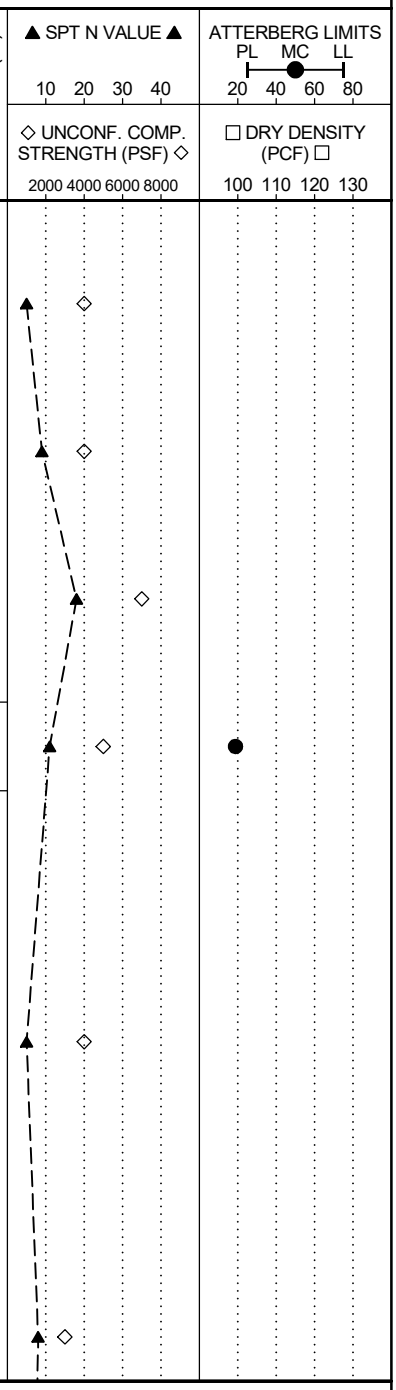
BORING ID: SB-16

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725350.5 N;1689190.5 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 593.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
592.5		Topsoil (6 inches)	0							
		Stiff to very stiff, brown silty CLAY, trace sand, gravel, brick, asphalt, and coal fragments, damp (FILL)		SS 1	3-3-2	5	89		4000[P]	
			5	SS 2	3-3-6	9	67		4000[P]	
				SS 3	4-9-9	18	78		7000[P]	
			10	SS 4	5-5-6	11	33		5000[P]	19
			15	SS 5	3-2-3	5	89		4000[P]	
			20	SS 6	4-2-6	8	100		3000[P]	



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

(Continued Next Page)

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BORING ID: SB-16

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725350.5 N;1689190.5 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 593.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Stiff to very stiff, brown silty CLAY, trace sand, gravel, brick, asphalt, and coal fragments, damp (FILL) *(continued)*	20							
569.5		Loose, gray silty SAND, some clay, trace gravel and shells, wet (SP-SM)	25	SS 7	3-2-5	7	95			
568.0		Bottom of borehole at 25.0 feet.								

▲ SPT N VALUE ▲ (10 20 30 40)
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
☐ DRY DENSITY (PCF) ☐ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
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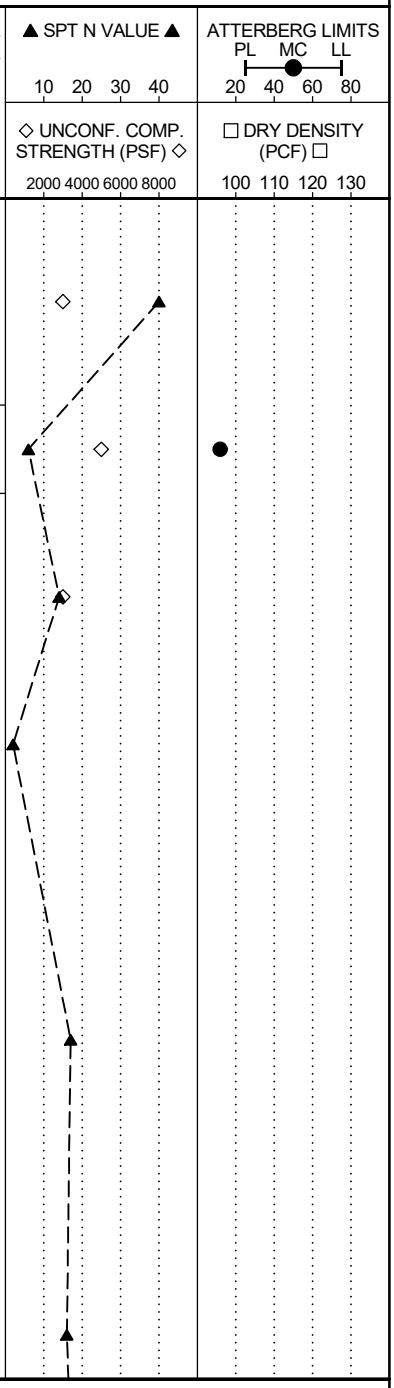
BORING ID: SB-17

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/13/18 **COMPLETED** 11/13/18
BORING COORDINATES 725500.0 N;1689074.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 586.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
585.5		Topsoil (6 inches)	0							
		Stiff to very stiff, brown and gray silty CLAY, little sand, trace gravel, shells, coal fragments, and fly ash, damp (FILL)		SS 1	5-25-15	40	39		3000[P]	
				SS 2	3-3-3	6	78		5000[P]	12
		Contains concrete fragments	5	SS 3	3-7-7	14	39		3000[P]	
577.5		Medium Dense , gray SAND, trace silt, gravel, and shells, wet (SW)		SS 4	1-1-1	2	55			
		Becomes medium dense	10	SS 5	3-9-8	17	100			
			15	SS 6	6-8-8	16	89			
			20							



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
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BORING COORDINATES 725500.0 N;1689074.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 586.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 25.0 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
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ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Medium Dense , gray SAND, trace silt, gravel, and shells, wet (SW) *(continued)*	20							
561.0			25	SS 7	7-9-10	19	100			
		Bottom of borehole at 25.0 feet.								

▲ SPT N VALUE ▲ (10 20 30 40)
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
☐ DRY DENSITY (PCF) ☐ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

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BORING ID: SB-18

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/14/18 **COMPLETED** 11/14/18
BORING COORDINATES 724030.4 N;1688612.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 591.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
590.5		Topsoil (6 inches)	0							
		Stiff, grayish-brown silty CLAY, little sand and gravel, trace asphalt fragments, moist (FILL)		SS 1	0-0-0	0	55		4000[P]	16
				SS 2	1-1-1	2	67		4000[P]	
585.0			5							
		Medium stiff, gray silty CLAY, damp (FILL)		SS 3	0-0-2	2	87		2000[P]	
		Becomes stiff and contains coal and fly ash	10	SS 4	1-1-1	2	100		3000[P]	
577.5		Stiff, gray and brown silty CLAY, little sand and gravel, trace shells, moist (CL)		SS 5	1-1-1	2	95		4000[P]	27
571.5			15							
			20	SS 6	1-2-5	7	78		3000[P]	

▲ SPT N VALUE ▲ (10 20 30 40)
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
□ DRY DENSITY (PCF) □ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
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AASHTO R18

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CLIENT Smith Group **PROJECT NAME** Proposed Urban Metro Park
PROJECT NUMBER S2950002 **PROJECT LOCATION** Toledo, OH
DATE STARTED 11/14/18 **COMPLETED** 11/14/18 **BORING COORDINATES** 724030.4 N;1688612.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon **GROUND ELEVATION** 591.0 FEET
DRILLING CONTRACTOR MSG **TOTAL DEPTH** 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic **ENGINEER ON RIG** ARE **CHECKED BY** GAB
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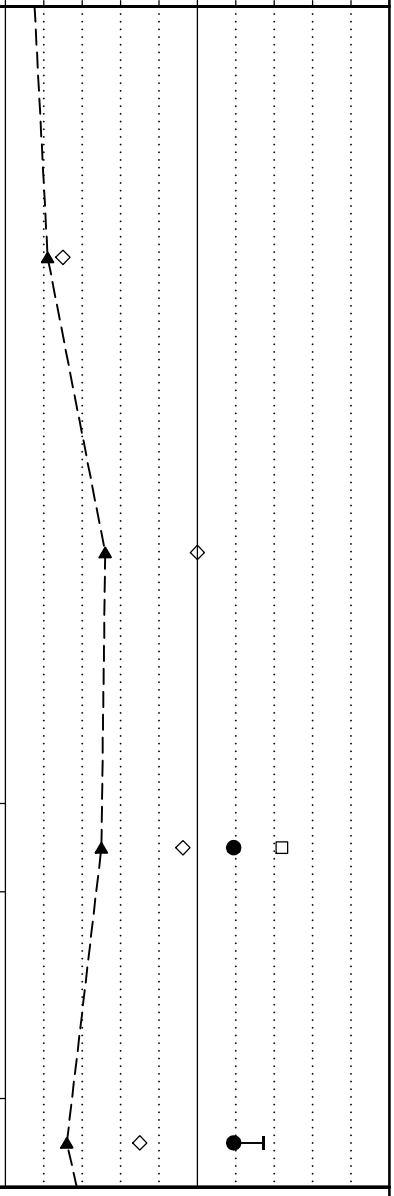
ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Loose, gray gravelly SAND, trace silt and clay, wet (SW) *(continued)*	20							
567.5		Stiff, gray silty CLAY, trace sand and gravel, moist (CL)	25	SS 7	2-5-6	11	61		3000^{P}	
562.5		Hard, gray silty CLAY, little sand, trace gravel, damp (CL)	30	SS 8	6-10-16	26	55		9000+^{P}	
		Becomes very stiff	35	SS 9	5-10-15	25	100	112	9250^{D}	19
			40	SS 10	3-6-10	16	100		7000^{P}	19



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

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AASHTO R18

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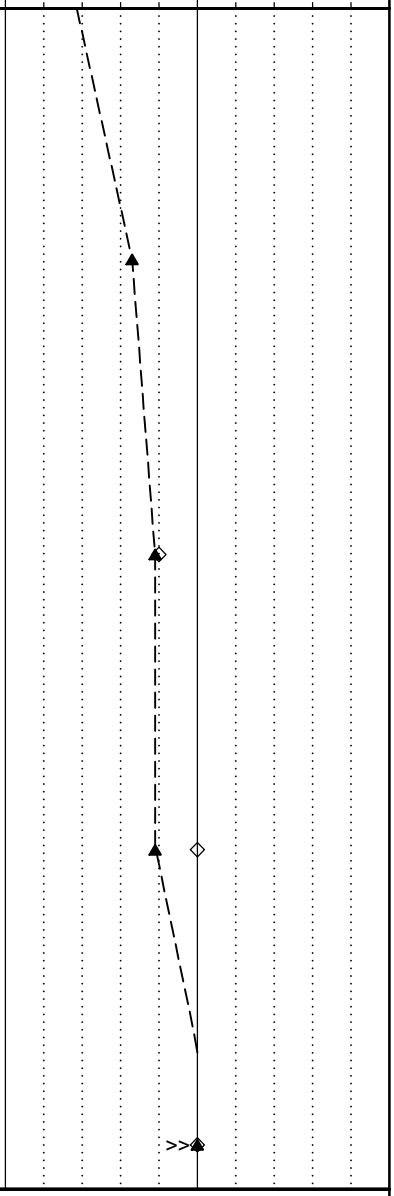
CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/14/18 **COMPLETED** 11/14/18
BORING COORDINATES 724030.4 N;1688612.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 591.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Hard, gray silty CLAY, little sand, trace gravel, damp (CL) *(continued)*	40							
547.5		Dense, gray silty SAND, wet (SW-SM)	45	SS 11	10-15-18	33	100			
542.5		Hard, gray silty CLAY, trace sand and gravel, damp (CL)	50	SS 12	10-14-25	39	100		8000[P]	
			55	SS 13	8-16-23	39	100		9000+[P]	
			60	SS 14	15-25-30	55	100		9000+[P]	



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

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AASHTO R18

(Continued Next Page)

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BORING ID: SB-18

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/14/18 **COMPLETED** 11/14/18
BORING COORDINATES 724030.4 N;1688612.1 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 591.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Hard, gray silty CLAY, trace sand and gravel, damp (CL) *(continued)*	60							
			65	SS 15	25-30-41	71	100		9000+P	
			70	SS 16	36-41-48	89	100		9000+P	
516.8				SS 17	45-50/2--	50+	75		9000+P	
		Refusal at 74.2 feet. Bottom of borehole at 74.2 feet.								

▲ SPT N VALUE ▲ (10 20 30 40) >>▲
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
□ DRY DENSITY (PCF) □ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
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AASHTO R18

GEOTECH STANDARD LOG - GINT STD US LAB.GDT - 2/1/19 13:09 - W:\PROJECTS\PROJECTS P-TS\2950002\ADMIN\LAB\BORINGS - CORRECTIONS.GPJ

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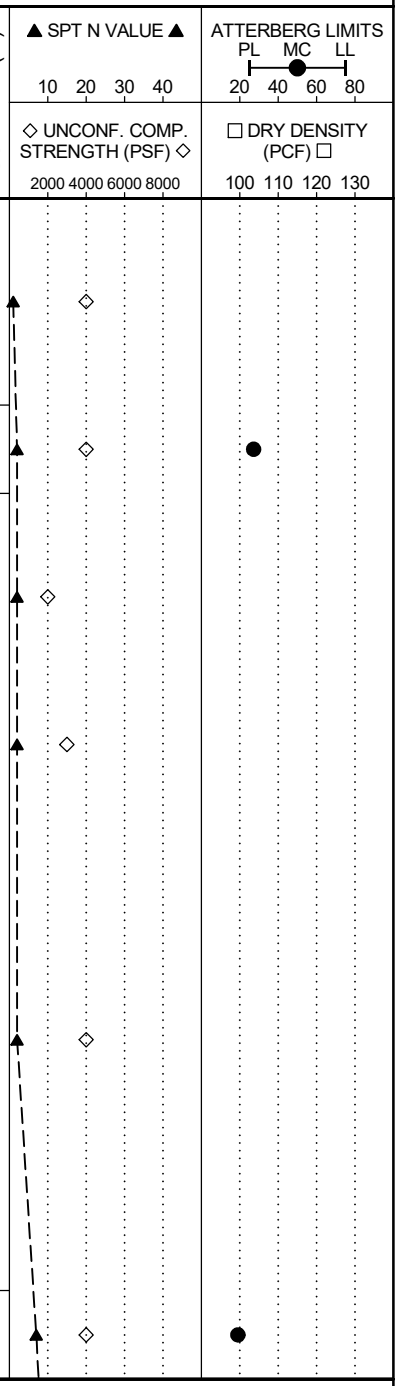
BORING ID: SB-19

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/15/18 **COMPLETED** 11/15/18
BORING COORDINATES 723908.2 N;1688524.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 592.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
591.5		Topsoil (6 inches)	0							
		Stiff, brown mottled with gray silty CLAY, little sand and gravel, trace organics, damp (CL)		SS 1	0-0-1	1	45		4000[P]	
			5	SS 2	0-1-1	2	78		4000[P]	27
586.0		Stiff, gray silty CLAY, trace sand, moist (CL)		SS 3	0-1-1	2	83		2000[P]	
			10	SS 4	1-1-1	2	100		3000[P]	
			15	SS 5	0-0-2	2	100		4000[P]	
			20	SS 6	1-3-4	7	89		4000[P]	19



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

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AASHTO R18

(Continued Next Page)

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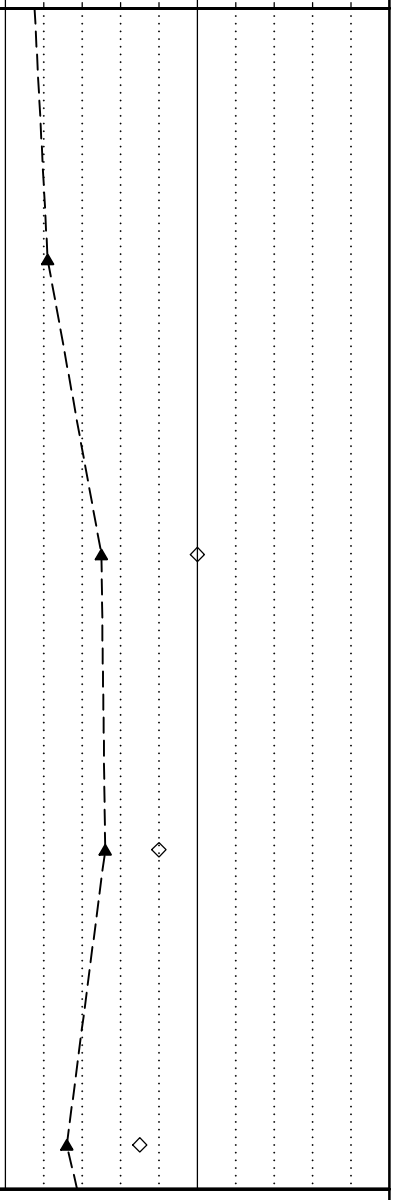
CLIENT Smith Group **PROJECT NAME** Proposed Urban Metro Park
PROJECT NUMBER S2950002 **PROJECT LOCATION** Toledo, OH
DATE STARTED 11/15/18 **COMPLETED** 11/15/18 **BORING COORDINATES** 723908.2 N;1688524.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon **GROUND ELEVATION** 592.0 FEET
DRILLING CONTRACTOR MSG **TOTAL DEPTH** 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic **ENGINEER ON RIG** ARE **CHECKED BY** GAB
DRILLER RJS **REMARKS** Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Stiff, gray silty CLAY, trace sand, moist (CL) *(continued)*	20							
			25	SS 7	3-4-7	11	0			
563.5		Hard, gray silty CLAY, trace sand and gravel, damp (CL)	30	SS 8	7-11-14	25	33		9000+P	
			35	SS 9	6-10-16	26	100		8000P	
		Becomes Very Stiff	40	SS 10	4-8-8	16	100		7000P	



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

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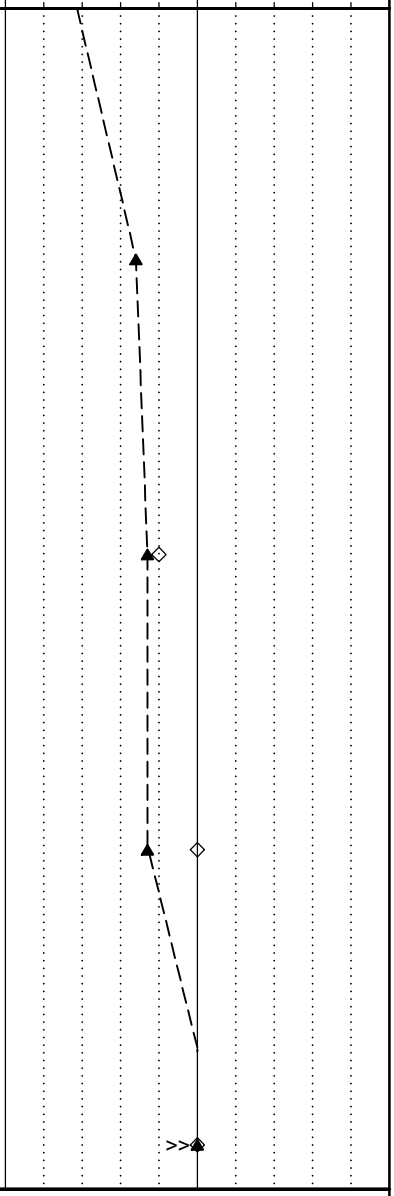
CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/15/18 **COMPLETED** 11/15/18
BORING COORDINATES 723908.2 N;1688524.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 592.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Hard, gray silty CLAY, trace sand and gravel, damp (CL) *(continued)*	40							
548.5		Dense, gray silty SAND, trace gravel, wet (SW-SM)	45	SS 11	12-14-20	34	100			
543.5		Hard, gray silty CLAY, trace sand and gravel, damp (CL)	50	SS 12	9-15-22	37	100		8000[P]	
			55	SS 13	10-15-22	37	100		9000+[P]	
			60	SS 14	16-24-32	56	100		9000+[P]	



LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

(Continued Next Page)

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BORING ID: SB-19

CLIENT Smith Group
PROJECT NAME Proposed Urban Metro Park
PROJECT NUMBER S2950002
PROJECT LOCATION Toledo, OH
DATE STARTED 11/15/18 **COMPLETED** 11/15/18
BORING COORDINATES 723908.2 N;1688524.9 E FEET
DRILLING METHOD 3 1/4" steel casing with split spoon
GROUND ELEVATION 592.0 FEET
DRILLING CONTRACTOR MSG
TOTAL DEPTH 74.2 FT **BACKFILL** Cuttings and bentonite
DRILL RIG 3230 DT **HAMMER TYPE** Automatic
ENGINEER ON RIG ARE **CHECKED BY** GAB
DRILLER RJS
REMARKS Elevations are estimates from Google Earth

ELEVATION (FEET)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (FEET)	SAMPLE TYPE NUMBER	BLOW COUNTS	SPT N VALUE	RECOVERY % (RQD)	DRY DENSITY (PCF)	UNCONF. COMP. STRENGTH (PSF)	MOISTURE CONTENT (%)
		Hard, gray silty CLAY, trace sand and gravel, damp (CL) *(continued)*	60							
			65	SS 15	27-30-38	68	100		9000+P	
			70	SS 16	34-42-48	90	100		9000+P	
517.8				SS 17	42-50		87		9000+P	
		Refusal at 74.2 feet. Bottom of borehole at 74.2 feet.								

▲ SPT N VALUE ▲ (10 20 30 40)
◇ UNCONF. COMP. STRENGTH (PSF) ◇ (2000 4000 6000 8000)
ATTERBERG LIMITS PL MC LL (20 40 60 80)
☐ DRY DENSITY (PCF) ☐ (100 110 120 130)

LEGEND:

WATER LEVEL AT TIME OF DRILLING N/A
WATER LEVEL AT END OF DRILLING N/A
WATER LEVEL AFTER DRILLING N/A

D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

AASHTO R18

GEOTECH STANDARD LOG - GINT STD US LAB.GDT - 2/1/19 13:09 - W:\PROJECTS\PROJECTS P-TS\2950002\ADMIN\LAB\BORINGS - CORRECTIONS.GPJ

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GENERALIZED SOIL PROFILE
Toledo Metroparks Profile A

CLIENT Smith Group

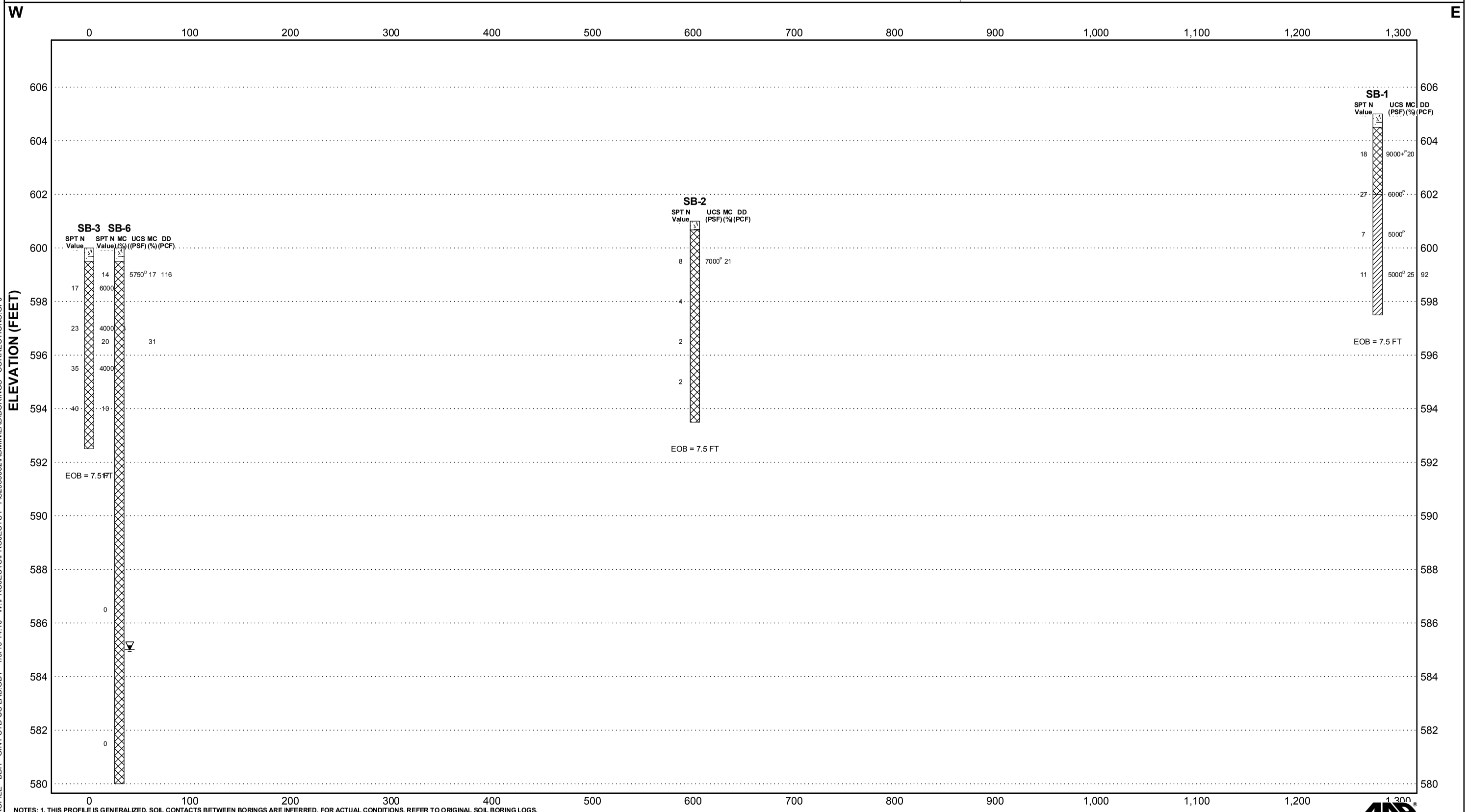
PROJECT NUMBER S2950002

PROJECT NAME Proposed Urban Metro Park

PROJECT LOCATION Toledo, OH

LEGEND:
TOPSOIL | Fill | CLAY

= WATER LEVEL AT TIME OF DRILLING
= WATER LEVEL AT END OF DRILLING
= WATER LEVEL AFTER DRILLING
D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST



NOTES: 1. THIS PROFILE IS GENERALIZED. SOIL CONTACTS BETWEEN BORINGS ARE INFERRED. FOR ACTUAL CONDITIONS, REFER TO ORIGINAL SOIL BORING LOGS.
2. EOB = END OF BORING.

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GENERALIZED SOIL PROFILE
Toledo Metroparks Profile B

CLIENT Smith Group

PROJECT NUMBER S2950002

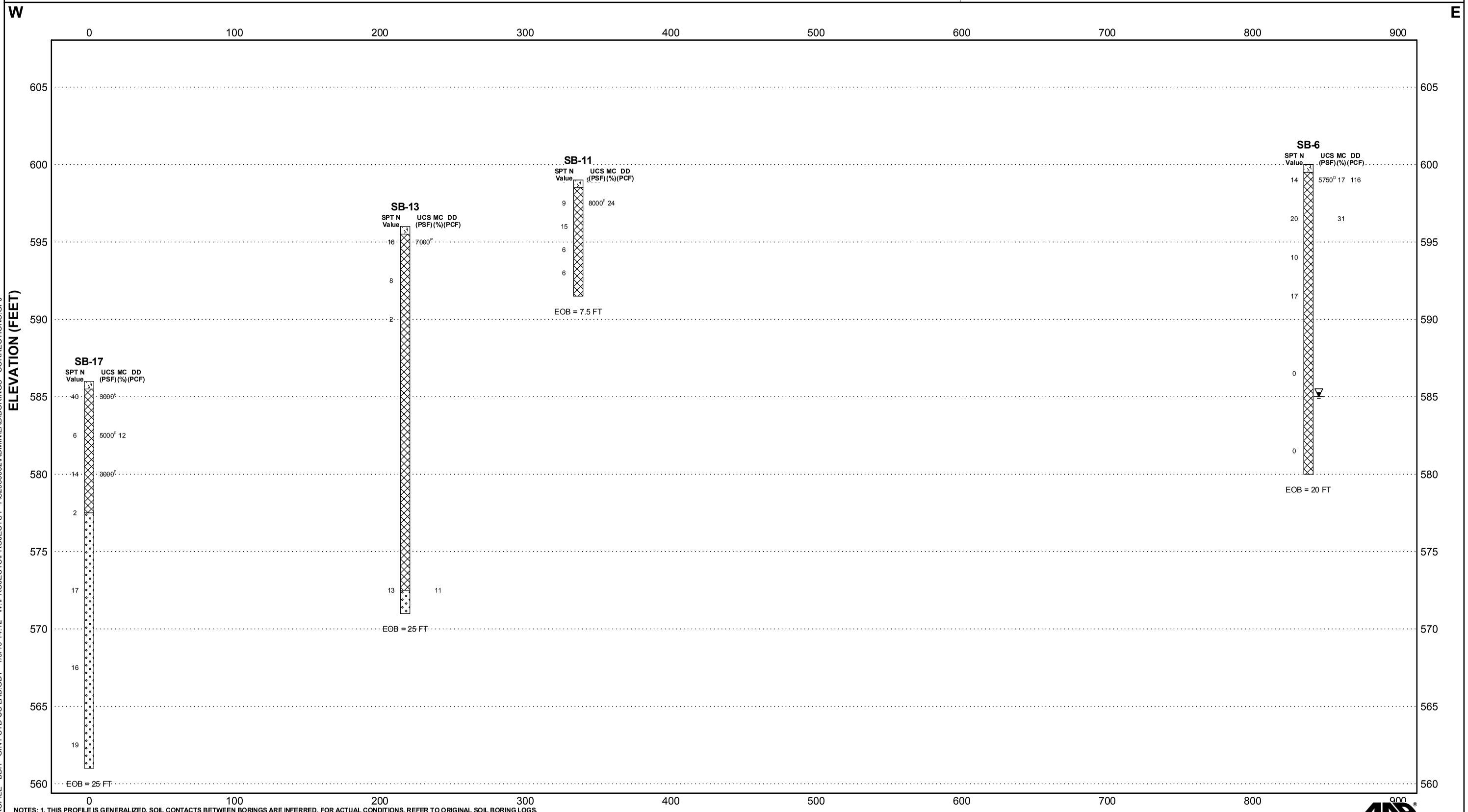
PROJECT NAME Proposed Urban Metro Park

PROJECT LOCATION Toledo, OH

LEGEND:
TOPSOIL | Fill | Well-graded SAND

= WATER LEVEL AT TIME OF DRILLING
= WATER LEVEL AT END OF DRILLING
= WATER LEVEL AFTER DRILLING
D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

W E



NOTES: 1. THIS PROFILE IS GENERALIZED. SOIL CONTACTS BETWEEN BORINGS ARE INFERRED. FOR ACTUAL CONDITIONS, REFER TO ORIGINAL SOIL BORING LOGS.
2. EOB = END OF BORING.

AASHTO R18

SOIL PROFILE - BBH - GINT STD US LAB.GDT - 1/9/19 14:12 - W:\PROJECTS\PROJECTS P-TS\2950002\ADMIN\LAB\BORINGS - CORRECTIONS.GPJ

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GENERALIZED SOIL PROFILE
Toledo Metroparks Profile C

CLIENT Smith Group

PROJECT NUMBER S2950002

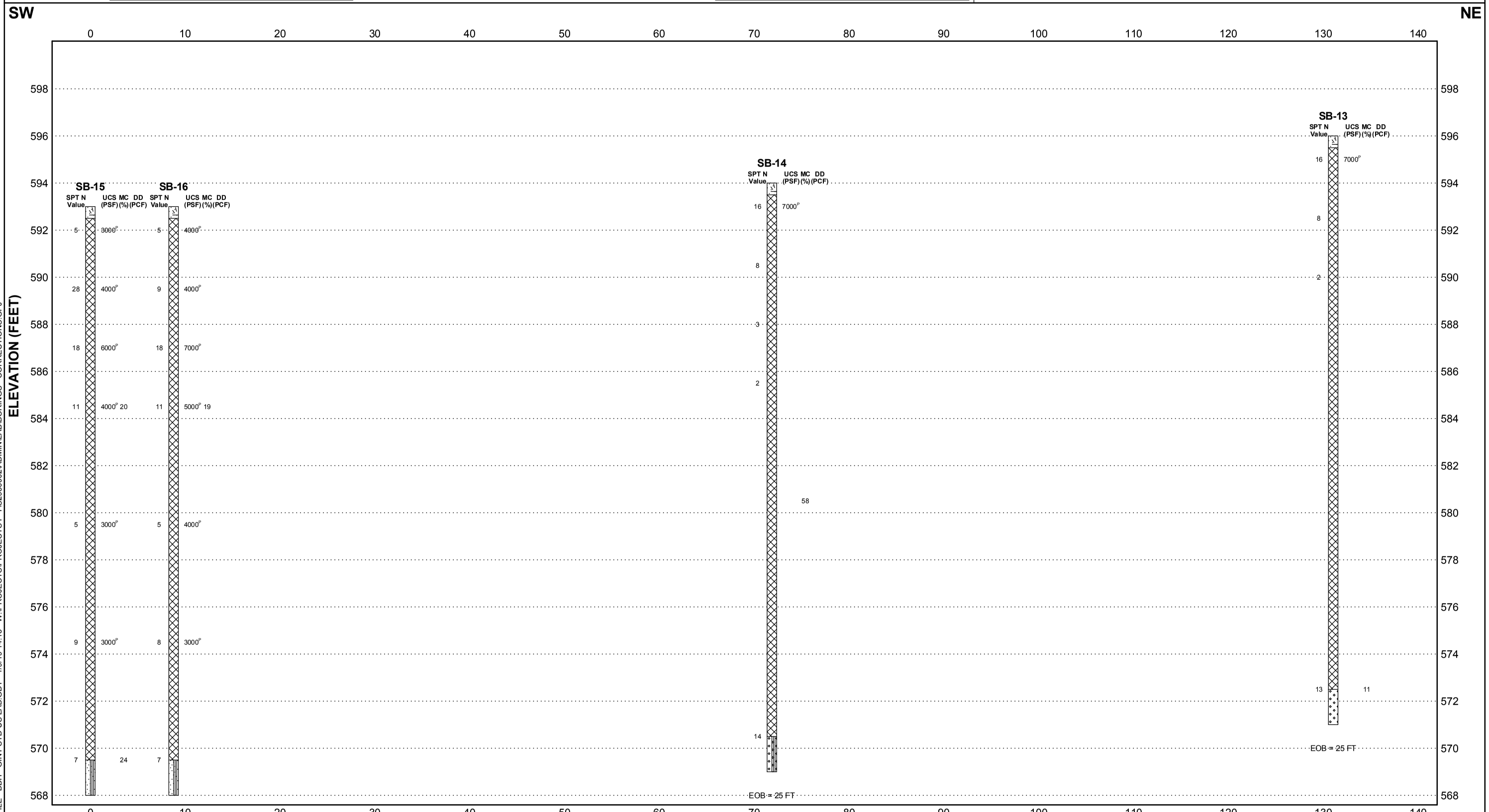
PROJECT NAME Proposed Urban Metro Park

PROJECT LOCATION Toledo, OH

LEGEND:

TOPSOIL | Fill | Well-graded SAND | Well-graded Silty SAND | Poorly-graded Silty SAND

= WATER LEVEL AT TIME OF DRILLING
= WATER LEVEL AT END OF DRILLING
= WATER LEVEL AFTER DRILLING
D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST



NOTES: 1. THIS PROFILE IS GENERALIZED. SOIL CONTACTS BETWEEN BORINGS ARE INFERRED. FOR ACTUAL CONDITIONS, REFER TO ORIGINAL SOIL BORING LOGS.
2. EOB = END OF BORING.

AASHTO R18

SOIL PROFILE - BBH - GINT STD US LAB.GDT - 1/9/19 14:13 - W:\PROJECTS\PROJECTS P-TS\2950002\ADMIN\LAB\BORINGS - CORRECTIONS.GPJ

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GENERALIZED SOIL PROFILE
Toledo Metroparks Profile D

CLIENT Smith Group

PROJECT NUMBER S2950002

PROJECT NAME Proposed Urban Metro Park

PROJECT LOCATION Toledo, OH

LEGEND:

TOPSOIL Fill

▽ = WATER LEVEL AT TIME OF DRILLING
▽ = WATER LEVEL AT END OF DRILLING
▼ = WATER LEVEL AFTER DRILLING
D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

W E

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700

605 600 595 590 585 580 575 570

SB-10

SPT N Value	UCS (PSF)	MC (%)	DD (PCF)
4			
14	9000+P		
9			
26			

EOB = 7.5 FT

SB-8

SPT N Value	UCS (PSF)	MC (%)	DD (PCF)
24	6000P	18	
22	7000P		
11	6000P	16	
55	4000P		

EOB = 7.25 FT

SB-12

SPT N Value	UCS (PSF)	MC (%)	DD (PCF)
40	4000P	14	
7	4000P		
12	3000P		
2	3000P		

EOB = 10 FT

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2. EOB = END OF BORING.

AASHTO R18

ELEVATION (FEET)

DISTANCE ALONG PROFILE (FEET)

SOIL PROFILE - BBH - GINT STD US LAB.GDT - 1/9/19 14:15 - W:\PROJECTS\PROJECTS P-T\S2950002\ADMIN\LAB\BORINGS - CORRECTIONS.GPJ

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GENERALIZED SOIL PROFILE
Toledo Metroparks Profile E

CLIENT Smith Group

PROJECT NUMBER S2950002

PROJECT NAME Proposed Urban Metro Park

PROJECT LOCATION Toledo, OH

LEGEND:

TOPSOIL | Fill | CLAY | Well-graded Gravelly SAND | Well-graded Silty SAND

▽ = WATER LEVEL AT TIME OF DRILLING
▽ = WATER LEVEL AT END OF DRILLING
▼ = WATER LEVEL AFTER DRILLING
D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

S N

0 100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400

650 640 630 620 610 600 590 580 570 560 550 540 530 520 510

ELEVATION (FEET)

SB-5

SPT N Value	UCS (PSF)	MC (%)	DD (PCF)
10	4000P		
6			
7	4000P		10
8	4000P		

EOB = 7.5 FT

SB-18

SPT N Value	UCS (PSF)	MC (%)	DD (PCF)
	4000P	16	
2	4000P		
	2000P		
2	3000P		
2	4000P	27	
7	3000P		
11	3000P		
26	9000+P		
25	9250D	19	112
16	7000P	19	
33			
39	8000P		
39	9000+P		
55	9000+P		
71	9000+P		
89	9000+P		
50+	9000+P		

EOB = 74.17 FT

SB-9

SPT N Value	UCS (PSF)	MC (%)	DD (PCF)
12	5000P	18	
10	5000P		
5	2000P		
7	3000P		

EOB = 10 FT

SB-8

SPT N Value	UCS (PSF)	MC (%)	DD (PCF)
24	6000P	18	
22	7000P		
11	6000P	16	
55	4000P		

EOB = 7.25 FT

NOTES: 1. THIS PROFILE IS GENERALIZED. SOIL CONTACTS BETWEEN BORINGS ARE INFERRED. FOR ACTUAL CONDITIONS, REFER TO ORIGINAL SOIL BORING LOGS.
2. EOB = END OF BORING.

AASHTO R18

DISTANCE ALONG PROFILE (FEET)

SOIL PROFILE - BBH - GINT STD US LAB.GDT - 1/9/19 14:16 - W:\PROJECTS\PROJECTS P-T\S2950002\ADMIN\LAB\BORINGS - CORRECTIONS.GPJ

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GENERALIZED SOIL PROFILE
Toledo Metroparks Profile F

CLIENT Smith Group

PROJECT NUMBER S2950002

PROJECT NAME Proposed Urban Metro Park

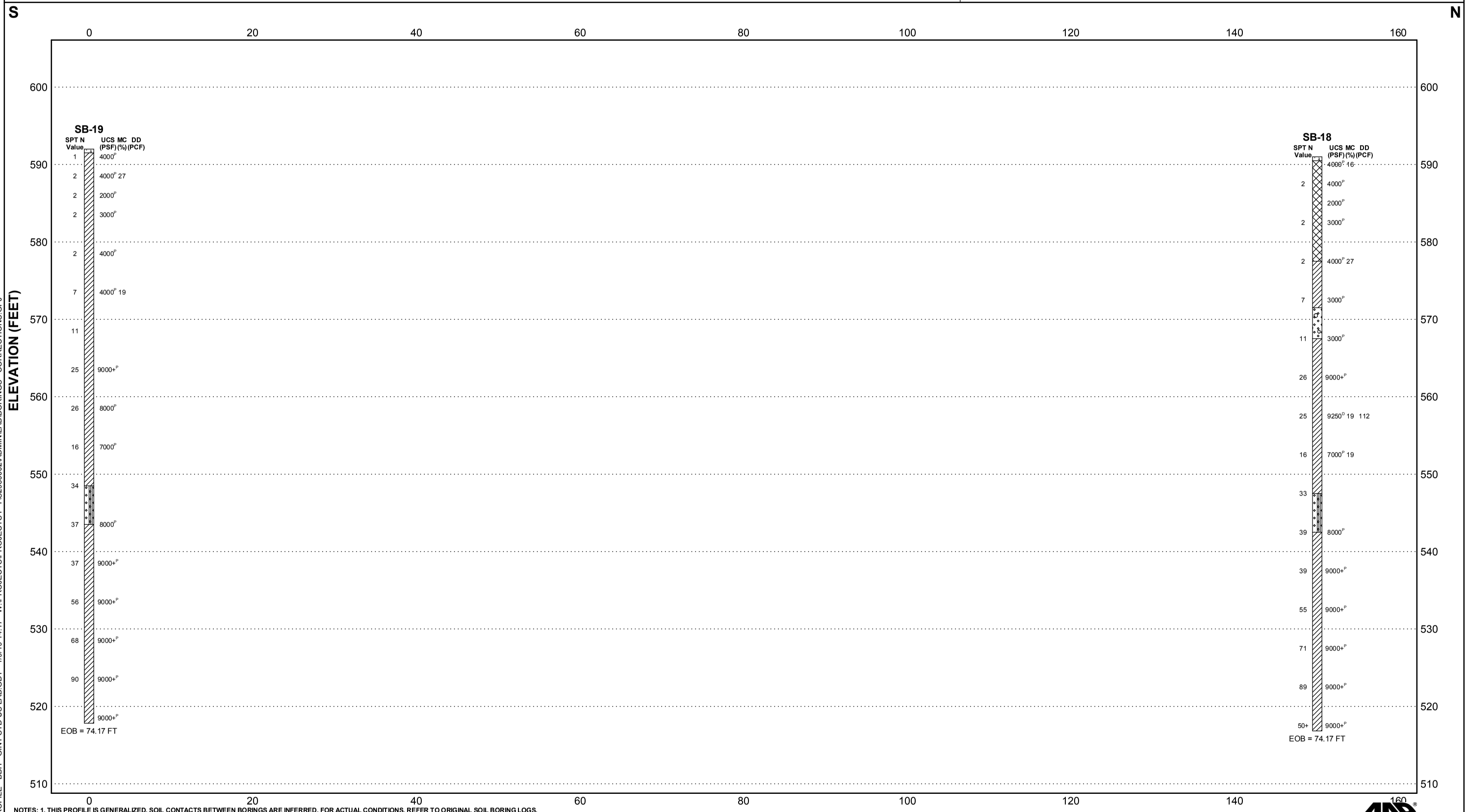
PROJECT LOCATION Toledo, OH

LEGEND:

TOPSOIL | Fill | CLAY | Well-graded Gravelly SAND | Well-graded Silty SAND

▽ = WATER LEVEL AT TIME OF DRILLING
▽ = WATER LEVEL AT END OF DRILLING
▼ = WATER LEVEL AFTER DRILLING
D = UCS TEST PERFORMED ON DISTURBED SAMPLE
P = POCKET PENETROMETER TEST
T = TORVANE SHEAR TEST

S N



NOTES: 1. THIS PROFILE IS GENERALIZED. SOIL CONTACTS BETWEEN BORINGS ARE INFERRED. FOR ACTUAL CONDITIONS, REFER TO ORIGINAL SOIL BORING LOGS.
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AASHTO R18

SOIL PROFILE - BBH - GINT STD US LAB.GDT - 1/9/19 14:17 - W:\PROJECTS\PROJECTS P-T\S2950002\ADMIN\LAB\BORINGS - CORRECTIONS.GPJ

APPENDIX C
SOIL LABORATORY TEST DATA

LABORATORY TEST PROCEDURES

A brief description of the most common laboratory tests performed at the Geotechnical Engineering Laboratory at the Mannik Smith Group is provided in the following sections.

DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE) (ASTM D2488)
The visual classification of soil samples are performed in accordance with ASTM D2488 standard. Our engineers use this test method to describe each soil sample using visual examination and simple manual tests. Visual classification helps grouping similar soil samples so that only a minimum number of laboratory tests are required for positive soil classification.

POCKET PENETROMETER
In the pocket penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small, calibrated spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square foot.

NATURAL MOISTURE CONTENT (ASTM D2216)
Natural moisture content represents the ratio of the weight of water in a given amount of soil to the weight of solid particles. Natural moisture content is expressed as a percentage (%). In this test method the water content is measured in the laboratory by noting the weight loss after drying the soil at specific temperature for 24 hours.

ATTERBERG LIMITS (ASTM D4318)
The Atterberg Limits test is performed in accordance with ASTM D4318. Liquid Limit (LL), Plastic Limit (PL) and Plasticity Index (PI) of the soil sample are determined using this test method. The Liquid Limit is the moisture content at which the soil begins to behave as a liquid material and starts to flow. The Plastic Limit is the moisture content at which the soil changes from plastic to semi-solid stage. The Plasticity Index (PI = LL - PL) is the range of moisture content at which the soil is in a plastic stage. Typically, a soil's potential for volume change increases with increase of plasticity indices.

PARTICLE SIZE ANALYSIS (ASTM D421, D422 and D1140)
These tests are performed to determine the partial soil particle size distribution. The soil sample is prepared according to ASTM D421 test method. The amount of material finer than the openings on the No. 200 sieve (0.075 mm) is determined by wash sieve method according to ASTM D1140. The hydrometer test is used to determine particle size distribution of material finer than 0.075 mm according to ASTM D422 test method.

STANDARD PROCTOR COMPACTION TEST (ASTM D698)
The Standard Proctor compaction test is used to determine maximum dry density and optimum moisture content of the soil sample. In this test, the soil is compacted in the Proctor mold in three lifts of equal volume using a standard effort by the free falling of a 5.5 lb rammer from 12 inches above soil surface. The test procedure is repeated on samples at several different moisture contents and a parabolic graph showing the relationship between moisture content and dry density of the soil is established. The maximum dry unit weight of the compacted sample and the respective moisture content is reported as maximum dry density and optimum moisture content of the soil sample.

MODIFIED PROCTOR COMPACTION TEST (ASTM D1557)
Modified Proctor compaction is similar to the Standard Proctor test. In this test, the soil is compacted in the Proctor mold in five lifts of equal volume using a standard effort by the free falling of a 10 lb rammer from 18 inches above the soil surface. The maximum dry unit weight of the compacted sample and the respective moisture content is reported as maximum dry density and optimum moisture content of the soil sample.

LABORATORY CALIFORNIA BEARING RATIO (ASTM D1883)
The CBR value is the ratio of forces required for 0.1-inch penetration of a 2-inch diameter circular plunger at the rate of 0.05 inch/min into a compacted soil sample compared to the same penetration in a certain standard crushed stone.

LOSS ON IGNITION TEST (LOI) (ASTM D2974)
LOI tests are performed on peat or suspected organic soils. An oven-dried sample is ignited in a furnace at 440°C (Method C) or 750°C (Method D). The ash content of the soil sample is determined as a percentage of the weight of the oven-dried sample. The organic content is the loss of weight due to ignition and reported as a percentage of the weight of the oven-dried sample.

ONE-DIMENSIONAL CONSOLIDATION TEST (ASTM D2435)
The consolidation test data is used to estimate the magnitude and rate of both differential and total settlement of a structure. A one-dimensional consolidation test is performed in a consolidation ring that does not allow lateral displacement of the sample. The sample is subjected to various vertical loading and unloading cycles. The deformation of the sample due to loading and unloading is recorded and used for the plotting a void ratio-applied pressure graph. The pre-consolidation pressure for the soil can also be determined from this test.

UNCONFINED COMPRESSION TEST ON ROCK SAMPLES (ASTM D7012)
In the unconfined compression test, the unconfined compressive strength (q_u) of a rock sample is estimated by measuring the resistance of the sample in compression when an axial loading is applied to the cylindrical specimen (with a height to diameter ratio of approximately 2) to reach the failure condition.

UNCONFINED COMPRESSION TEST ON SOIL SAMPLES (ASTM D2166)
In the unconfined compression test, the unconfined compressive strength (q_u) of a cohesive soil sample is estimated by measuring the resistance of the sample in compression when an axial loading is applied to the cylindrical specimen (with a height to diameter ratio of 2 to 2.5) to reach the failure condition or 15 percent (%) of axial deformation, whichever is secured first.

UNCONSOLIDATED-UNDRAINED (UU) TRIAXIAL COMPRESSION TEST (ASTM D2850)
Triaxial Shear tests are used to determine the shear strength of soil samples under various loading conditions. The test is performed on a relatively undisturbed sample extruded from a Shelby tube. In this test method, fluid flow is not permitted into or out of the soil specimen as the load is applied (undrained condition), therefore pore pressure builds up in the sample. The compressive strength of a soil is determined in terms of the total stress. The various confining pressures help determining the shear strength of the soil at different depths.

CONSOLIDATED-UNDRAINED (CU) TRIAXIAL COMPRESSION TEST (ASTM D4767)
The shear characteristics of cohesive samples (collected from relatively undisturbed sample extruded from a Shelby tube) are measured in this test under undrained conditions. This test represents field conditions where fully consolidated soils under one set of stresses are subjected to a sudden change in stress without sufficient time for further consolidation (undrained condition). The data from this test is used to analyze the shear strength parameters of the soil at different depths. The compressive strength of a soil is reported in terms of the effective stress.

WATER SOLUBLE SULFATE, RESISTIVITY AND PH
To evaluate the corrosion potential of the site, MSG performs sulfates (Ohio DOT Supplement 1122), resistivity (ASTM G187), and pH tests (ASTM D4972) on select soil samples.

SPECIFIC GRAVITY (ASTM D854)
Specific gravity is defined as the ratio of the unit weight of soil solids only to unit weight of water at a specific temperature. MSG performs specific gravity tests for soils according to ASTM D854 test procedure.

PERMEABILITY (ASTM D2434 and ASTM D5084)
This test method covers laboratory measurements of the hydraulic conductivity (the coefficient of permeability) of water-saturated granular and cohesive materials. MSG performs multiple methods for permeability tests according to ASTM D2434 and ASTM D5084.

DIRECT SHEAR TEST (ASTM D3080)
The direct shear tests are performed to determine the maximum and residual shear strength. A horizontal load is applied at a constant rate of strain. The soil sample is placed in a box where the lower half of the box is mounted on rollers and is pushed forward at a uniform rate by a motorized apparatus. The upper half of the box bears against a steel proving ring, the deformation of which is shown on a dial gauge indicating the shear force. The various information that can be obtained from the results includes the maximum (peak) shear strength and the ultimate (residual) shear strength.

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SUMMARY OF LABORATORY RESULTS

AASHTO R18

CLIENT Smith Group **PROJECT NAME** Proposed Urban Metro Park

PROJECT NUMBER S2950002 **PROJECT LOCATION** Toledo, OH

Boring No. / Sample No.	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Bulk Density (pcf)	Satur-ation (%)	Specific Gravity
SB-1 / SS-2	1.5							19.6			
SB-1 / SS-5	6.0							25.4	115.4		
SB-10 / SS-1	0.0							11.6			
SB-11 / SS-2	1.5							24.1			
SB-12 / SS-1	1.0							13.9			
SB-13 / SS-7	23.5				25	15		10.5			
SB-14 / SS-5	13.5							57.6			
SB-15 / SS-4	8.5							20.1			
SB-15 / SS-7	23.5				9.525	25		23.7			
SB-16 / SS-4	8.5							18.8			
SB-17 / SS-2	3.5							11.9			
SB-18 / SS-1	1.0							16.5			
SB-18 / SS-5	13.5							27.2			
SB-18 / SS-9	33.5							18.9	132.7		
SB-18 / SS-10	38.5	34	18	16	9.525	88	CL	18.9			
SB-19 / SS-2	3.5							27.2			
SB-19 / SS-6	18.5							19.0			
SB-2 / SS-2	1.5							21.4			
SB-3 / SS-3	3.0							13.3			
SB-5 / SS-1	0.0							33.2			
SB-5 / SS-3	3.0				19	44		10.4			
SB-6 / SS-1	1.0	35	18	17	9.525	85	CL	16.6	134.9		
SB-6 / SS-2	3.5							30.8			
SB-8 / SS-2	1.5							18.2			
SB-8 / SS-4	4.5	21	16	5	9.525	65	CL-ML	15.6			
SB-9 / SS-1	1.0							18.4			

ATTERBERG LIMITS' RESULTS

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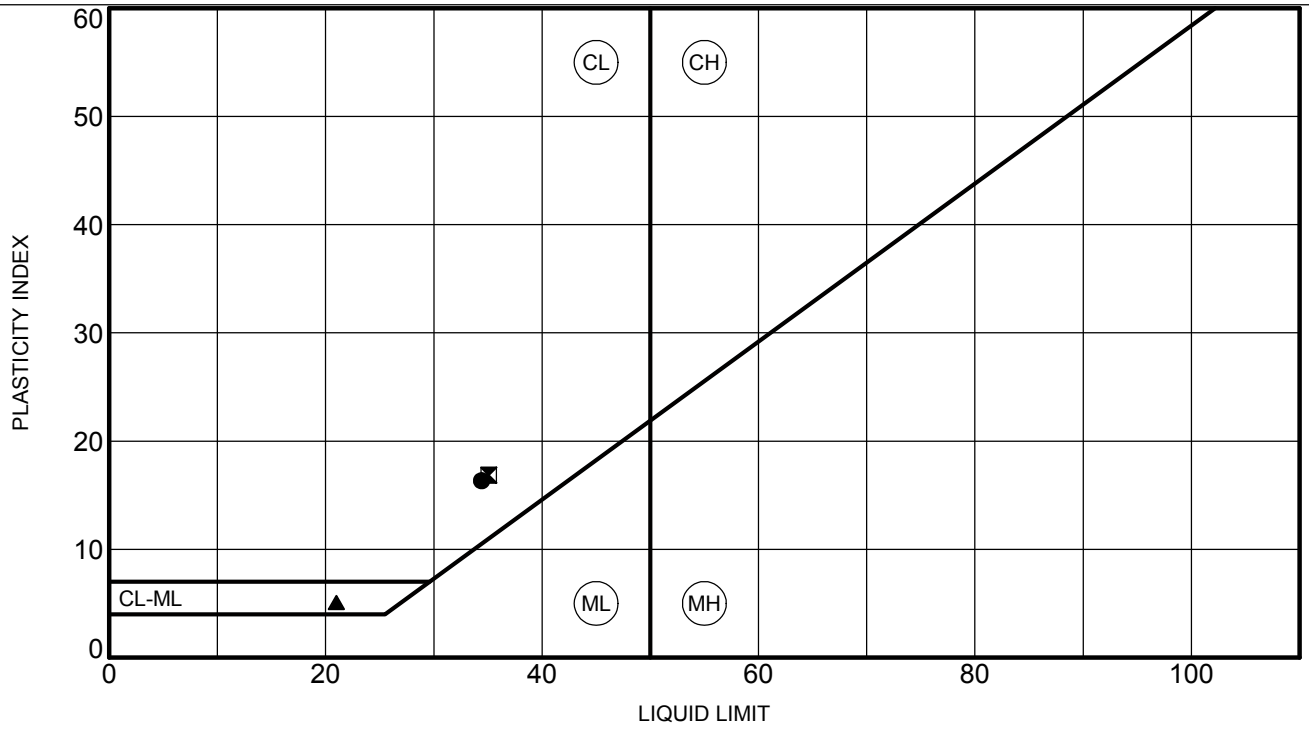
AASHTO R18

CLIENT Smith Group **PROJECT NAME** Proposed Urban Metro Park

PROJECT NUMBER S2950002 **PROJECT LOCATION** Toledo, OH



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**SB-18 / SS-10**	**38.5**	**34**	**18**	**16**	**88**	**LEAN CLAY (CL)**
⊠	**SB-6 / SS-1**	**1.0**	**35**	**18**	**17**	**85**	**LEAN CLAY (CL)**
▲	**SB-8 / SS-4**	**4.5**	**21**	**16**	**5**	**65**	**SANDY SILTY CLAY (CL-ML)**

GRAIN SIZE DISTRIBUTION

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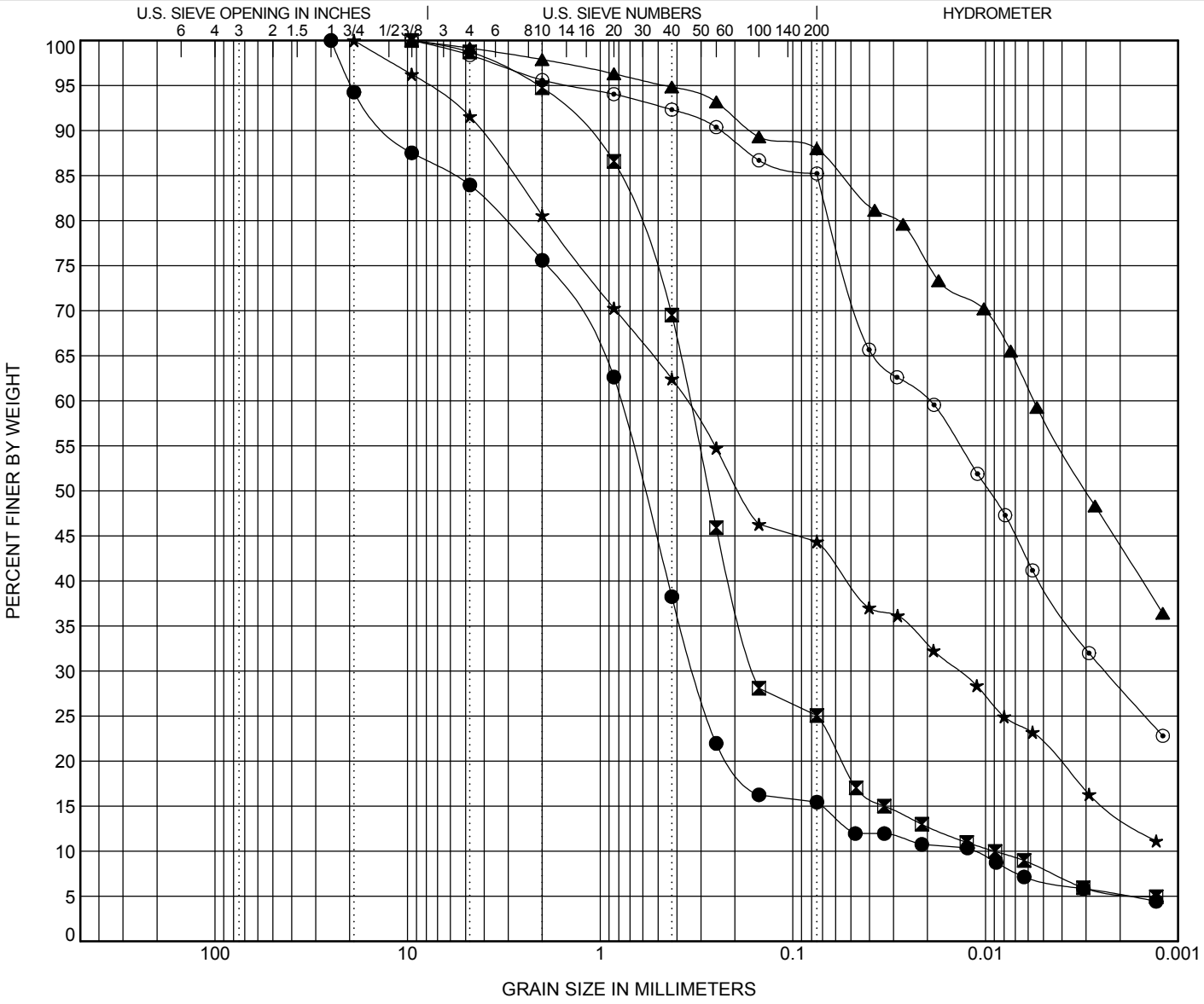
CLIENT Smith Group **PROJECT NAME** Proposed Urban Metro Park

PROJECT NUMBER S2950002 **PROJECT LOCATION** Toledo, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-13 / SS-7	23.5					11.63	68.58
⊠	SB-15 / SS-7	23.5					8.13	38.12
▲	SB-18 / SS-10	38.5	LEAN CLAY (CL)	34	18	16		
★	SB-5 / SS-3	3.0						
⊙	SB-6 / SS-1	1.0	LEAN CLAY (CL)	35	18	17		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-13 / SS-7	23.5	25	0.789	0.325	0.011	16.0	68.5	10.3	5.1
⊠	SB-15 / SS-7	23.5	9.525	0.343	0.158	0.009	1.3	73.7	19.6	5.4
▲	SB-18 / SS-10	38.5	9.525	0.006			0.9	11.2	44.1	43.9
★	SB-5 / SS-3	3.0	19	0.359	0.014		8.4	47.2	30.5	13.9
⊙	SB-6 / SS-1	1.0	9.525	0.02	0.002		1.6	13.1	57.1	28.1

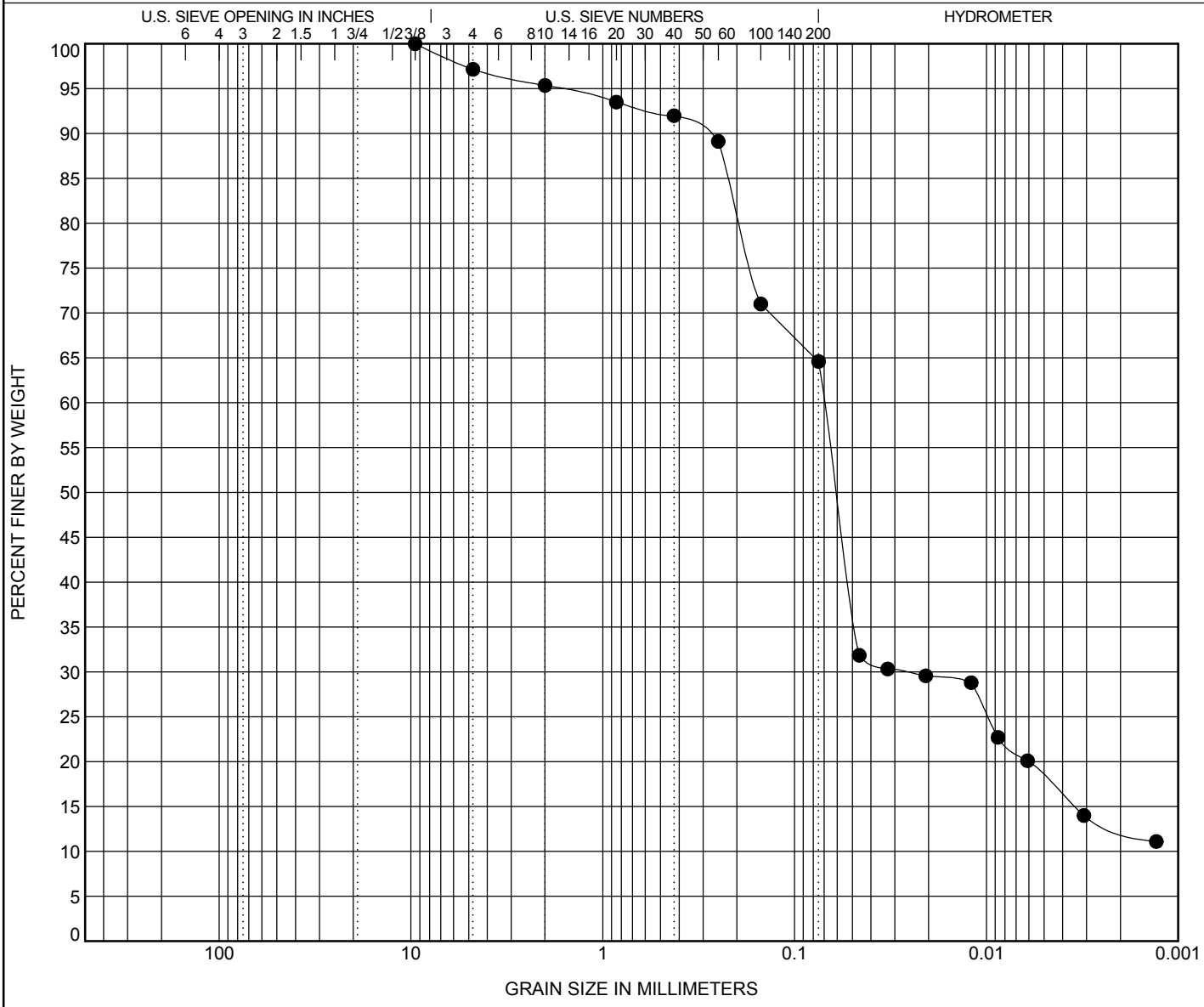
GRAIN SIZE DISTRIBUTION

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle, Maumee, OH 43537
ph: (419) 891-2222 fax: (419) 891-1595
www.manniksmithgroup.com

AASHTO R18

CLIENT Smith Group **PROJECT NAME** Proposed Urban Metro Park

PROJECT NUMBER S2950002 **PROJECT LOCATION** Toledo, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **SB-8 / SS-4**	**4.5**	**SANDY SILTY CLAY (CL-ML)**	**21**	**16**	**5**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **SB-8 / SS-4**	**4.5**	**9.525**	**0.07**	**0.027**		**2.9**	**32.6**	**52.1**	**12.5**

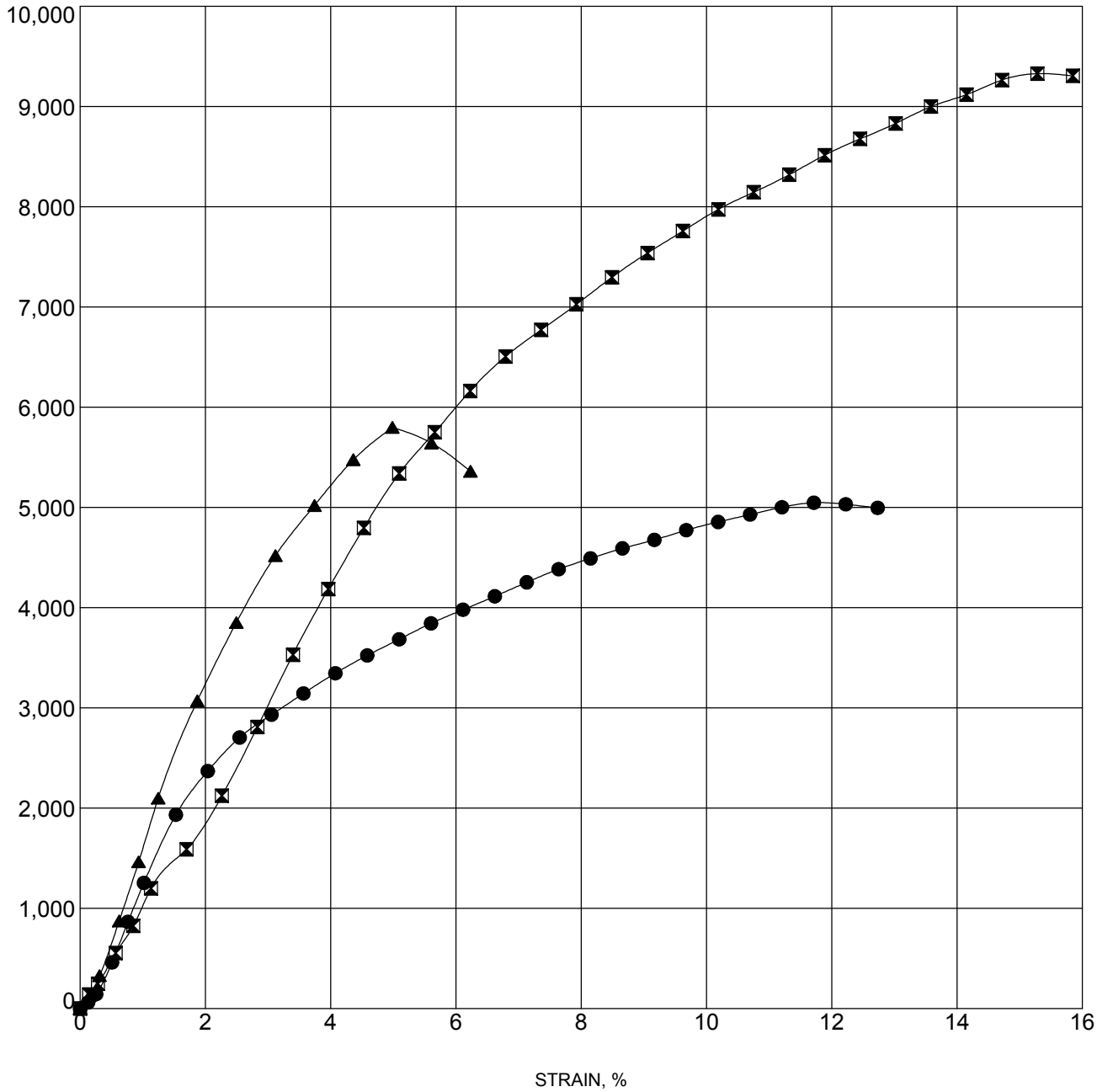
UNCONFINED COMPRESSION TEST

The Mannik & Smith Group, Inc.
1800 Indian Wood Circle, Maumee, OH 43537
ph: (419) 891-2222 fax: (419) 891-1595
www.manniksmithgroup.com

AASHTO R18

CLIENT Smith Group **PROJECT NAME** Proposed Urban Metro Park

PROJECT NUMBER S2950002 **PROJECT LOCATION** Toledo, OH



Specimen Identification		Classification	γ_d	MC%
● SB-1 / SS-5	6.0		92	25
⊠ SB-18 / SS-9	33.5		112	19
▲ SB-6 / SS-1	1.0	LEAN CLAY (CL)	116	17

Mannik Smith Group, Inc.
DETERMINING SULFATE CONTENT IN SOILS
SUPPLEMENT 1122
LABORATORY TEST SHEET

Project No.	S2950002
Date	1/15/2019
Tested by:	FRK/MJG
Checked	FRK

Sample or Boring ID	Start Soak Date/Time	Start Filter Date/Time	Start Test Date/Time	Soaking Time (hr)	Diluation Ratio	Replicate Sample Readings			Average Reading	Sulphate Content (ppm)
						1	2	3		
SB-8 SS-2	1/15/2019	1/16/2019	1/18/2019	24	1:160	59	60	59	59	9493
SB-1 SS-2	1/15/2019	1/16/2019	1/18/2019	24	1:20	30	31	31	31	613
SB-5 SS-2	1/15/2019	1/16/2019	1/18/2019	24	1:20	0	0	0	0	0

MOISTURE, ASH, AND ORGANIC MATTER OF PEAT AND OTHER ORGANIC SOILS
ASTM D2974 and SOIL pH

Project Name:	Toledo Metroparks	Project No.	S2950002
Sample No.	SB-6 SS-4	Date:	1/7/2019
Visual Soil Description:	Black silty soil	Depth:	8.5'-10'

Moisture Content: Test Method A

Note: **Moisture Contents are determined by proportion of as-received mass**

Formula: Moisture Content,%=[(A - B) x 100]/A

A= Mass of Moist Sample (g)	57.4
B= Mass of Oven Dried Sample (g)	48.6

Oven Dried MC%	18.1

Ash Content: Test Method C

Note: **Furnace temperature used for ash content determination= 440 ºC**

Formula: Ash Content,%= (C x 100)/B

B= Mass of Oven Dried Sample (g)	48.6
C= Mass of Ash (g)	46.3

D= Ash Content %	95.3

Organic Matter

Formula: Organic Matter,%=100 - D

Organic Matter %	4.7

pH: -

Computed By:	KL	Checked By:	FRK

MOISTURE, ASH, AND ORGANIC MATTER OF PEAT AND OTHER ORGANIC SOILS
ASTM D2974 and SOIL pH

Project Name:	Toledo Metroparks	Project No.	S2950002
Sample No.	SB-9 SS-3	Date:	1/7/2019
Visual Soil Description:	Black silty soil	Depth:	6'-7.5'

Moisture Content: Test Method A

Note: **Moisture Contents are determined by proportion of as-received mass**

Formula: Moisture Content,%=[(A - B) x 100]/A

A= Mass of Moist Sample (g)	63.4
B= Mass of Oven Dried Sample (g)	54.5

Oven Dried MC%	16.3

Ash Content: Test Method C

Note: **Furnace temperature used for ash content determination= 440 ºC**

Formula: Ash Content,%= (C x 100)/B

B= Mass of Oven Dried Sample (g)	54.5
C= Mass of Ash (g)	53.3

D= Ash Content %	97.7

Organic Matter

Formula: Organic Matter,%=100 - D

Organic Matter %	2.3

pH: -

Computed By:	KL	Checked By:	FRK

Brighton Analytical L.L.C. ™

2105 Pless Drive Brighton, Michigan 48114 Phone (810)229-7575 Fax (810)229-8650 E-mail bai-brighton@sbcglobal.net

January 15, 2019

Mannik & Smith Group, Inc.
2365 S. Haggerty Rd.
Canton, MI 48188

Subject: Toledo Metroparks
S2950002

Dear Ms. Koch :

Thank you for making Brighton Analytical, L.L.C. your laboratory of choice. Attached are the results for the samples submitted on 01/08/2019 for the above mentioned project. NELAP/TNI Accredited Analysis and MDEQ Drinking Water Certified Analysis will be identified in their respective reporting formats. Hard copies can be supplied at your request for a fee of $20.00 per copy.

The invoice for this project will be emailed separately. If you have any questions concerning the data or invoice, please don't hesitate to contact our office. We welcome your comments and suggestions to improve our quality systems. Please reference Brighton Analytical, L.L.C. Project ID 54906 when calling or emailing. We thank you for this opportunity to partner with you on this project and hope to work with you again in the future.

Sincerely,
Brighton Analytical, L.L.C.

Brighton Analytical LLC
2105 Pless Drive
Brighton, Michigan 48114
Phone: (810)229-7575 (810)229-8650
e-mail:bai-brighton@sbcglobal.net
MDNRE Certified #9404
NELAC Accredited #176507

Sample Date: 01/07/2019
Submit Date: 01/08/2019
Report Date: 01/15/2019

To: Mannik & Smith Group, Inc.
2365 S. Haggerty Rd.
Canton, MI 48188

BA Report Number: **54906**
BA Sample ID: **CJ01746**
Project Name: **Toledo Metroparks**
Project Number: **S2950002**
Sample ID: **SB-14 SS-4 8.5-10'**

Parameters	Result	Units	DL	Method Reference	Analyst	Analysis Date
Inorganic Analysis						
Chloride (ASTM Leach)	**Not detected**	ug/Kg	20000	SW846 9056	RM	01/10/2019
pH (Soil and Waste)	**8.3**	S.I.		SW846 9045C	LS	01/15/2019
Reduction Oxidation Potential	**118**	mV	2	ASTM G200	WT	01/09/2019
Resistivity (ASTM Leach)	**0.0056**	megohms/cm		EPA 120.1	LS	01/15/2019
Water-soluable Sulfates (ASTM Leach)	**820000**	ug/Kg	20000	ASTM C1580	RM	01/10/2019
%Solid	**67**	%		ASTM D2216	LS	01/10/2019

DL=Reported detection limit for analytical method requested. Some compounds require special analytical methods to achieve MDNR designated target detection limits (TDL).

Released by

Date 1/15/2019

Brighton Analytical, L.L.C.™

Email: bai-brighton@sbcglobal.net

2105 Pless Drive
Brighton, MI 48114

Phone: 810-229-7575
Fax: 810-229-8650

BA PROJECT #: 54906

PAGE 1 OF 1

ABBREVIATIONS FOR MATRIX
S = Solid
L = Liquid
DW = Drinking H_2O
O = Oil
P = Wipe
A = Air (Tedlar Bag)
F = Filter
T = Tube
M = Misc.

PROJECT NAME: Toledo Metroparks

PROJECT #: S2950002

PO #: (PLEASE NOTE IF DIFFERENT BILLING ADDRESS) GEOTEST1

Sample collected by:

REQUESTED TURNAROUND: (circle one)
Rush: 1 -3 business days (verify with lab & specify date needed)
1 Day = 2.5X Cost 2 Day = 2X Cost 3 Day = 1.5X Cost
Standard: 5 business days

If RUSH, approved by: _____

Brighton ID #	Sample Description	Sample Coll. Date	Sample Coll. Time	Container Type & Quantity: VOA'S (PRES) Y N N/A	HDPE UNPRESERVED	HDPE HNO_3	HDPE H_2SO_4	HDPE NAOH	AMBER PRESERVED?	GLASS, NO PRESERVATIVE	STERILIZED BACTERIA	MEOH Preserved Y N	Sample Matrix	Analysis Requested/Method: Chloride (ASTM Leach)	pH	Red. Oxidation Potential	Resistivity (ASTM Cond)	Water Soluble Sulfates			
CJ01746	SB-14 S5-4 8.5-10	1/7/19	14:00							1			S	/	/	/	/	/			MeOH
2)																					
3)																					
4)																					
5)																					
6)																					
7)																					
8)																					
9)																					
10)																					

COMPANY/MAILING ADDRESS:
MSG
2365 Haggerty Rd S.
Canton, MI 48188
ATTN: Felicia Koch
PHONE: 734-397-3100
FAX OR EMAIL: fkoch@mannikksmithgroup.com
Samples received within hold time? yes ☑ no ☐
Temperature of samples °C: 4.5
pHs verified in login? yes ☐ no ☑
Headspace/bubbles in VOA's? yes ☐ no ☐ n/a ☑
Sample containers and COC match? yes ☑ no ☐

BILLING ADDRESS (IF REQUIRED):
Same as Above

Drinking H_2O:
Fax to LCHD? yes ☐ no ☐
Chlorinated Water Supply? yes ☐ no ☐
AMT.: _____

MCL Failure: yes ☐ no ☐
Client Notified (date/time/initials): _____

Special Instructions:

Please fill out the Chain of Custody completely and review. Incorrect or incomplete information will result in a "hold" on all analyses.

Trans. #	RELINQUISHED BY:	RECEIVED BY:	DATE:	TIME:	Trans. #	RELINQUISHED BY:	RECEIVED BY:	DATE:	TIME:
1	Felicia Koch	[signature]	1/8/19	10:16am	3				
2	[signature]	[signature]	1-8-2019	12:30	4				

Brighton Analytical L.L.C.

BRIGHTON ANALYTICAL, LLC

QUALITY ASSURANCE/QUALITY CONTROL

REPRESENTATIVE BATCH QUALITY CONTROL

Accuracy & Precision

Analyst: LS **Parameter:** CONDUCTIVITY

Analysis Date: 1/15/2019 **Method Reference:** EPA 120.1

BATCH 1

SPIKE - ACCURACY

Laboratory ID	Spike Concentration	Background	% Recoveries	Range (%)	Method Blank Concentration
ERA263-506	511	<10000	101	80-120	<10000

Laboratory ID	Observed A	Observed B	RPD	Acceptable Range	
CJ01854	1048	1048	0.0	≤20%	

MISCELLANEOUS

	Standard ID #	% Recovery	
Independent Secondary Reference Material:			
Method Standard (Laboratory Control Spike):			

COMMENTS:

REPRESENTATIVE BATCH QUALITY CONTROL

Accuracy & Precision

Analyst: LS **Parameter:** pH

Analysis Date: 1/15/2019 **Method Reference:** SM4500H+B/9040/9045

SPIKE - ACCURACY					
Laboratory ID	**True Value**	**Observed (°F)**	**DIFFERENCE**	**Acceptable Range**	
ERA 282-977	9.38	9.39	0.01	0.05	
Laboratory ID	**Observed A**	**Observed B**	**DIFFERENCE**	**Acceptable Range**	
CJ01944	7.26	7.26	0	0.05	

COMMENTS:

Representative Batch Precision And Accuracy Quality Control Summary

Ion Chromatograph EPA Method 300.0

Date: 1/10/19

Reviewed by:

Analyst: RM

ERA P263
ERA # : WP 270
Exp. Date: Oct-20

Analyte	Sample Conc	LCS Value	LCS Conc.	% Rec. LCS	ERA Conc.	ERA TRUE Value	%Rec ERA	Control limits	Units
Fluoride	<100	5,000	4,809	96	3,595	3,790	95	90-110%	ug/L
Chloride	<1000	50,000	51,161	102	117,806	116,000	102	90-110%	ug/L
Nitrite	<10	1,000	1,035	103					
Nitrate	<10	1,000	973	97	11,629	10,700	109	90-110%	ug/L
Sulfate	<1000	50,000	50,168	100	15,541	16,900	92	90-110%	ug/L

Sample ID# 1811

Analyte	Sample Conc	Spike Value	MS Conc.	MSD Conc.	% Rec MS	% Rec MSD	RPD	Control limits	Units
Fluoride	1,222	5,000	6,041	5,855	96	93	3.1	80-120%	ug/L
Chloride	15,434	50,000	67,516	65,656	104	100	2.8	80-120%	ug/L
Nitrite	0	1,000	1,066	1,026	107	103	3.8	80-120%	ug/L
Nitrate	0	1,000	872	834	87	83	4.5	80-120%	ug/L
Sulfate	7,946	50,000	59,153	57,233	102	99	3.3	80-120%	ug/L

Sample ID# 1869

Analyte	Sample Conc	Spike Value	MS Conc.	MSD Conc.	% Rec MS	% Rec MSD	RPD	Control limits	Units
Fluoride	118	5,000	4,901	5,046	96	99	2.9	80-120%	ug/L
Chloride	76,847	50,000	124,479	125,787	95	98	1.0	80-120%	ug/L
Nitrite	0	1,000	997	1,021	100	102	2.4	80-120%	ug/L
Nitrate	0	1,000	837	870	84	87	3.9	80-120%	ug/L
Sulfate	31,091	50,000	79,674	80,922	97	100	1.6	80-120%	ug/L

Sample ID# _____

Analyte	Sample Conc	Spike Value	MS Conc.	MSD Conc.	% Rec MS	% Rec MSD	RPD	Control limits	Units
Fluoride		5,000						80-120%	ug/L
Chloride		50,000						80-120%	ug/L
Nitrite		1,000						80-120%	ug/L
Nitrate		1,000						80-120%	ug/L
Sulfate		50,000						80-120%	ug/L

SHEET NUM.											PART.			ITEM	ITEM EXT	GRAND TOTAL	UNIT	DESCRIPTION	SEE SHEET NO.
9	10	11	12	13	42	16	17	18	19										
																		EROSION CONTROL	
														201	11000	LS		CLEARING AND GRUBBING	
														832	30000	1	EACH	EROSION CONTROL	
														832	15000	LS		STORM WATER POLLUTION PREVENTION PLAN	
																		DRAINAGE	
324														605	06000	324	FT	4" BASE PIPE UNDERDRAINS	9
60														611	00100	60	FT	4" CONDUIT, TYPE B	9
55														611	04900	55	FT	12" CONDUIT, TYPE D	9
1														611	98651	1	EACH	CATCH BASIN FRAME AND GRATE, AS PER PLAN	9
30														839	30100	30	FT	TRENCH DRAIN WITH PEDESTRIAN GRATE	9
2														611	98631	2	EACH	CATCH BASIN ADJUSTED TO GRADE, AS PER PLAN	9
																		PAVEMENT	
						350	841	842	111					203	10000	2,144	CY	EXCAVATION	
						94	2,951							203	20000	3,045	CY	EMBANKMENT	
930														203	35110	930	CY	GRANULAR MATERIAL, TYPE B	
1,572	1,004.3	1,384.1	1,084.7	747.2										204	10000	5,792.3	SY	SUBGRADE COMPACTION	
														204	45000	8	HOUR	PROOF ROLLING	
58														204	50001	58	SY	GEOTEXTILE FABRIC, AS PER PLAN	9
260														203	98000	260	CY	ROADWAY, MISC.:Geofoam Fill	9
560	223	298	241	166										304	20000	1,488	CY	AGGREGATE BASE	
32	46	52	45											407	10001	175	GAL	TACK COAT, AS PER PLAN	
			17	56										410	14001	73	CY	TRAFFIC COMPACTED SURFACE, AS PER PLAN	
22.5	32.1	36	31.4											441	50000	122	CY	ASPHALT CONCRETE SURFACE COURSE, TYPE 1, (448), PG64-22	
31.5	44.9	50.6	44											441	50300	171	CY	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, (448)PG64-22	
100														451	10010	100	SY	6" REINFORCED CONCRETE PAVEMENT, CLASS QC 1P	
380														452	09010	380	SY	4" NON-REINFORCED CONCRETE PAVEMENT, CLASS QC 1P	
148														452	10010	148	SY	6" NON-REINFORCED CONCRETE PAVEMENT, CLASS QC 1P	
200														607	98300	200	SF	FENCE, MISC.:VANDAL PROTECTION FENCE, SS MESH, AS PER PLAN	9
322														SPECIAL	69098100	322	FT	42" HT. GUARDRAIL	9
5														SPECIAL	69050600	5	EACH	BOLLARD Fixed Bollard	9
																		LANDSCAPING	
					467									659	00301	467	CY	TOPSOIL, AS PER PLAN	42
					1,310									659	10001	1,310	SY	SEEDING AND MULCHING, AS PER PLAN LOW-MOW FESCUE SEED MIX	
					66									659	15000	66	SY	INTER-SEEDING	
					0.27									659	31000	0.27	ACRE	LIME	
					0.18									659	20000	0.18	TON	COMMERCIAL FERTILIZER	
					8									659	35000	8	MGAL	WATER	42
																		RETAINING WALLS (XXX)	
222														511	46211	222	CY	CLASS QC1 CONCRETE, RETAINING/WINGWALL INCLUDING FOOTING, AS PER PLAN	9
3,242														870	10001	3,242	SF	PREFABRICATED MODULAR RETAINING WALL, AS PER PLAN	9
110														518	21201	110	CY	POROUS BACKFILL WITH GEOTEXTILE FABRIC, AS PER PLAN	9
														509	10000	34800	LBS	STEEL REINFORCEMENT AS PER PLANS	
																		STRUCTURE OVER 20 FOOT SPAN (CTY-RTE-SECT or SFN)	
45														511	34445	45	CY	CLASS QC2 CONCRETE, BRIDGE DECK, AS PER PLAN	9
168														511	43511	168	CY	CLASS QC1 CONCRETE, ABUTMENT INCLUDING FOOTING, AS PER PLAN	9
1,960														507	00400	1,960	FT	STEEL PILES, MISC.: HP 10X49, FURNISHED	9
1,960														507	00400	1,960	FT	STEEL PILES, MISC.: HP 10X49, DRIVEN	9
2,872														607	98300	2,872	SF	FENCE, MISC.:VANDAL PROTECTION FENCE, SS MESH, AS PER PLAN	9
222														SPECIAL	69098100	222	FT	42" HT. GUARDRAIL, NO INFILL PANEL, AS PER PLAN	9
1														SPECIAL	53000200	LS		STRUCTURES: UNLOADING, ASSEMBLY AND INSTALLATION OF PEDESTRIAN BRIDGE	9
1														SPECIAL	90017000	LS		PREFAB PEDESTRIAN BRIDGE, BASE DESIGN	9
														509	10000	26400	LBS	STEEL REINFORCEMENT (EXCLUDES BRIDGE DECK) AS PER PLANS	
																		INCIDENTALS	
60														202	38001	60	FT	GUARDRAIL REMOVED, AS PER PLAN	9
171														202	23001	171	SY	PAVEMENT REMOVED, AS PER PLAN	9
														614	11001	LS		MAINTAINING TRAFFIC, AS PER PLAN	
														614	12421	LS		DETOUR SIGNING, AS PER PLAN	
														623	10000	LS		CONSTRUCTION LAYOUT STAKES AND SURVEYING	
														624	10000	LS		MOBILIZATION	

CALCULATED DGM CHECKED JY

GENERAL SUMMARY

LUC–RIVERSIDE TRAIL EAST

6
51

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SHEET NUM.	PART.	ITEM	ITEM EXT	GRAND TOTAL	UNIT	DESCRIPTION	SEE SHEET NO.
15							

ADD ALTERNATE 1: TREE FORMS ON BRIDGE

					MISCELLANEOUS STRUCTURE ALTERNATES	
1	SPECIAL	90017000	LS		PREFAB PEDESTRIAN BRIDGE, TREE FORMS	15

ADD ALTERNATE 2: STEEL PLANTERS

					MISCELLANEOUS STRUCTURE ALTERNATES	
1	SPECIAL	90017000	LS		STEEL PLANTERS	15

ADD ALTERNATE 3: EAST STAIRCASE

					PAVEMENT ALTERNATES	
-47	SPECIAL	69098100	-47	FT	42" HT. GUARDRAIL	15
9	203	10000	9	CY	EXCAVATION	15
178	203	20000	178	CY	EMBANKMENT	15
59	204	10000	59	SY	SUBGRADE COMPACTION	15
10	304	20000	10	CY	AGGREGATE BASE	15
4	452	09010	4	SY	4" NON-REINFORCED CONCRETE PAVEMENT, CLASS QC 1P	15
280	511	46211	280	CY	CLASS QC1 CONCRETE, RETAINING/WINGWALL INCLUDING FOOTING, AS PER PLAN	15
240	608	40001	240	FT	CONCRETE STEPS, TYPE A, AS PER PLAN	15
70	SPECIAL	69098100	70	FT	HANDRAIL	15
34	SPECIAL	69098100	34	FT	42" HT. GUARDRAIL	15
38	SPECIAL	69098100	38	FT	66" HT. GUARDRAIL	15
2	SPECIAL	69050600	2	EACH	BOLLARD Fixed Bollard	15
	509	10000	44,900	LBS	STEEL REINFORCEMENT AS PER PLANS	

ADD ALTERNATE 4: WEST STAIRCASE

					PAVEMENT ALTERNATES	
-27	SPECIAL	69098100	-27	FT	42" HT. GUARDRAIL	15
8	203	10000	8	CY	EXCAVATION	15
61	203	20000	61	CY	EMBANKMENT	15
174	204	10000	174	SY	SUBGRADE COMPACTION	15
29	304	20000	29	CY	AGGREGATE BASE	15
120	452	09010	120	SY	4" NON-REINFORCED CONCRETE PAVEMENT, CLASS QC 1P	15
155	511	46211	155	CY	CLASS QC1 CONCRETE, RETAINING/WINGWALL INCLUDING FOOTING, AS PER PLAN	15
234	608	40001	234	FT	CONCRETE STEPS, TYPE A, AS PER PLAN	15
57	SPECIAL	69098100	57	FT	HANDRAIL	15
50	SPECIAL	69098100	50	FT	42" HT. GUARDRAIL	15
18	SPECIAL	69098100	18	FT	66" HT. GUARDRAIL	15
1	SPECIAL	69050600	1	EACH	BOLLARD Fixed Bollard	15
	509	10000	25,500	LBS	STEEL REINFORCEMENT AS PER PLANS	

ADD ALTERNATE 5: ARCHED TRELLIS

					MISCELLANEOUS STRUCTURE ALTERNATES	
2	SPECIAL	90011000	2	EACH	ARCHED TRELLIS	15

CALCULATED DGM CHECKED JY

GENERAL SUMMARY (ADD ALTERNATES)

LUC–RIVERSIDE TRAIL EAST

7
51

P:\21738.005\CAD\C\Sheet\Bridge & Trail\21738–G–002–BT.dwg 18–May–20 8:18 PM

Metroparks Toledo – Riverside Trail East,
1001 Front St., Toledo, Ohio 43608

Bid Opening Friday, November 20, 2020, 3:00 pm Local Time, Fallen Timbers Field Office

Bidder's List

COMPANY NAME	DISCIPLINE	PHONE	FAX	EMAIL	CONTACT NAME	ADDRESS
The Lathrop Company	General Contractor	419-887-4259		aziemkiewicz@tcco.com	Allen Ziemkiewicz	28 N. St. Clair Street Suite 200 Toledo, OH 43604
Expercon, LLC	General Contractor	419-214-4343		rb2@expercon.biz	Rob Bischoff	1 Maritime Plaza, Toledo, OH 43604
ES Wagner Co.	General Contractor	419-392-2788	419-691-0429	mpfeiffer@eswagner.com	Michael Pfeiffer	840 Patchen Road, Oregon, OH 43616
Mosser Construction, Inc.	General Contractor	419-861-5100		mahten@mossergrp.com	Michael A. Ahten	1613 Henthorne Dr, Maumee, OH 43537
Anderzach Pitzen Construction, Inc.	General Contractor	419-644-2111		marynicholas@wecandigit.com	Mary Nicholas	424 E Main St, Metamora, OH 43540
Comte Construction Co.	General Contractor	419-241-3254	419-241-3425	bobjr@comteconstruction.com	Robert Comte	912 N. Summit St. Toledo, OH 43604
The Delventhal Company	General Contractor	419-244-5570	419-244-5575	cathy@thedelventhalco.com	Cathy Permar	3796 Rockland Circle, Millbury, OH 43447
George Gradel Co,	Sitework	419-691-7123	419-691-0877	estimating@geogradelco.com	Frederick Sander	3135 Front St., Toledo, OH 43605
Miller Bros. Const., Inc.	General Contractor	419-445-1015		estimating@mbcholdings.com	Jeremy Hurst	1613 S Defiance St, PO Box 30, Archbold, OH 43502
Helms & Sons Excavating Inc.	General Contractor	419-422-7738	419-422-9638	bmohr@helmsandsons.com	Brian Mohr	1753 Lima Ave, Findlay, OH 45840
Mark Haynes Construction Inc	General Contractor	419-663-2457	419-663-3457	amanda@markhaynesconstruction.com	Amanda Mooney	3130 St Rt 18 Norwalk, OH 44857
AA Boos & Sons	General Contractor	419-691-2329		staciewilburn@aaboos.com	Stacie Wilburn	2015 Pickle Rd, Oregon, OH 43616
Rudolph Libbe, Inc.	General Contractor	419-725-3284	419-837-9373	mdean@rlcos.com	Michelle Dean	6494 Latcha Road Walbridge, OH 43465-9738
Contech Engineered Solutions, LLC	Bridge Manufacturer	513-320-0268 270-331-3936		john.kanzlemar@contechllc.com ncammack@contechllc.com david.rogers@contechllc.com	John Kanzlemar Nick Cammack David Rogers	212 Norwegian Cove, Eaton, OH 45320
Kokosing Construction Co. Inc.	General Contractor	614-228-1029 419-565-5858		mck2@kokosing.biz	M. Cody Kerr	6235 Westerville Rd., Westerville, OH 43081
Vernon Nagel, Inc.	General Contractor	419-592-3861		estimates@nagelinc.com	Marc Nagel	0154 County Rd. 11C Napoleon, OH 43545
The Spieker Co.	General Contractor	419-872-7000		santanna@office.spiekercompany.com	Aaron White	2541 Tracy Rd. Northwood, OH 43619
Geddis Paving & Excavating, Inc.	Paving & Excavating	419-536-8501	419-536-0551	pmunson@geddispaving.com	Petra Munson	1019 Wamba Ave. Toledo, OH 43607
Henry W Bergman Inc	Paving	419-855-4757		shelly@hwb1912.com	Rachelle Thoman	218 E 9th St. Genoa, OH 43430
Rietschlin Construction Inc	General Contractor	419-347-4241		meg@rietsclinconstructionoh.com	Margaret Rietschlin	4240 Baker Rd Crestline, OH 44827