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September 16, 2024

TYLin – Greeley and Hansen Water Solutions
77 Broadway Street – Suite 208
Buffalo, New York 14203

Attn: Edmund Aplerh-Doku, PE, DBIA, ENV SP
Program Manager Email: edmund.aplerhdoku@tylin.com

Re: Subsurface Investigation and Geotechnical Evaluation
Proposed Edison Martha OLS Project
Edison Street
Buffalo, New York
ATL Report No. BD161E-01-05-24

Edmund Aplerh-Doku:

Enclosed is one (1) electronic copy of the referenced report. ATL appreciates the opportunity to provide geotechnical services for your project.

Please note that upon completion of the subsurface investigation, the borings were backfilled with on-site soils and the surface was patched as appropriate. It is important that the backfilled borings be monitored for settlement or subsidence. This will be the responsibility of TYLin – Greeley and Hansen Water Solutions. ATL assumes no liability for loss or damage resulting from borehole settlement. The soil and bedrock samples obtained during this investigation will be retained for a period of six months and subsequently discarded, unless otherwise instructed.

Please contact our office should you have any questions or comments on this information, or if we may be of further service. We look forward to our continued association to obtain a successful completion of this project.

Sincerely,
ATLANTIC TESTING LABORATORIES, Limited

Thomas R. Seider, PE
Senior Engineer

TRS/sw

Enclosures

SUBSURFACE INVESTIGATION
AND
GEOTECHNICAL EVALUATION

PROPOSED EDISON MARTHA OLS PROJECT
EDISON STREET
BUFFALO, NEW YORK

TYLIN – GREELEY AND HANSEN WATER SOLUTIONS

PREPARED FOR: **TYLin – Greeley and Hansen Water Solutions**
77 Broadway Street – Suite 208
Buffalo, New York, 14203

PREPARED BY: **Atlantic Testing Laboratories, Limited**
5167 South Park Avenue
Hamburg, New York, 14075

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1.0 INTRODUCTION

At the request of TYLin – Greeley and Hansen Water Solutions (TYLin), and in accordance with our proposal (ATL File No. BD998-1151-04-24, dated April 30, 2024), Atlantic Testing Laboratories, Limited (ATL) performed a subsurface investigation and geotechnical evaluation for the referenced project. The purpose of the investigation was to ascertain the general subsurface soil, bedrock, and groundwater conditions at the site, to evaluate the engineering significance of these findings, and to provide recommendations related to the design and construction of the proposed project.

2.0 SITE AND PROJECT DESCRIPTION

The proposed project is expected to include the following major components.

- Construction of an approximate 4 million gallon Offline Storage (OLS) Tank, within an open field area to the west of the existing Charter School of Inquiry, located at 404 Edison Avenue, within the City of Buffalo. This is expected to consist of an approximate 130 feet wide by 340 feet long, and 10 to 15 feet deep, cast-in-place concrete structure. The top of the tank will be about 12 feet below grade, with the bottom of the tank bearing about 23 feet below grade at the north end and about 30 feet below grade at the south end. Interior columns will be used to support the top of the tank.
- Installation of approximately 400 linear feet of 48-inch diameter, gravity flow, influent sewer piping, extending from the sewer line within Edison Avenue, along the north end of the school, and into the new OLS Tank. The piping will have an invert of about 17 feet to 23 feet below existing site grades.
- Installation of approximately 330 linear feet of 24-inch diameter, gravity flow, effluent sewer piping, extending from the south end of the new OLS Tank, back to the sewer line with Edison Avenue. The piping will have an invert of about 30 feet to 34 feet below existing site grades.
- A diversion chamber is planned at the connection between the existing sewer line and the new influent sewer line at the north end of the project. Several additional sewer manholes are planned along the proposed influent and effluent sewer lines.

- It is our understanding that micro-tunneling is being considered for installation of the sewer piping. Micro-tunneling is a trenchless construction method that uses a horizontal boring machine. The boring machine is pushed by hydraulic jacks from a launch shaft / pit. As the excavation is advanced, the spoils are removed, and piping is installed behind the boring machine.

The general limits of the proposed project are shown on the **Boring Location Plan**, which is included in **Appendix A**. The **Preliminary Site Plan** included in **Appendix B** was provided by TYLin, and shows the approximate limits of the proposed OLS Tank and sewer lines. The vertical dimensions of the tank shown on the site plan have been revised, as summarized above.

3.0 SUBSURFACE INVESTIGATION & SAMPLING METHODOLOGY

3.1 Boring Locations

Eight (8) boring locations, designated as B-1 through B-8, were selected by TYLin to provide general coverage of the proposed tank, sewer piping, and manhole structures. ATL used Google Earth to establish the GPS northing and easting coordinates for each boring location, based on the plan provided by TYLin. A Trimble Model R8 GPS / GNSS Receiver was then used to locate the borings in the field and to determine the approximate ground surface elevations. The recorded coordinates at the boring locations, along with the approximate ground surface elevations are included in **Table 1**, within **Appendix C**. The approximate boring locations are shown on the Boring Location Plan in Appendix A.

3.2 Soil and Bedrock Borings

The borings were completed by ATL between July 3rd and July 24th, 2024, using a Central Mine Equipment (CME) model 550X, all-terrain tire mounted drill rig, and a CME model 55LC, rubber track mounted drill rig. The borings were advanced through the overburden soil using hollow stem auger and split spoon soil sampling techniques. Soil sampling and standard penetration testing was performed continuously throughout the full depth of the overburden soils. The soil sampling and standard penetration testing was completed utilizing a 2-inch outside diameter split spoon sampler and automatic drop hammer, in accordance with ASTM D 1586.

All of the borings were advanced through the overburden soils until encountering auger refusal conditions at the top of apparent bedrock, at depths ranging from about 9 feet to 14 feet. Following auger refusal within borings B-1, B-4, B-5, and B-8, the borings were advanced using rock coring methods, in accordance with ASTM D 2113. Borings B-1, B-5, and B-8 were advanced with an NQ size core barrel, to a depths ranging from 45 feet to 60 feet each. Boring B-4 was advanced with an HQ size core barrel, to a depth of 25 feet, creating a larger size core hole for installation of a groundwater observation well.

The collected soil samples were visually classified in the laboratory by a Geologist using the Burmister Soil Classification System. The split spoon sampler does not recover particles larger than 1⅜-inch in nominal dimension; therefore, the soil classifications may not be representative of the entire soil matrix. The recovered rock cores were also described, including characteristics such as color, rock type, core recovery and rock quality designation (RQD). The visual classifications and the standard penetration test results are presented on the **Subsurface Investigation Logs** included in **Appendix D**.

The boreholes that were not completed with observation wells were backfilled with on-site soils, and the surface was patched as appropriate. It is important that the backfilled borings be monitored for settlement or subsidence. This will be the responsibility of TYLin or others. ATL assumes no liability for loss or damage resulting from borehole settlement.

3.3 Groundwater Observation Wells

Following the completion of borings B-3, B-4, and B-6, groundwater observation wells were installed. The observation wells consist of 2-inch diameter PVC machine slot well screen and riser pipe, with filter sand installed around the well screen.

The sand pack for observation well B-4 extends from the bottom of the rock core hole at 25 feet, up to about 8 feet below the surface. A bentonite chip seal was installed above the sand pack up to about 6 feet. Accordingly, the sand pack at observation well B-4 extends across the overburden / top of bedrock interface, which is about 9.5 feet below the surface.

The sand pack for observation well B-3 extends from the bottom of the boring at 14.1 feet, up to about 7 feet below the surface. A bentonite chip seal was installed above the sand pack up to about 5 feet, sealing the sand pack within the indigenous soils. The sand pack for observation well B-6 extends from the bottom of the boring at 10.4 feet, up to about 3.4 feet, and is mostly within the indigenous soils.

A cement-bentonite grout and / or concrete was used to backfill the remainder of the bore holes above the bentonite seals, and flush-mount protective casings were installed at the surface. Additional details regarding the construction of the observation wells are shown on the **Monitoring Well Completion Records**, following boring logs B-3, B-4, and B-6, within **Appendix D**.

4.0 GEOTECHNICAL LABORATORY ANALYSES

Select samples of the overburden fill soils and indigenous soils were tested in ATL's geotechnical laboratory for the following physical analyses.

- Laboratory Determination of Moisture Content of Soils (ASTM D 2216).
- Particle Size Distribution, both with and without Hydrometer Analyses (ASTM D 422).
- Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318).

The **Laboratory Test Results** for the soil samples are included in **Appendix E**, and are summarized in **Table 2**, within **Appendix C**.

In addition to the soil testing, eight (8) pieces of the recovered bedrock cores were tested by ATL for Unconfined Compressive Strength (ASTM D 7012, Method C). These results are also included in Appendix E, and are summarized in **Table 3**, within **Appendix C**.

5.0 SUBSURFACE CONDITIONS

The following description of the surface and subsurface conditions is based on the subsurface soil, bedrock, and groundwater conditions encountered during the subsurface investigation performed between July 3rd and July 24th, 2024, along with a review of the laboratory test results. Actual conditions could vary across the project site in both the horizontal and vertical dimensions. More detailed subsurface descriptions are provided on the subsurface investigation logs in Appendix D.

5.1 Surface Conditions and Existing Fill Soils

Boring B-8 was completed within the south parking lot, and encountered about 3-inches of asphalt pavement at the surface. The remaining borings were completed within open lawn areas, and encountered topsoil at the surface, with a thickness ranging from about 4 to 12 inches. The topsoil thickness measurements noted by the driller were made at widely spaced locations. In addition, properly measuring the topsoil thicknesses within the split spoon samples and / or boring holes is difficult and can vary depending on the driller's interpretation of topsoil. Accordingly, it should be expected that the topsoil thickness will vary between and away from the boring locations.

Beneath the pavement or topsoil, man-placed fill type soils were encountered, which extended to depths ranging from about 2 feet to 4 feet. The following table summarizes the approximate fill depths and apparent bottom of fill elevations encountered at the boring locations.

Approximate Fill Depths and Bottom of Fill Elevations

Boring	Approximate Surface Elevation (feet)	Fill Depth / Bottom of Fill Elevation (feet)
B-1	668.2	2 / 666.2
B-2	670.7	4 / 666.7
B-3	673.5	4 / 669.5
B-4	667.6	4 / 663.6
B-5	667.4	2 / 665.4
B-6	666.3	4 / 662.3
B-7	669.4	4 / 665.4
B-8	670.0	4 / 666.0

It should be expected that the fill thickness will vary between and away from the boring locations, and will be dependent on the original site topography prior to development of the site. The fill soils will also extend to the bottom of the excavations made for any existing or former structure foundations or utilities. The nature of the existing fill soils varied between the boring locations and with depth. However, it can generally be described a mixture of clay and silt with varying amounts of intermixed sand and gravel. Trace amounts of organics were often observed within the fill samples, and a few of the fill samples contained trace amounts of

cinders, glass, or slag. One sample of the fill soil from boring B-4 was tested for particle size distribution. The results are summarized in Table 2, within Appendix C, and confirm the visual soil descriptions. The Standard Penetration Test (SPT) "N" values obtained within fill soils ranged from 5 to 32, but were mostly less than 30, indicating the fill soils have "medium" to "very stiff" consistency.

5.2 Indigenous Soils

The indigenous soils consisted predominately of a medium plasticity clay and silt soil with varying amounts of intermixed sand and gravel. Beneath depths of about 6 to 8 feet within the southern-most borings (i.e. B-5 through B-8), the indigenous soils contained a relatively higher percentage of sand and gravel size particles than the remaining samples of indigenous soils.

The Standard Penetration Test (SPT) "N" values obtained within the indigenous soils mostly ranged from more than 30 to "sample spoon refusal" (i.e. more than 50 blows required to advance the sample spoon with six inches or less of penetration), indicating the indigenous soils generally have a "hard" consistency. Exceptions include boring B-8, where the SPT "N" values form 4 feet to 10 feet were 8, 13, and 25, correlating to soils with a "stiff" to "very stiff" consistency. Laboratory test results completed on samples of the indigenous soils are summarized in Table 2, within Appendix C.

5.3 Bedrock

All eight borings were advanced through the overburden fill and indigenous soils until encountering auger refusal conditions at the top of apparent bedrock, at depths ranging from about 9 feet to 14 feet. Rock coring completed within borings B-1, B-4, B-5, and B-8, confirmed the auger refusal conditions consisted of bedrock. The following table summarizes the depth and elevation where the top of bedrock was encountered, as identified by rock coring (C) or auger refusal (AR).

Approximate Depth and Elevation at Top of Bedrock

Boring	Approximate Ground Surface Elevation (feet)	Depth / Elevation at Top of Bedrock (feet)
B-1	668.2	9.5 / 658.7 (C)
B-2	670.7	12.1 / 658.6 (AR)
B-3	673.5	14.1 / 659.4 (AR)
B-4	667.6	9.5 / 658.1 (C)
B-5	667.4	9.5 / 657.9 (C)
B-6	666.3	10.4 / 655.9 (AR)
B-7	669.4	13.5 / 655.9 (AR)
B-8	670.0	13.0 / 657.0 (C)

The bedrock cores recovered consisted of grey, hard to very hard, mostly sound, laminated to massively bedded, Limestone bedrock, with some fractures, along with varying amounts of chert. Exceptions include the upper 1 to 3 feet of bedrock core from borings B-1 and B-4 which were described as weathered to sound.

The percent recovery and the rock quality designation (RQD) value for each core run are summarized in Table 3, included within Appendix C. As shown, the core recoveries ranged from 79% to 100%. The RQD values mostly ranged from 83% to 100%, indicating the rock mass quality is “good” to “excellent”. Exceptions include the first core runs from borings B-1, B-4, and B-5, where the RQD values were 37%, 51%, and 73%, respectively.

Several pieces of the recovered rock cores were tested for Unconfined Compressive Strength. The results are included in Appendix E, and are also summarized in Table 3. The unconfined compressive strength of the rock cores tested, ranged from about 13,100 pounds per square inch (psi) to 18,000 psi.

During the bedrock coring process, water is introduced into the borings to cool the rock core bit and flush cuttings from the hole. The core water is typically returned to the surface. However, the driller did note the loss of core water within boring B-5 at a depth of about 42 feet.

5.4 Groundwater

At the completion of overburden drilling to the top of bedrock, and prior to rock coring, no freestanding water was observed within the bore holes. Based on the subsequent water level measurements made within overburden observation wells B-3 and B-6, it appears that the groundwater did not have adequate time to accumulate in the borings, during the relatively short time period that had elapsed from the completion of overburden drilling operations and the time of the measurements.

Following the completion of rock coring at borings B-1, B-4, B-5, and B-8, freestanding water was measured within the core holes at depths ranging from near the surface to 10 feet. However, because water was introduced into the borings to facilitate the rock coring, these measurements should not be considered to represent an actual groundwater condition.

Groundwater observation wells were installed within completed borings B-3, B-4, and B-6. The well screen and sand pack at observation wells B-3 and B-6 are within the overburden soils The well screen and sand pack at observation well B-4 are mostly within the bedrock core hole, but do extend into the overburden soils. Water level measurements were obtained at the observation wells on three occasions, and are summarized in the following table.

Summary of Water Levels within Observation Wells			
Observation Well	Ground Surface Elevation (feet)	Date	Groundwater Depth / Elevation (feet)
B-3 (overburden)	673.5	July 23, 2024	9.29 / 664.2
		August 01, 2024	9.53 / 664.0
		August 12, 2024	9.18 / 664.3
B-4 (overburden / bedrock)	667.6	July 23, 2024	7.53 / 660.1
		August 01, 2024	11.58 / 656.0
		August 12, 2024	11.72 / 655.9
B-6 (overburden)	666.3	July 23, 2024	6.42 / 659.9
		August 01, 2024	9.01 / 657.3
		August 12, 2024	7.13 / 659.2

Following the water level readings, some water was removed from the wells. This lowered the water level to near the bottom of the overburden wells B-3 and B-4, and lowered the water level by about 5 feet within the bedrock well B-4. Supplemental water level readings at observation wells B-3 and B-4 indicate the water levels returned to near the same level. The water levels within observation well B-6 were more sporadic.

The water level measurements obtained within well B-3 were relatively consistent, about 5-feet above the top of bedrock, and appears to represent a general overburden groundwater condition. Removal of water from well B-3 lowered the water level by about 4 feet. Over an approximate 15 minute duration, the water level recovered by about 1.3 feet, or by about 30 percent.

The water level measurements obtained within well B-6 were somewhat variable, ranging from about 1-foot to 4-feet above the top of bedrock. As noted, the soil conditions within the southern portion of the site, including boring B-6, contained a higher percentage of gravel and sand size particles. Accordingly, the variable water levels could be the result of infiltrating surface waters resulting from precipitation events. Removal of water from well B-6 lowered the water level by about 1 to 2.5 feet. Over an approximate 15 minute duration, the water level recovered by about 0.5 to 0.8 feet, or by about 30 to 50 percent.

The second and third water level measurements obtained within well B-4 were relatively consistent, and about 2-feet below the top of bedrock. The first water level measurement, which was shallower, may have resulted from the water that was introduced into the boring to facilitate the rock coring. Removal of water from well B-4 lowered the water level by about 5 feet. Over an approximate 15 minute duration, the water level recovered by about 4 feet, or by about 80 percent.

Perched groundwater conditions, such as those that appear to exist in the area of well B-6, can be more prevalent following heavy or extended periods of precipitation and during seasonally wet periods. It should be expected that both perched and general groundwater within the overburden and bedrock will vary with location and with changes in soil conditions, precipitation and seasonal conditions. Consideration should be given to obtaining additional groundwater depth measurements within the observation wells to evaluate for seasonal fluctuations.

6.0 GEOTECHNICAL ENGINEERING DISCUSSION & RECOMMENDATIONS

6.1 General

The geotechnical engineering discussion and recommendations are based on the information provided by TYLin and the subsurface conditions outlined in this report. Based on the proposed OLS tank, diversion chamber, manhole structures, and sewer piping, along with the subsurface conditions encountered, the following items should be considered with regard to design and construction of the project.

- OLS tank, diversion chamber, and manhole structure support, lateral earth pressures, and uplift resistance.
- Bedrock excavation and shoring requirements.
- Excavation dewatering.
- Protection of existing structures and utilities.

These considerations, along with associated recommendations are discussed in the following sections of this report.

6.2 OLS Tank and Manhole Structures

6.2.1 Bearing Capacity

The proposed OLS Tank, diversion chamber, and manhole structures will be bearing within the hard to very hard Limestone bedrock, which is considered suitable for supporting the proposed structures. The Limestone bedrock is adequate to support an allowable net bearing pressure increase in excess of 10 tons per square foot, which is more than adequate, considering construction of the tank and manhole structures are expected to result in minor to no net bearing pressure increases to the bedrock bearing grades. This is due to the volume of soil and bedrock that will be displaced by the tank and manhole structures. It may be desirable to level the bedrock bearing surface with Structural Fill or concrete fill (f'c at 28 days $>$ 2,000 psi), prior to construction of the tank and manhole structures. Recommendations for Structural Fill are provided in Section 7.5 of this report.

6.2.2 Uplift Resistance

Design of the below grade structures should consider the presence of groundwater conditions and hydrostatic lateral and uplift pressures. An overburden groundwater condition appears to exist at depths ranging from about 7 to 9 feet (elevation 660 feet to 664 feet). A bedrock groundwater condition exist near a depth of 12 feet (elevation 656 feet). However, it is recommended for design purposes that groundwater conditions be assumed to exist at the surface, to account for potentially variable groundwater conditions, and the possibility of surface water accumulation within the more granular soils / stone that will likely be used to backfill the structures.

A lip should be provided at the bottom of the structures in order to help mobilize the soil backfill weight against uplift. The weight of the soil column extending out at an angle of 20 degrees from vertical, above the bottom of the lip of the structure, can be added to the dead weight of the structure in computing the resistance to hydrostatic uplift. This only applies for the structures above any near vertical bedrock excavation sidewalls. For the portion of the structures within a near vertical bedrock excavation, the weight of the soil column extending out at an angle of 20 degrees from vertical, (up to the width of the excavation), above the bottom of the lip of the structure, can be added to the dead weight of the structure in computing the resistance to hydrostatic uplift. A submerged unit weight of 75 pounds per cubic foot can be used, where the tank and manhole backfill is Structural Fill, as described in section 7.5 of this report.

The use of rock anchors, grouted into pre-drilled holes into the Limestone bedrock, can be considered to provide additional uplift resistance. We recommend a minimum anchor (or dowel) hole diameter of 3 inches and a minimum bond length of 5 feet be used in the design of the anchors. The anchor hole should be over-bored approximately 1 foot, and the bond strength for the first upper 1 foot of rock be disregarded. Therefore, a rock anchor designed for 5 feet of bond strength length should be embedded a minimum of 7 feet into the bedrock.

It is general practice to develop a performance specification, with the desired capacity and locations, and then have a Specialty Contractor design the rock anchors. For preliminary planning purposes, an ultimate bond strength of 200 psi between the Limestone bedrock and the grout can be used for design of the rock anchors. Accordingly, a 3-inch diameter rock anchor with 5 feet of effective bond length in the Limestone bedrock would provide an ultimate capacity of about 113 kips.

The Post Tensioning Institute (PTI) - "Recommendations for Prestressed Rock and Soil Anchors" can be referenced with regard to providing design criteria and installation requirements for Rock Anchors. At least the first three anchors installed should be performance tested and all remaining rock anchors should be proof tested. Installation and testing of the rock anchors should be in accordance with NYSDOT Standard Specifications.

6.2.3 Earth Pressures

The design of the tank and manhole structure walls should be based on the lateral earth pressures caused by the load of backfill against the wall and the surcharge effects from any permanent or temporary adjacent loads. The depressed structure walls (restrained walls), should be designed to resist “at rest” lateral earth pressures generated by the earth backfill and any temporary or permanent surcharge loads, based on the following soil parameters. The lateral earth pressures can be computed using the following soil parameters where the wall backfill is a Structural Fill material.

Recommended Soil Parameters for Below Grade Wall Design

- Coefficient of At-Rest Lateral Earth Pressure – 0.47
- Coefficient of Active Lateral Earth Pressure – 0.31
- Angle of Internal Friction – 32 Degrees
- Moist Unit Weight of Soil – 140 pcf
- Submerged or Buoyant Unit Weight of Soil – 75 pcf
- Surcharge Load Lateral Coefficient – 0.50

The walls should also be designed to resist the hydrostatic pressures as well as the lateral earth pressures acting the walls. In this case, the lateral earth pressure should be computed based on a submerged soil unit weight below the design groundwater level. In addition, the floor or bottom slabs must be designed to resist potential hydrostatic uplift pressure acting on the floor and the structures should also be fully water proofed.

6.3 Sewer Lines

The effluent sewer piping will be situated 15 to 20 feet below the top of the Limestone bedrock, and could be installed using micro-tunneling methods, which appears to be a suitable option for the subsurface conditions encountered.

The influent sewer line invert is planned at a depth of 17 feet to 23 feet below the ground surface. Assuming a 5-feet diameter micro-tunnel will be required, the top of the tunnel could be as shallow as 12 feet below the surface, which is expected to be near or slightly above the interface between the overburden soils and the top of bedrock. This could present some issues with micro-tunneling methods of excavation due to the dissimilar materials. Accordingly, the use of traditional open cut trench methods might be a better option for the influent sewer piping installation.

Excavation shoring considerations are provided in Section 7.3. Where open cut trench methods are used, the pipe manufacture recommendations for bedding stone thicknesses are expected to be adequate for piping bearing within the Limestone bedrock.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation Dewatering

As noted, an overburden groundwater condition appears to exist at depths ranging from about 7 to 9 feet (elevation 660 feet to 664 feet). A bedrock groundwater condition exist near a depth of 12 feet (elevation 656 feet). Accordingly, both overburden and bedrock excavation dewatering will be necessary. As noted, the groundwater recovery rate within the bedrock observation well B-4 was relatively faster than the recovery rate within the overburden soils. Any fractures within the bedrock are expected to result in a relatively fast groundwater recovery rate. Where pumping is not adequate to dewater the excavation, it could become necessary to grout the bedrock fractures and / or implement alternative dewatering methods.

Excavation dewatering should be implemented as necessary to allow for construction to proceed in the dry. The amount of groundwater seepage can depend on the excavation location and depth, along with the soil / bedrock permeability, site drainage, and precipitation conditions at the time of construction.

Consideration should be given to obtaining additional groundwater depth measurements at the observation wells, to evaluate for seasonal fluctuations. Additional rock coring with packer testing should be considered to evaluate for fractures within the bedrock and where higher zones of groundwater infiltration can be expected. A groundwater drawdown test within the bedrock observation well can also be completed to help estimate the dewatering requirements. Both packer testing and drawdown testing should be completed by a dewatering contractor / consultant, experienced with bedrock dewatering methods.

Groundwater dewatering plans should include implementation of measures to control erosion, sedimentation, and the migration of soil fines. All dewatering activities should comply with New York State Department of Environmental Conservation (NYSDEC) stormwater discharge requirements and/or applicable federal and local regulations for construction.

7.2 Bedrock Excavation and Vibration Monitoring

The excavation of Limestone bedrock is expected to be necessary for the proposed OLS Tank, proposed manhole structures, and launch shafts / pits for the micro-tunneling equipment. The hard to very hard, and sound nature of the Limestone bedrock, its Chert content, and its relatively high RQD values indicates it will be necessary to loosen the bedrock prior to excavation, using hydraulic/pneumatic breakers (i.e. “hoe rams”), rock grinders or possibly through controlled drilling and blasting methods.

If blasting methods are permitted, they will need to be controlled and monitored to prevent uncontrolled rock heave and/or over-breakage of the bedrock subgrades that will support the OLS tank, manhole structures, and piping, as well as prevent potential detrimental impacts to existing adjacent structures and utilities. The Contractor should be required to prepare and submit a blasting operations plan. The plan should include all measures that will be employed to protect the public, workmen, and structures during blasting events. A schedule of blast events should also be established and coordinated with all appropriate parties. The plan should also include measures which will be used for monitoring blast vibrations, and to confirm that no damage has occurred to existing structures and utilities, and to subgrades for proposed tank and manhole structures.

For sensitive structures and structures in poor structural condition, it is generally recommended that the peak particle velocity (ppv) measured at the structure location not exceed 5 mm/sec (0.2 inches/sec). Higher ppv thresholds, in the range of 25 mm/sec (1 inch/sec) are generally considered acceptable for structures and utilities of sound condition.

The completion of pre-condition surveys should be considered of any nearby structures, documenting the existing conditions, damaged areas and defects. Such documentation should include photographs, video-taping, crack mapping, installation of “tell-tales”, etc. This should also include documentation of doorway and window operation, and other features, which could be perceived as having been impacted or damaged.

Each blast event should be properly documented and monitored for vibration and over pressure by qualified personnel. Vibration monitoring for each blast event should be set up at the nearest structure/utility location, and at multiple locations, if appropriate. The vibrations should be limited to the thresholds stated above. In addition to the vibration monitoring the sound levels (over pressure) should not exceed 0.01 pounds per square inch (psi).

It should also be understood that quantity disputes for rock excavation can arise, as the result of bedrock heave and over-breakage from blasting. Accordingly, the construction contract should be clear that the rock excavation pay quantity is to be based on the depth of the in-situ undisturbed bedrock surface prior to blasting, along with the design bottom and side wall neat lines. Payment for additional rock excavation necessary due to heave and over-breakage beyond the trench width and bottom neat lines should not be allowed.

7.3 Excavation and Shoring

An open cut excavation could be used where there is sufficient room to cut back the excavation side slopes to safe and stable conditions, provided that any groundwater is depressed below the excavation bottom. The excavation sidewalls must be adequately sloped back in accordance with OSHA requirements as a minimum. The soil / bedrock conditions could vary away from the test boring locations. Accordingly, the Contractor should confirm the OSHA soil classification and excavation requirements at the time of construction based on actual soil, bedrock, and groundwater conditions present. The Contractor shall be solely responsible for all excavation safety, including the design of all excavation support systems.

Properly braced, or tied back shoring should be required at locations where existing structures, utilities, must be protected from potential detrimental soil movement as the result of soil relaxation/stress relief. It is noted that the use of cantilevered sheet piling (unbraced tight sheeting) or trench boxes will not be sufficient to prevent soil relaxation/stress relief (i.e. soil deformation) as excavations takes place. The use of rock anchors should be considered for excavations extending into the bedrock.

Excavation support systems should be designed by a registered Professional Engineer, who is experienced in the design of earth support systems. The design requirements at each location must consider the subsurface conditions, the potential for undercutting subgrades, utilities, structures, construction sequence, lateral earth pressures, hydrostatic conditions, and surcharge effects associated with excavation wall and bottom stability. In addition, driving sheet piles can cause detrimental damage to nearby structures, surface features, and underground utilities and must be considered during design and construction. Removal of excavation support systems should also be properly evaluated so as not to affect the integrity of the adjacent infrastructure.

7.4 Testing and Inspection

The final plans and project specifications should be reviewed by ATL, as the Geotechnical Engineer of Record, to verify that there has not been a misinterpretation of this report and/or ATL's understanding of the project.

The tank construction and manhole and sewer line installations should be continuously monitored by a Geotechnical Engineer to verify the stability and uniformity of the subgrades, to identify the presence of deleterious fill, and to ensure that adequate bearing capacity is obtained.

We recommend that ATL, as the Geotechnical Engineer of Record, be retained to perform inspections in accordance with the plans. An ATL geotechnical representative familiar with the findings and recommendations of this report will be able to assess the subsurface conditions encountered during construction, provide necessary remedial recommendations, and verify that adequate soil and bedrock conditions and bearing capacities are achieved.

7.5 Structural Fill

Structural Fill which is placed beneath the tank and manholes or used as excavation backfill should consist of a crushed ledge-rock, which is free of clay, organics and friable or deleterious particles. The material should comply with NYSDOT Standard Specifications, Item No. 304.12 - Type 2 Subbase. The Structural Fill should have the following gradation requirements.

Item 304.12 – Type 2 Subbase (crushed ledge-rock)	
Sieve Size Distribution	Percent Finer by Weight
2 inch	100
¼ inch	25 to 60
no. 40	5 to 40
no. 200	0 to 10

The Structural Fill should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Placement of fill should not exceed a maximum loose lift thickness of 8 to 10 inches. The loose lift thickness should be reduced in conjunction with the compaction equipment used so that the required density is attained. The Structural Fill / Subbase Stone should have a moisture content within two percent of the optimum moisture content, or as directed by the Geotechnical Engineer, at the time of compaction.

8.0 LIMITATIONS

The subsurface investigation logs and this report in its entirety should be provided to the designers and contractors for information and interpretation. The subsurface investigation logs may not be representative of the entire sites subsurface condition, but only what was encountered at the individual test locations at the time of the investigation. The subsurface soil, bedrock, and groundwater conditions encountered at the time of construction may be different from those described on the subsurface investigation logs.

This report was prepared to present the findings of our subsurface investigation and engineering evaluation, and to outline concepts to be utilized in foundation design and construction. These concepts may require alterations to meet the specific design and economic considerations for this project.

Prepared by:

Thomas R. Seider, PE
Senior Engineer

Reviewed by:

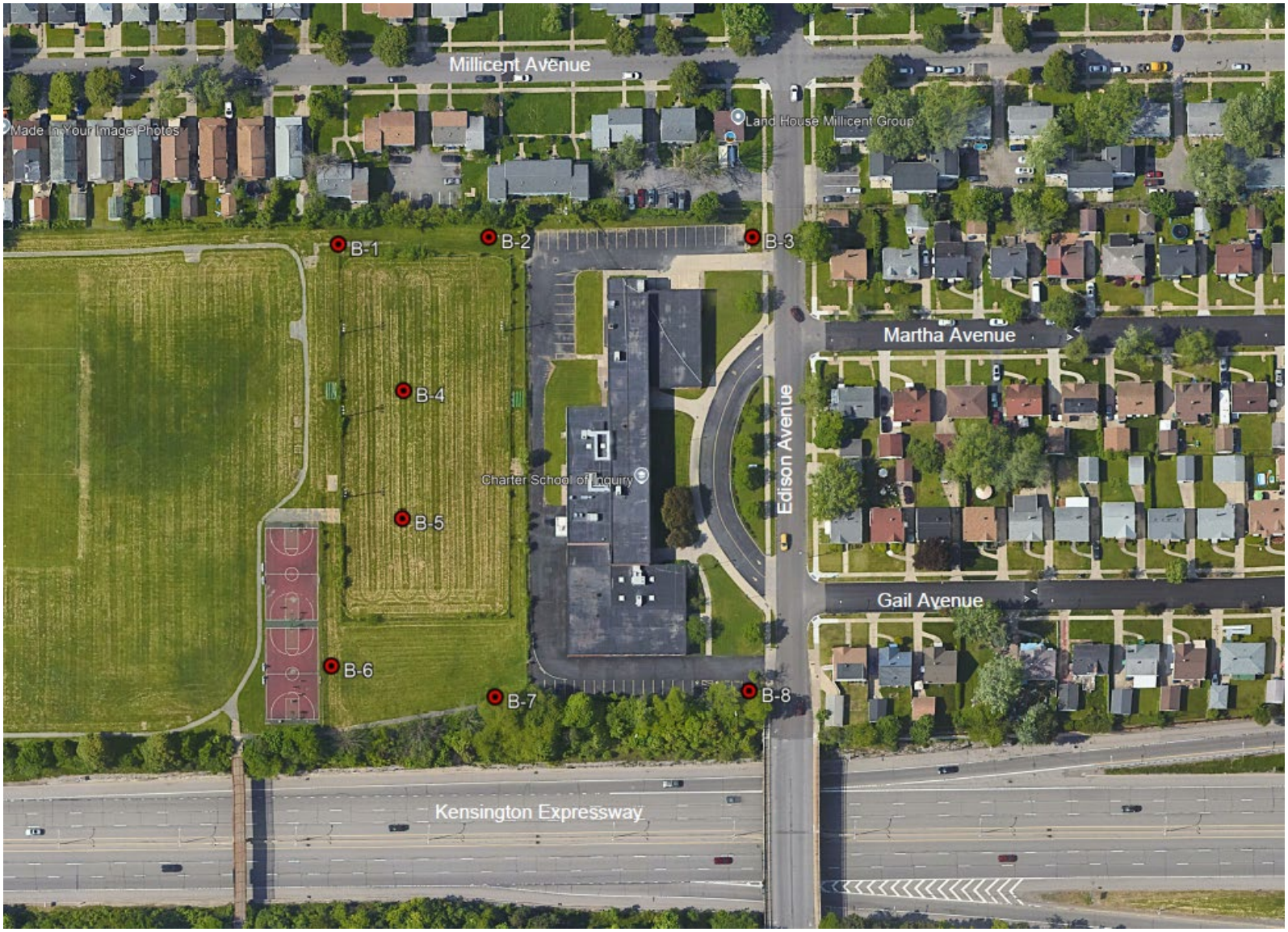
Brian T. Barnes, PE
Senior Engineer

TRS/BTB/sw

APPENDIX A

BORING LOCATION PLAN

North



Note: Figure developed Google Earth

Boring Location Plan	Drawn by: TRS	Scale: Not to scale	Project No.: BD 162	Date: 09-11-2024

Proposed Edison Martha OLS Project
Edison Avenue
Buffalo, New York

***ATLANTIC TESTING LABORATORIES*, Limited**

Albany, NY	Binghamton, NY	Buffalo, NY	Canton, NY
Elmira, NY	Plattsburgh, NY	Poughkeepsie, NY	Syracuse, NY
Rochester, NY	Utica, NY	Watertown, NY	

APPENDIX B

PRELIMINARY SITE PLAN

BUFFALO SEWER AUTHORITY
LONG TERM CONTROL PLAN OPTIMIZATION

CSO053_5.2 EDISON MARTHA OLS

APPENDIX C

TABLES

TABLE 1
Approximate Boring Locations and Ground Surface Elevations

Proposed Edison Martha OLS Project
Edison Avenue
Buffalo, New York

Boring Number	Approximate Boring Locations GPS Coordinates		Approximate Ground Surface Elevation
	Latitude (Northing)	Longitude (Easting)	(feet)
B-1	42° 56' 04.77"	78° 48' 13.10"	668.2
B-2	42° 56' 04.82"	78° 48' 11.25"	670.7
B-3	42° 56' 04.79"	78° 48' 08.02"	673.5
B-4	42° 56' 03.45"	78° 48' 12.32"	667.6
B-5	42° 56' 02.30"	78° 48' 12.35"	667.4
B-6	42° 56' 00.98"	78° 48' 13.24"	666.3
B-7	42° 56 '00.69"	78° 48' 11.23"	669.4
B-8	42° 56' 00.72"	78° 48' 08.11"	670.0

Table 2
Summary of Geotechnical Laboratory Data - Soils

Proposed Eidson Marth OLS Project
Edison Avenue
Buffalo, New York

Boring Number	Sample Depth (ft. bgs)	Moisture Content (%)	Grain Size Distribution				Plastic / Liquid Limits		
			Gravel (%)	Sand (%)	Fines		Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)
					Silt (%)	Clay (%)			
Existing Fill Soils / Materials									
B-4	2 to 4	16.0	1.1	12.6	86.3		not tested		
Indigenous Soils									
B-1	2 to 6	13.5	2.0	14.4	33.7	49.9	not tested		
B-3	4 to 8.3	6.2	16.2	35.8	48.0		not tested		
B-5	2 to 6	14.6	9.1	16.3	74.6		16	32	16
B-5	6 to 8	6.6	29.4	47.9	22.7		not tested		
B-5	8 to 9.4	6.3	10.9	43.7	30.4	15.0	not tested		
B-6	4 to 8	16.7	1.1	11.7	87.2		16	31	15
B-6	8 to 9.9	7.2	19.5	46.9	33.6		not tested		
B-7	4 to 8	18.4	3.5	38.3	58.2		16	33	17
B-7	8 to 11.3	8.6	7.9	37.0	32.6	22.5	not tested		
B-8	4 to 8	11.7	6.7	45.3	32.7	15.3	not tested		
B-8	8 to 11.2	6.6	16.7	39.7	43.6		11	14	3

Note: ft. bgs = feet below ground surface.

Table 3
Summary of Bedrock Cores and Geotechnical Laboratory Data

Proposed Sidney OLS Project
Sidney Street and Lark Street
Buffalo, New York

Boring Number	Core Run Number	Core Run Depth (ft. bgs)	Core Recovery (percent)	Core RQD (percent)
B-1	1	9.5 to 10.5	83	37
	2	10.5 to 15.5	92	83
	3	15.5 to 20.5	100	100
	4	20.5 to 25.5	98	98
	5	25.5 to 30.5	95	94
	6	30.5 to 35.5	100	99
	7	35.5 to 40.5	97	89
	8	40.5 to 45.5	98	98
B-4	1	9.5 to 12.5	86	51
	2	12.5 to 17.5	100	88
	3	17.5 to 22.5	100	94
	4	22.5 to 25.0	87	85

Boring Number	Core Run Number	Core Run Depth (ft. bgs)	Core Recovery (percent)	Core RQD (percent)	Core Unconfined Compressive Strength (psi)
B-5	1	9.5 to 14.5	79	73	
	2	14.5 to 16.5	100	100	14,200
	3	16.5 to 21.5	95	84	
	4	21.5 to 26.5	97	94	13,070
	5	26.5 to 31.5	95	93	
	6	31.5 to 36.5	100	100	16,380
	7	36.5 to 41.5	99	98	
	8	41.5 to 46.5	100	98	15,300
B-8	1	13.0 to 15.0	98	90	17,130
	2	15.0 to 20.0	98	95	
	3	20.0 to 25.0	99	99	
	4	25.0 to 30.0	93	93	17,560
	5	30.0 to 35.0	98	98	
	6	35.0 to 40.0	98	92	
	7	40.0 to 45.0	99	90	18,010
	8	45.0 to 50.0	98	92	
	9	50.0 to 55.0	95	95	
	10	55.0 to 60.0	100	100	13,990

Notes:

1) ft. bgs = feet below ground surface.

2) RQD = Rock Quality Designation

3) psi = pounds per square inch

4) Blank space indicates testing was not completed for that sample.

5) no core water return at 42' within boring B-5.

APPENDIX D

SUBSURFACE INVESTIGATION LOGS

DATE:
START 7/3/2024
FINISH 7/9/2024
SHEET 1 OF 2

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO. B-1
SURF. ELEV 668.2'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	11	14			TOPSOIL	Driller noted approximately 12" of Topsoil at the surface
		18	21		32	Grey CLAY & SILT; trace f Gravel; trace cmf Sand; trace Organics (grass, roots); trace Debris (cinders) (moist, medium plasticity) FILL	
	2	9	17				
		23	30		40		
5	3	18	20			Brown CLAY & SILT; little cmf Sand; trace f Gravel; trace Organics (roots) (moist, medium plasticity)	
		24	27		44		
	4	12	27			Similar Soils; no Organics	REF = Sample Spoon Refusal
		50/0.3			REF	Similar Soils; little cf Gravel	
	5	50/0.2			REF	Similar Soils; some cf Gravel	NQ '2' Size Rock Core
10						Gray LIMESTONE Rock; hard to very hard; weathered; laminated to bedded; some fractures; contains chert	Run #1: 9.5' - 10.5' REC = 83% RQD = 37%
						Similar Rock; sound; laminated to massively bedded	Run #2: 10.5' - 15.5' REC = 92% RQD = 83%
15							
						Similar Rock	Run #3: 15.5' - 20.5' REC = 100% RQD = 100%
20							
						Similar Rock; thickly bedded to massively bedded	Run #4: 20.5' - 25.5' REC = 98% RQD = 98%
25							
						Similar Rock; laminated to thickly bedded	Run #5: 25.5' - 30.5' REC = 95% RQD = 94%
30							
						Similar Rock	Run #6: 30.5' - 35.5' REC = 100% RQD = 99%
35							
						Similar Rock; laminated to massively bedded	Run #7: 35.5' - 40.5' REC = 97% RQD = 89%
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 7/3/2024
FINISH 7/9/2024
SHEET 2 OF 2

Atlantic Testing Laboratories, Limited

Subsurface Log

HOLE NO. B-1
SURF. ELEV 668.2'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40						Similar Rock; bedded to thickly bedded	Run #8: 40.5' - 45.5' REC = 98% RQD = 98%
45						Boring Complete at 45.5'	No Free Standing Water encountered at completion of overburden drilling Free Standing Water recorded at grade at completion of rock coring
50							
55							
60							
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 7/3/2024
FINISH 7/3/2024
SHEET 1 OF 1

Atlantic Testing Laboratories, Limited

Subsurface Log

HOLE NO. B-2
SURF. ELEV 670.7'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	3	4			TOPSOIL	Driller noted approximately 12" of Topsoil at the surface
		5	5		9	Brown CLAY & SILT; and cf Gravel; trace cmf Sand; trace Organics (grass, roots) (moist, medium plasticity) FILL	
	2	3	3				
		9	18		12		
5	3	10	18			Similar Soils; Grey-Brown some cf Gravel; no grass (moist, medium plasticity) FILL	
		21	26		39		
	4	21	22			Brown CLAY & SILT; trace f Gravel; trace cmf Sand (moist, medium plasticity)	
		27	30		49		
	5	7	14			Similar Soils	
10		21	24		35	Similar Soils	
	6	6	24			Similar Soils; some cf Gravel; little cmf Sand	REF = Sample Spoon Refusal
		46	31		70	Similar Soils; trace f Gravel	
	7	50/0.1			REF		
						Boring Complete at 12.1' with Auger Refusal	No Free Standing Water encountered at boring completion
15							
20							
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 7/12/2024
FINISH 7/12/2024
SHEET 1 OF 1

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO. B-3
SURF. ELEV 673.5'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	4			TOPSOIL	Driller noted approximately 8" of Topsoil at the surface
		5	4		9	Brown-Grey CLAY & SILT; little cmf Sand; trace f Gravel; trace Organics (roots); trace Debris (glass) (moist, medium plasticity) FILL	
	2	8	10				
		14	15		24		
5	3	18	50			Similar Soils; little f Gravel; trace cmf Sand	REF = Sample Spoon Refusal
		50/0.3			REF	Brown SILT & CLAY; and cmf Sand; little cf Gravel (moist, low plasticity)	
	4	50/0.4			REF	Similar Soils	
						Similar Soils	
	5	50/0.3			REF		
10						Similar Soils; little f Gravel	
	6	50/0.3			REF		
						Similar Soils; some f Gravel	
	7	50/0.3			REF	Similar Soils	
15	8	50/0.1			REF	Boring Complete at 14.1' with Auger Refusal	No Free Standing Water encountered at boring completion
20							2" PVC observation well installed within completed boring
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

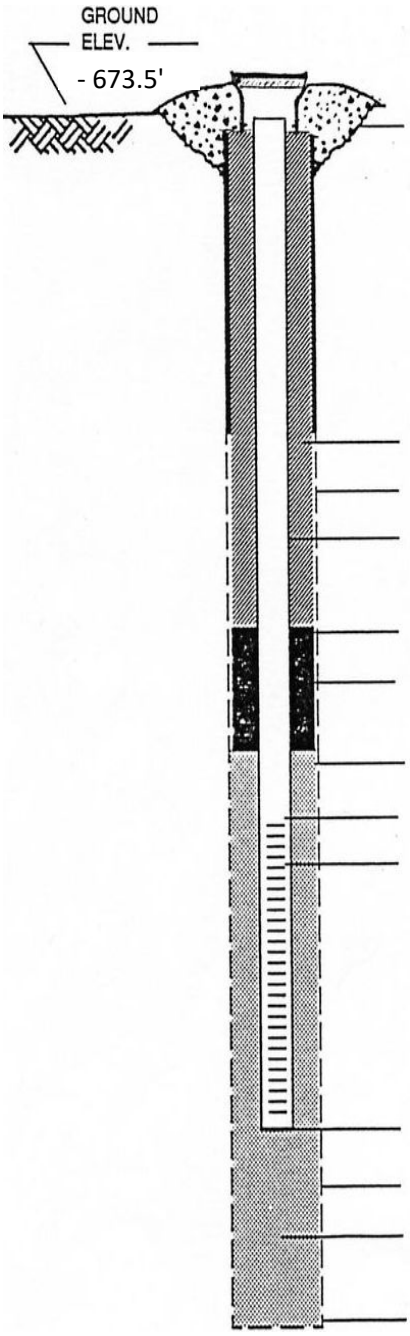
DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

MONITORING WELL COMPLETION RECORD

WELL NUMBER: B-3	
PROJECT: EDISON MARTHA OLS	**DRILLING METHOD:** ASTM D-1586 USING HSA
PROJECT NUMBER: BD162	**GEOLOGIST:** N/A
DRILLER: S. WOLKIEWICZ, SR.	**INSTALLATION DATE(S):** 7/12/24



TYPE OF SURFACE SEAL:	CONCRETE
TYPE OF BACKFILL:	GROUT
BOREHOLE DIAMETER:	±8.0"
I.D. OF RISER PIPE:	2.0"
TYPE OF RISER PIPE:	PVC
DEPTH OF SEAL:	5.0'
TYPE OF SEAL:	BENTONITE CHIPS
DEPTH OF SAND PACK:	7.0'
DEPTH OF TOP OF SCREEN:	9.0'
TYPE OF SCREEN:	PVC
SLOT SIZE X LENGTH:	.010"x5.0'
I.D. OF SCREEN:	2.0"
TYPE OF SAND PACK:	'0' FILTER SAND
DEPTH BOTTOM OF SCREEN:	14.0'
DEPTH BOTTOM OF SAND PACK:	14.1'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	N/A
ELEVATION/ DEPTH OF HOLE:	14.1'

DATE:
START 7/10/2024
FINISH 7/11/2024
SHEET 1 OF 1

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO. B-4
SURF. ELEV 667.6'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	3			TOPSOIL	Driller noted approximately 6" of Topsoil at the surface
		6	5		9	Grey-Brown CLAY & SILT; little cmf Sand; trace f Gravel; trace Organics (grass, roots) (moist, medium plasticity) FILL	
	2	7	5				
		8	13		13		
5	3	5	11			Brown CLAY & SILT; little cmf Sand; trace f Gravel (moist, medium plasticity)	
		17	29		28		
	4	26	30			Similar Soils	REF = Sample Spoon Refusal
		35	34		65		
	5	12	19			Similar Soils; some cf Gravel	HQ Size Rock Core
10		50/0.2			REF		
						Grey LIMESTONE Rock; hard to very hard; weathered to sound; laminated to bedded; some fractures; contains chert; contains soil from 9.5' - 10.5'	Run #1: 9.5' - 12.5' REC = 86% RQD = 51%
						Similar Rock; sound; laminated to massively bedded	Run #2: 12.5' - 17.5' REC = 100% RQD = 88%
15							
						Similar Rock; laminated to thickly bedded	Run #3: 17.5' - 22.5' REC = 100% RQD = 94%
20							
						Similar Rock	Run #4: 22.5' - 25' REC = 87% RQD = 85%
25							
						Boring Complete at 25'	No Free Standing Water encountered at completion of overburden drilling
30							Free Standing Water recorded at 1' after coring
							2" PVC observation well installed within completed boring
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

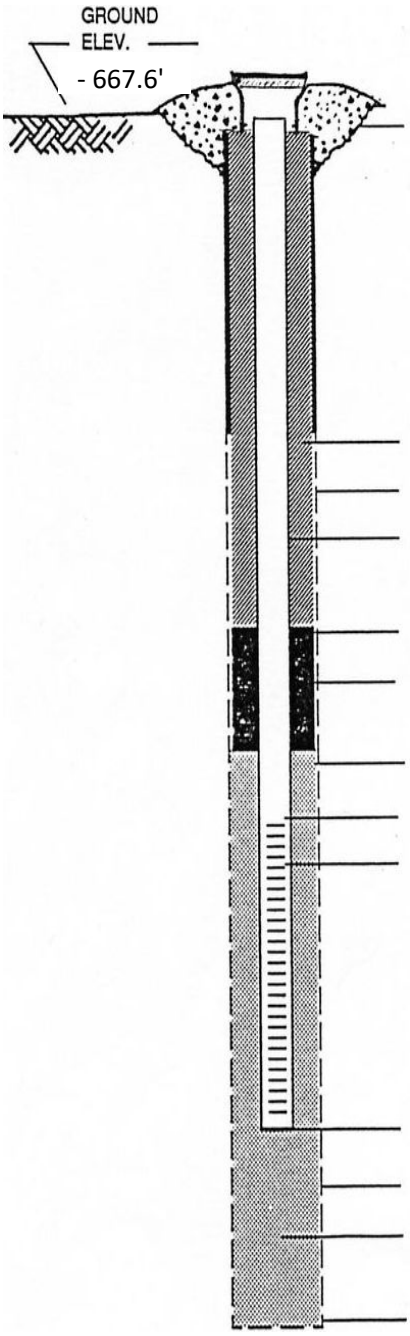
DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

MONITORING WELL COMPLETION RECORD

WELL NUMBER: B-4	
PROJECT: EDISON MARTHA OLS	**DRILLING METHOD:** ASTM D-1586 USING HSA
PROJECT NUMBER: BD162	**GEOLOGIST:** N/A
DRILLER: S. WOLKIEWICZ, SR.	**INSTALLATION DATE(S):** 7/11/24



TYPE OF SURFACE SEAL:	CONCRETE
TYPE OF BACKFILL:	GROUT
BOREHOLE DIAMETER:	±8"/3.8"
I.D. OF RISER PIPE:	2.0"
TYPE OF RISER PIPE:	PVC
DEPTH OF SEAL:	6.0'
TYPE OF SEAL:	BENTONITE CHIPS
DEPTH OF SAND PACK:	8.0'
DEPTH OF TOP OF SCREEN:	12.0'
TYPE OF SCREEN:	PVC
SLOT SIZE X LENGTH:	.010"x5.0'
I.D. OF SCREEN:	2.0"
TYPE OF SAND PACK:	'0' FILTER SAND
DEPTH BOTTOM OF SCREEN:	22.0'
DEPTH BOTTOM OF SAND PACK:	25.0'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	N/A
ELEVATION/ DEPTH OF HOLE:	25.0'

DATE:
START 7/9/2024
FINISH 7/10/2024
SHEET 1 OF 2

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO. B-5
SURF. ELEV 667.4'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	3			TOPSOIL	Driller noted approximately
		6	6		9	Brown-Grey CLAY & SILT; trace cmf Sand; trace f Gravel	3" of Topsoil at the surface
	2	5	8			trace Organic (grass, roots) FILL	
		11	12		19	Brown CLAY & SILT; little cmf Sand; trace f Gravel	
5	3	13	40			(moist, medium plasticity)	
		40	50		80	Similar Soils; some cf Gravel; little cmf Sand	
	4	36	37			Brown cmf SAND; some cf Gravel; some Silt & Clay	REF = Sample Spoon
		34	35		71	(moist, slight plasticity)	Refusal
	5	50	49			Brown SILT & CLAY; and cmf Sand; little cf Gravel	NQ '2' Size Rock Core
10		50/0.4			REF	(moist, low plasticity)	
						Grey LIMESTONE Rock; hard to very hard; sound; laminated to thickly beddd; some fractures; contains chert	Run #1: 9.5' - 14.5' REC = 79% RQD = 73%
15							
						Similar Rock	Run #2: 14.5' - 16.5' REC = 100% RQD = 100%
						Similar Rock; laminated to massively bedded	Run #3: 16.5' - 21.5' REC = 95% RQD = 84%
20							
						Similar Rock	Run #4: 21.5' - 26.5' REC = 97% RQD = 94%
25							
						Similar Rock; laminated to thickly bedded	Run #5: 26.5' - 31.5' REC = 95% RQD = 93%
30							
						Similar Rock; massively bedded	Run #6: 31.5' - 36.5' REC = 100% RQD = 100%
35							
						Similar Rock; laminated to massively bedded	Run #7: 36.5' - 41.5' REC = 99% RQD = 98%
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 7/9/2024
FINISH 7/10/2024
SHEET 2 OF 2

Atlantic Testing Laboratories, Limited

Subsurface Log

HOLE NO. B-5
SURF. ELEV 667.4'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40							
						Similar Rock; thinly bedded to massively bedded	Run #8: 41.5' - 46.5' REC = 100% RQD = 98%
45						Note: No core water return at 42'	
						Boring Complete at 46.5'	No Free Standing Water encountered at completion of overburden drilling
50							Free Standing Water recorded at 6.5' after coring
55							No core water return at 42'
60							
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 7/9/2024
FINISH 7/9/2024
SHEET 1 OF 1

Atlantic Testing Laboratories, Limited

Subsurface Log

HOLE NO. B-6
SURF. ELEV 666.3'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	3			TOPSOIL	Driller noted approximately 4" of Topsoil at the surface
		4	5		7	Brown-Grey SILT & CLAY; little f Gravel; little cmf Sand; trace Organics (grass, roots) (moist, low plasticity) FILL	
	2	2	3			Similar Soils; trace cf Gravel; trace f Sand	
		4	7		7		
5	3	5	9			Brown CLAY & SILT; little cmf Sand; trace f Gravel (moist, medium plasticity)	
		13	19		22		
	4	19	23			Similar Soils	
		22	25		45		
	5	5	16			Brown cmf SAND; some Silt & Clay; little cf Gravel (moist, slight plasticity)	REF = Sample Spoon Refusal
10		35	50/0.4		51		
	6	50/0.4			REF	Brown SILT & CLAY; some cf Gravel; some cmf Sand (moist, low plasticity)	
						Boring Complete at 10.4' with Auger Refusal	No Free Standing Water encountered at boring completion
15							
20							2" PVC observation well installed within completed boring
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

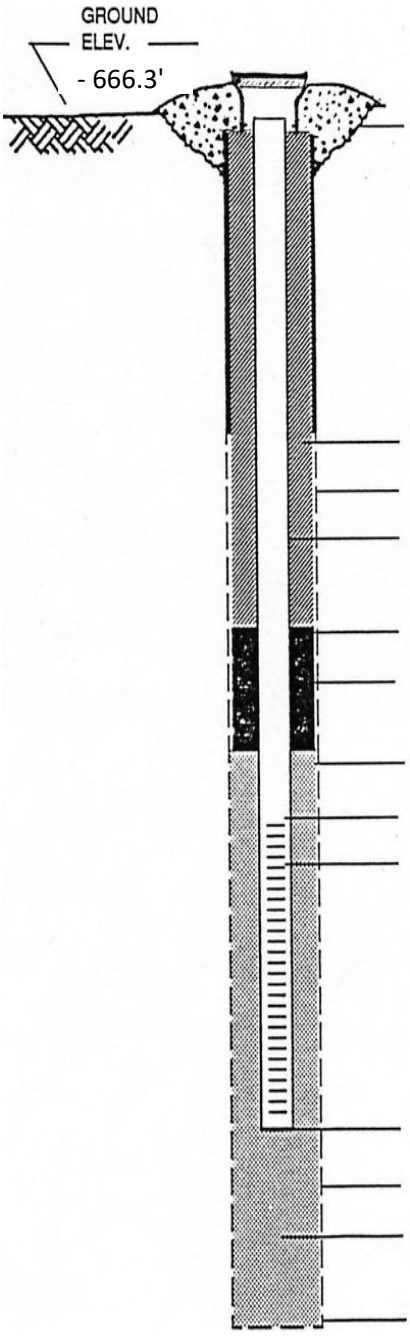
DRILLER: R. STEINER

DRILL RIG TYPE : CME - 45

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

MONITORING WELL COMPLETION RECORD

WELL NUMBER: B-6	
PROJECT: EDISON MARTHA OLS	**DRILLING METHOD:** ASTM D-1586 USING HSA
PROJECT NUMBER: BD162	**GEOLOGIST:** N/A
DRILLER: S. WOLKIEWICZ, SR.	**INSTALLATION DATE(S):** 7/9/24



TYPE OF SURFACE SEAL:	CONCRETE
TYPE OF BACKFILL:	GROUT
BOREHOLE DIAMETER:	±8"
I.D. OF RISER PIPE:	2.0"
TYPE OF RISER PIPE:	PVC
DEPTH OF SEAL:	1.4'
TYPE OF SEAL:	BENTONITE CHIPS
DEPTH OF SAND PACK:	3.4'
DEPTH OF TOP OF SCREEN:	5.2'
TYPE OF SCREEN:	PVC
SLOT SIZE X LENGTH:	.010"x5'
I.D. OF SCREEN:	2.0"
TYPE OF SAND PACK:	'0' FILTER SAND
DEPTH BOTTOM OF SCREEN:	10.2'
DEPTH BOTTOM OF SAND PACK:	10.4'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	N/A
ELEVATION/ DEPTH OF HOLE:	10.4'

DATE:
START 7/3/2024
FINISH 7/3/2024
SHEET 1 OF 1

Atlantic Testing Laboratories, Limited

Subsurface Log

HOLE NO. B-7
SURF. ELEV 669.4'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	6	9			TOPSOIL	Driller noted approximately 12" of Topsoil at the surface
		13	12		22	Brown-Grey CLAY & SILT; trace f Gravel; trace cmf Sand; trace Organics (grass, roots) (moist, medium plasticity) FILL	
	2	7	8				
		9	10		17		
5	3	8	11			Similar Soils; little cf Gravel; trace Debris (slag); no grass	
		14	21		25		
	4	15	21			Brown CLAY & SILT; and cmf Sand; trace f Gravel (moist, medium plasticity)	
		23	25		45		
	5	6	18			Similar Soils	
10		32	33		50	Brown SILT & CLAY; and cmf Sand; trace f Gravel (moist, low plasticity)	
	6	18	34				REF = Sample Spoon Refusal
		50/0.3			REF	Similar Soils; little f Gravel	
	7	32	50/0.2		REF	Similar Soils; trace f Gravel	
						Boring Complete at 13.5' with Auger Refusal	No Free Standing Water encountered at boring completion
15							
20							
25							
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, SR.

DRILL RIG TYPE : CME 550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 7/23/2024
FINISH 7/24/2024
SHEET 1 OF 2

Atlantic Testing Laboratories, Limited
Subsurface Log

HOLE NO. B-8
SURF. ELEV 670.0'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	X	3			ASPHALT	Driller noted approximately 3" of Asphalt at the surface
		3	2		5	Brown CLAY & SILT; little f Gravel; little cmf Sand; trace Organics (roots) (moist, medium plasticity) FILL	
	2	4	4				
		3	3		7	Brown cf GRAVEL; some Clay & Silt; trace cmf Sand (moist, slight plasticity) FILL	
5	3	3	3				
		5	7		8	Brown SILT & CLAY; and cmf Sand; trace f Gravel (moist, low plasticity)	
	4	4	7				REF = Sample Spoon Refusal
		6	9		13	Similar Soils	
	5	6	9			Brown Clayey SILT; and cmf Sand; little f Gravel (moist, slight plasticity)	NQ '2' Size Rock Core
10		16	25		25		
	6	17	42			Similar Soils	
		50/0.2			REF		
						Gray LIMESTONE Rock; hard to very hard; sound; thinnly bedded to thickly bedded; some fractures; contain chert	Run #1: 13.0' - 15.0' REC = 98% RQD = 90%
15							
						Similar Rock; laminated to thickly bedded	Run #2: 15.0' - 20.0' REC = 98% RQD = 95%
20							
						Similar Rock; thickly bedded to massively bedded	Run #3: 20.0' - 25.0' REC = 99% RQD = 99%
25							
						Similar Rock	Run #4: 25.0' - 30.0' REC = 93% RQD = 93%
30							
						Similar Rock	Run #5: 35.0' - 40.0' REC = 98% RQD = 98%
35							
						Similar Rock; thinnly bedded to massively bedded	Run #6: 40.0' - 45.0' REC = 98% RQD = 92%
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, JR.

DRILL RIG TYPE : CME 55LC

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE
START 7/23/2024
FINISH 7/24/2024
SHEET 2 OF 2

Atlantic Testing Laboratories, Limited

Subsurface Log

HOLE NO. B-8
SURF. ELEV 670.0'
G.W. DEPTH See Notes

PROJECT: PROPOSED EDISON MARTHA OLS
PROJ. NO.: BD162
LOCATION: EDISON AVENUE
BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40						Similar Rock	Run #7: 40.0' - 45.0' REC = 99% RQD = 90%
45						Similar Rock	Run #8: 45.0' - 50.0' REC = 98% RQD = 92%
50						Similar Rock; massively bedded	Run #9: 50.0' - 55.0' REC = 95% RQD = 95%
55						Similar Rock; thickly bedded to massively bedded	Run #10: 55.0' - 60.0' REC = 100% RQD = 100%
60						Boring Complete at 60.0'	No Free Standing Water recorded at completion of overburden drilling Free Standing Water recorded at 10' after coring
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ, JR.

DRILL RIG TYPE : CME-55LC

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

APPENDIX E

LABORATORY TEST RESULTS

ATLANTIC TESTING LABORATORIES

WBE certified company

PROJECT INFORMATION

Client: TY Lin - Greeley Hansen Water Solutions
Project: Buffalo Sewer Authority - Edison Martha OLS

ATL Report No.: BD162SL-01-09-24
Report Date: September 6, 2024
Date Received: August 12, 2024

UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
ASTM D 7012, Method C

Core ID	Depth (ft)	Diameter (in)	Length (in)	Load Rate (lbs/sec)	Total Load (lbs)	Area (in^2)	Compressive Strength (psi)	Calculated Density (pcf)
B-5	15.2 - 16.0	1.98	4.57	400	43720	3.08	14,200	165.5
B-5	22.1 - 22.6	1.98	4.53	400	40230	3.08	13,070	165.3
B-5	34.7 - 35.2	1.98	4.54	400	50430	3.08	16,380	167.3
B-5	42.3 - 43.0	1.98	4.59	400	47110	3.08	15,300	166.1
B-8	13.2 - 13.8	1.99	4.56	400	53270	3.11	17,130	163.3
B-8	26.0 - 26.9	1.98	4.55	400	54070	3.08	17,560	165.0
B-8	40.5 - 41.0	1.99	4.53	400	56020	3.11	18,010	167.4
B-8	55.3 - 56.1	1.99	4.56	400	43500	3.11	13,990	168.1

Reviewed By: _____ Date: 9/6/2024

ATLANTIC TESTING LABORATORIES

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LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS

ASTM D 2216

PROJECT INFORMATION

Client:	TY Lin - Greeley & Hansen Water Solutions	**ATL Report No.:**	BD165SL-01-09-24
Project:	Buffalo Sewer Authority - Edison Martha OLS	**Report Date:**	September 6, 2024
		Date Received:	August 12, 2024

TEST DATA

Boring No.	Sample No.	Depth (ft)	Moisture Content (%)
B-1	S-2&3 [1]	2-6	13.5
B-3	S-3,4&5 [1]	4-8.3	6.2
B-4	S-2	2-4	16.0
B-5	S-2&3 [1]	2-6	14.6
B-5	S-4 [1]	6-8	6.6
B-5	S-5 [1]	8-9.4	6.3
B-6	S-3&4 [1]	4-8	16.7
B-6	S-5 [1]	8-9.9	7.2
B-7	S-3&4 [1]	4-8	18.4
B-7	S-5&6 [1]	8-11.3	8.6
B-8	S-3&4 [1]	4-8	11.7
B-8	S-5&6 [1]	8-11.2	6.6

REMARKS

1 The drying temperature was 110°C ±5°C.

2 No material was excluded from the test sample.

Reviewed By: _____ Date: 9/6/2024

ATLANTIC TESTING LABORATORIES

WBE certified company

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOIL
ASTM D 4318

PROJECT INFORMATION

Client: TY Lin - Greeley & Hansen Water Solutions
Project: Buffalo Sewer Authority - Edison Martha OLS

ATL Report No.: BD165SL-01-09-24
Report Date: September 9, 2024
Date Received: August 12, 2024

TEST DATA

Boring No.	Sample No.	LL	PL	PI
B-5	S-2 &S-3	32	16	16
B-6	S-3 & S-4	31	16	15
B-7	S-3 & S-4	33	16	17
B-8	S-5 & S-6	14	11	3

SAMPLE INFORMATION

Boring No.	Sample No.	Maximum Grain Size (mm)	Estimated Amount of Sample Retained on No. 40 Sieve (%)	As Received Moisture Content (%)
B-5	S-2 &S-3	12.5	15	14.6
B-6	S-3 & S-4	9.5	5	16.7
B-7	S-3 & S-4	9.5	16	18.4
B-8	S-5 & S-6	12.5	40	6.6

PREPARATION INFORMATION

Boring No.	Sample No.	Preparation	Method of Removing Oversized Material
B-5	S-2 &S-3	Air Dry	Pulverizing and Screening
B-6	S-3 & S-4	Air Dry	Pulverizing and Screening
B-7	S-3 & S-4	Air Dry	Pulverizing and Screening
B-8	S-5 & S-6	Air Dry	Pulverizing and Screening

EQUIPMENT INFORMATION

Liquid Limit Procedure:	Multipoint - Method A	X	Single Point - Method B	
Liquid Limit Apparatus:	Manual	X	Motor Driven	
Liquid Limit Grooving Tool Material:	Plastic		Metal	X
Liquid Limit Grooving Tool Shape:	Flat	X	Curved (AASHTO Only)	
Plastic Limit:	Hand Rolled	X	Mechanical Rolling Device	

REMARKS

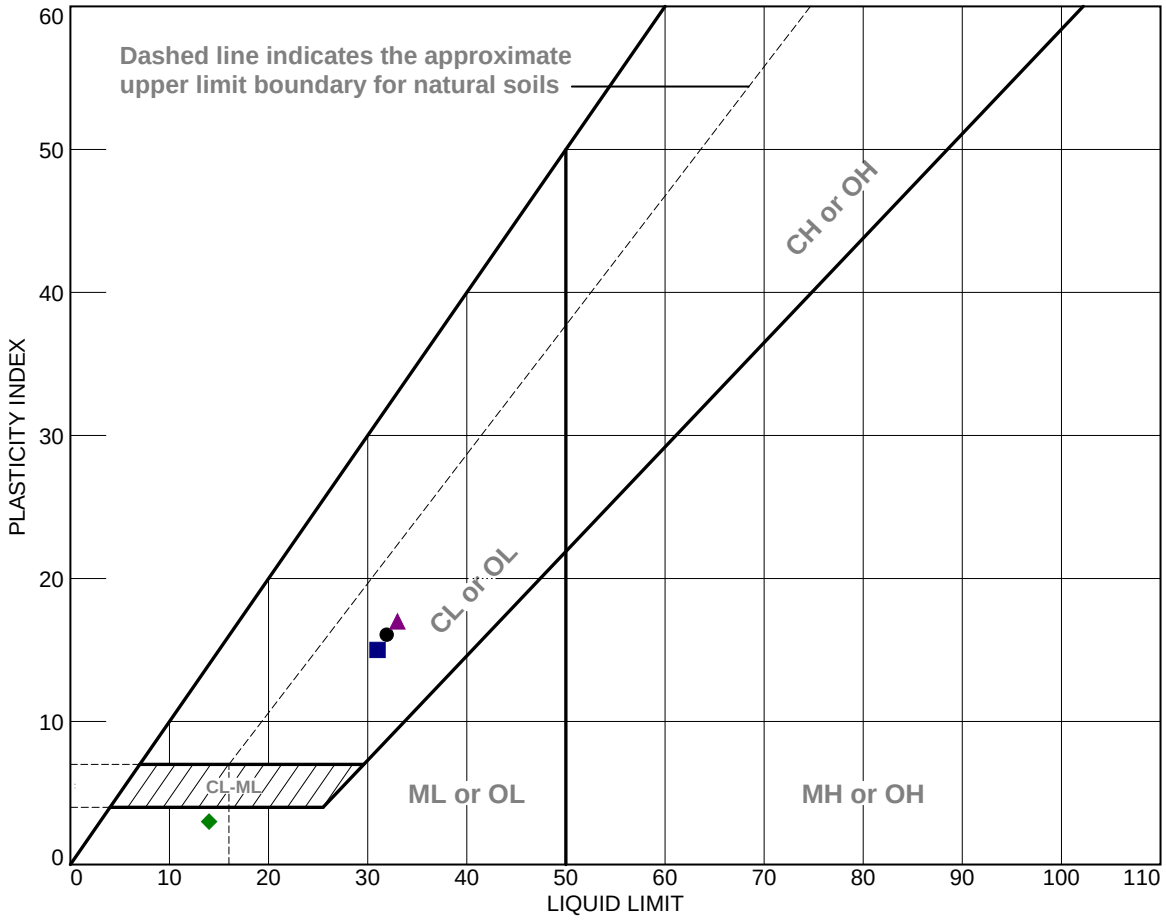
1 The drying temperature was 110° ± 5° C

Reviewed By: _____ Date: 9/9/2024

ATLANTIC TESTING LABORATORIES

WBE certified company

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-5	S-2 & S-3	2.0'-6.0'	14.6	16	32	16	
■	B-6	S-3 & S-4	4.0'-8.0'	16.7	16	31	15	
▲	B-7	S-3 & S-4	4.0'-8.0'	18.4	16	33	17	
◆	B-8	S-5 & S-6	8.0'-11.2'	6.6	11	14	3	

ATLANTIC TESTING LABORATORIES, LIMITED
Buffalo, New York

Client: TY Lin - Greeley & Hansen Water Solutions
Project: Buffalo Sewer Authority - Edison Martha OLS

Project No.: BD-162 **Figure**

ATLANTIC TESTING LABORATORIES

WBE certified company

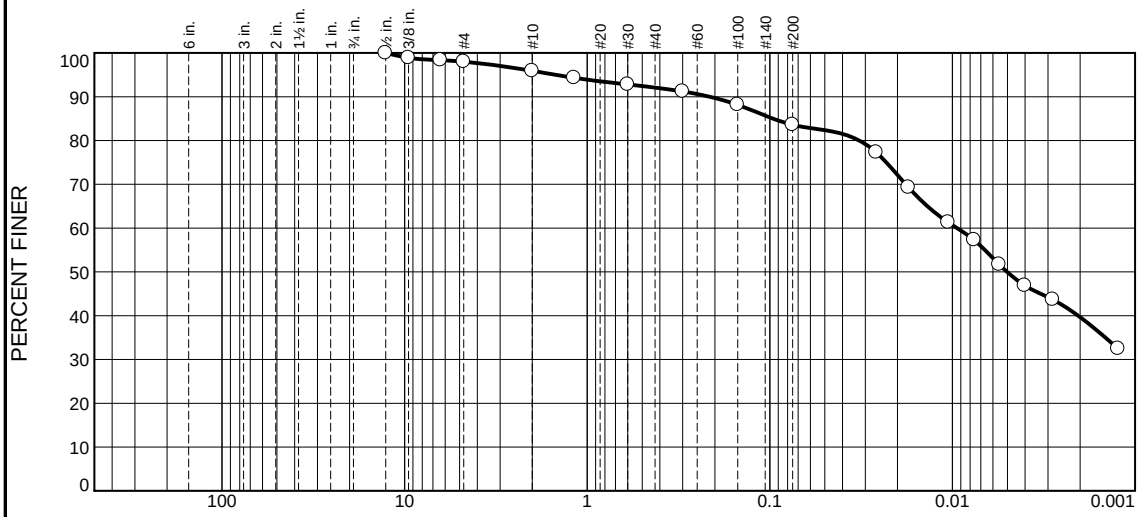
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-26-24

Sample No: S-2 & S-3 **Source of Sample:** B-1

Location: in-place **Elev./Depth:** 2.0'-6.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.0	2.1	3.8	8.5	33.7	49.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.5	100.0		
.375	98.9		
.25	98.4		
#4	98.0		
#10	95.9		
#16	94.3		
#30	92.8		
#50	91.2		
#100	88.2		
#200	83.6		

* (no specification provided)

Soil Description

Brown CLAY & SILT;little cmf Sand;trace f Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0960 D_{60}= 0.0094 D_{50}= 0.0050

D_{30}= D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 13.5 %

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

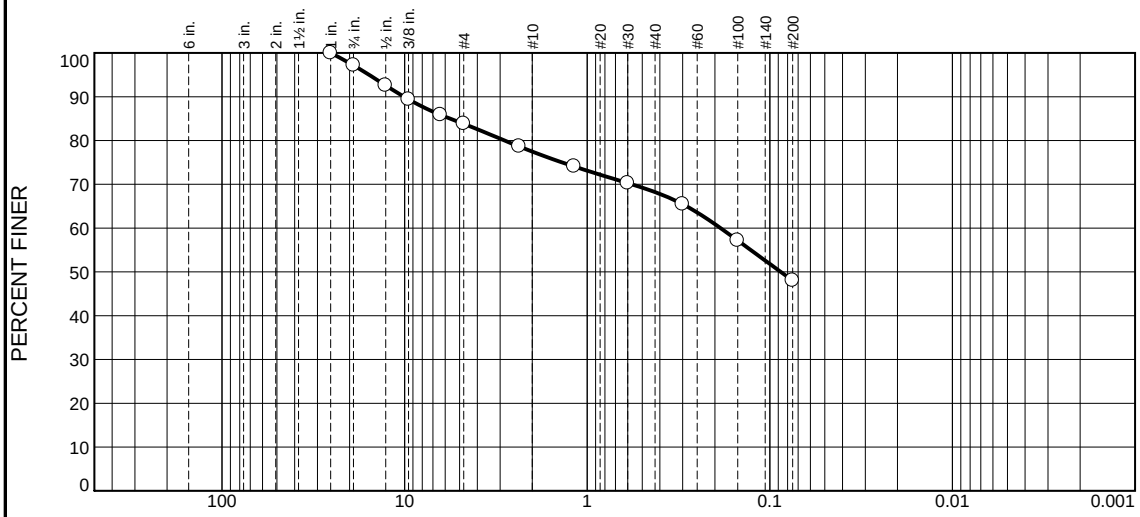
WBE certified company

Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-23-24

Sample No: S-3,S-4 & S-5 **Source of Sample:** B-3
Location: in-place **Elev./Depth:** 4.0'-8.3'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.8	13.4	6.3	9.3	20.2	48.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1	100.0		
.75	97.2		
.5	92.6		
.375	89.4		
.25	85.8		
#4	83.8		
#8	78.6		
#16	74.1		
#30	70.3		
#50	65.5		
#100	57.2		
#200	48.0		

Soil Description

Brown SILT & CLAY;some cmf Sand;little f Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 5.6435 D_{60}= 0.1861 D_{50}= 0.0872
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 6.2 %

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

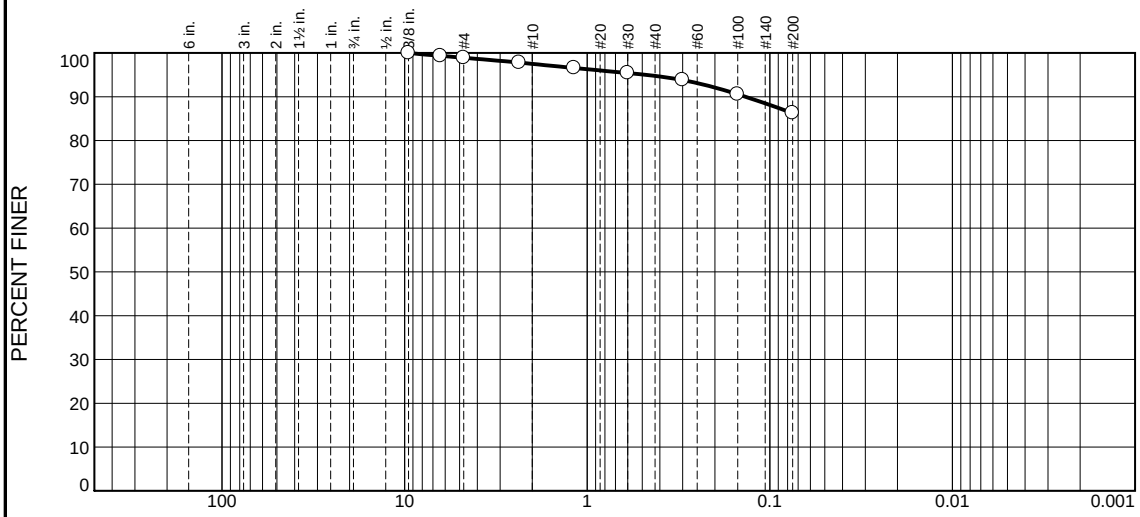
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-23-24

Sample No: S-2 **Source of Sample:** B-4

Location: in-place **Elev./Depth:** 2.0'-4.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	1.4	2.7	8.5	86.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.375	100.0		
.25	99.3		
#4	98.9		
#8	97.8		
#16	96.6		
#30	95.4		
#50	93.8		
#100	90.6		
#200	86.3		

* (no specification provided)

Soil Description

Brown CLAY & SILT;little cmf Sand;trace f Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 16.0 %

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

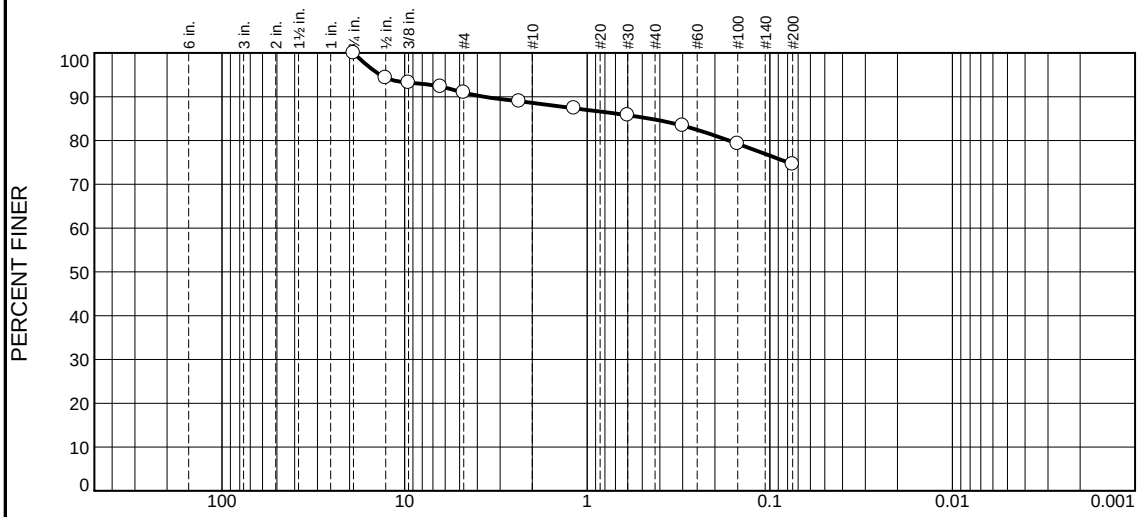
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-22-24

Sample No: S-2 & S-3 **Source of Sample:** B-5

Location: in-place **Elev./Depth:** 2.0'-6.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.1	2.3	3.8	10.2	74.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.75	100.0		
.5	94.3		
.375	93.2		
.25	92.3		
#4	90.9		
#8	89.0		
#16	87.4		
#30	85.8		
#50	83.4		
#100	79.3		
#200	74.6		

* (no specification provided)

Soil Description

Brown CLAY & SILT;little cmf Sand;trace f Gravel

Atterberg Limits

PL= 16 LL= 32 PI= 16

Coefficients

D_{85}= 0.4544 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 14.6 %

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

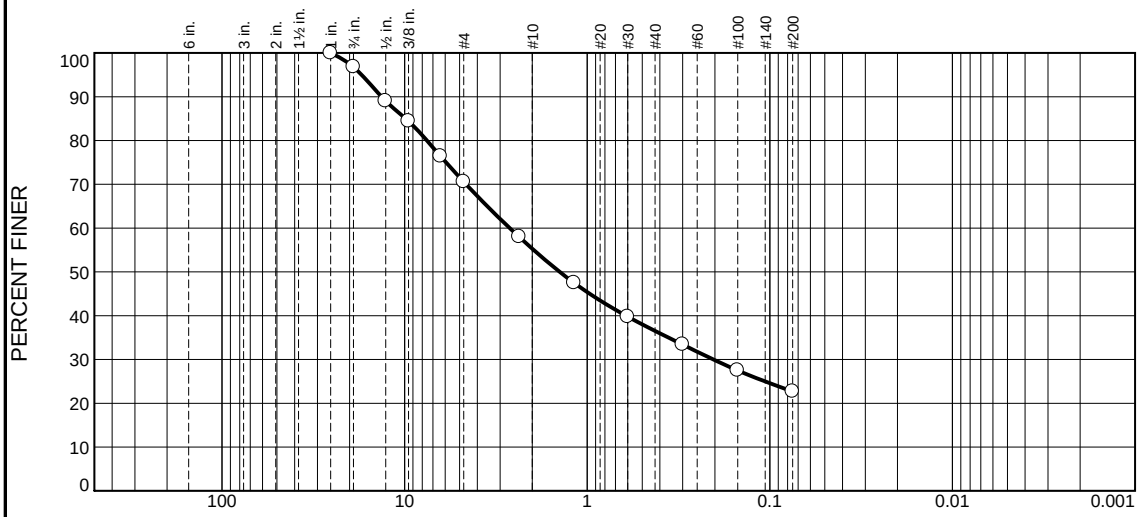
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-22-24

Sample No: S-4 **Source of Sample:** B-5

Location: in-place **Elev./Depth:** 6.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.2	26.2	15.3	18.8	13.8	22.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1	100.0		
.75	96.8		
.5	89.0		
.375	84.4		
.25	76.4		
#4	70.6		
#8	58.0		
#16	47.5		
#30	39.8		
#50	33.4		
#100	27.5		
#200	22.7		

Soil Description

Brown cmf SAND;some cf Gravel;some Silt & Clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 9.8690 D_{60}= 2.6558 D_{50}= 1.4141

D_{30}= 0.2038 D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 6.6 %

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

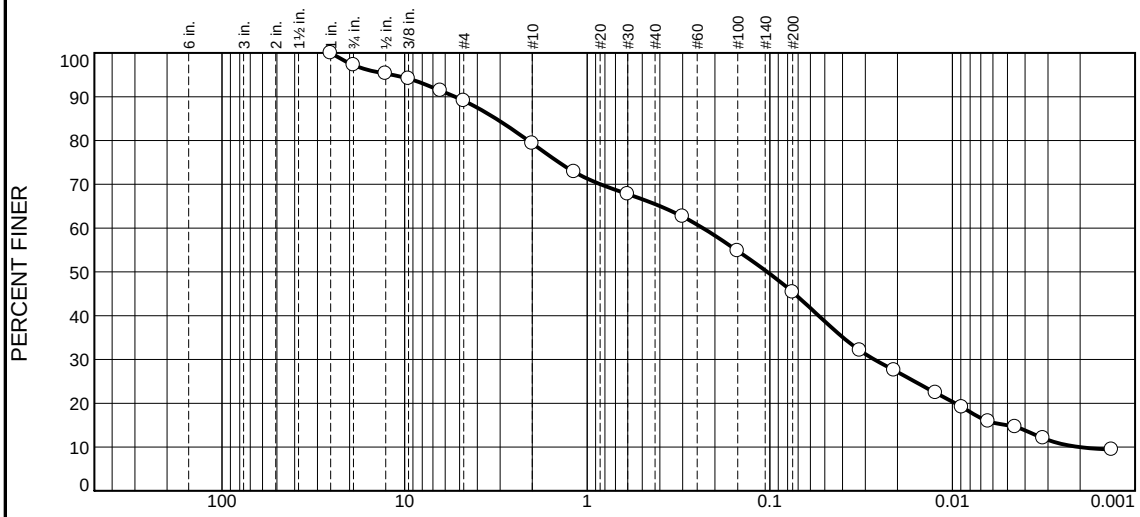
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-26-24

Sample No: S-5 **Source of Sample:** B-5

Location: in-place **Elev./Depth:** 8.0'-9.4'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.8	8.1	9.8	13.8	20.1	30.4	15.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1	100.0		
.75	97.2		
.5	95.3		
.375	94.1		
.25	91.4		
#4	89.1		
#10	79.3		
#16	72.8		
#30	67.8		
#50	62.6		
#100	54.8		
#200	45.4		

* (no specification provided)

Soil Description

Brown SILT & CLAY;and cmf Sand;little cf Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 3.1629 D_{60}= 0.2324 D_{50}= 0.1033

D_{30}= 0.0268 D_{15}= 0.0050 D_{10}= 0.0020

C_u= 114.44 C_c= 1.52

Classification

USCS= AASHTO=

Remarks

moisture content= 6.3 %

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

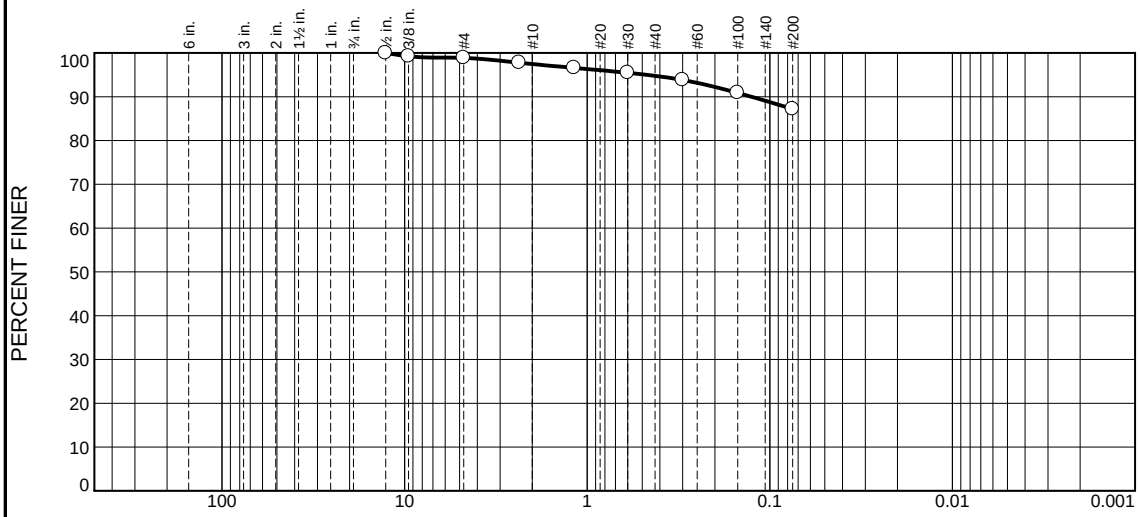
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-22-24

Sample No: S-3 & S-4 **Source of Sample:** B-6

Location: in-place **Elev./Depth:** 4.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.1	1.4	2.7	7.6	87.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.5	100.0		
.375	99.2		
#4	98.9		
#8	97.8		
#16	96.6		
#30	95.5		
#50	93.8		
#100	90.9		
#200	87.2		

* (no specification provided)

Soil Description

Brown CLAY & SILT;litle cmf Sand;trace f Gravel

Atterberg Limits

PL= 16 LL= 31 PI= 15

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 16.7 %

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

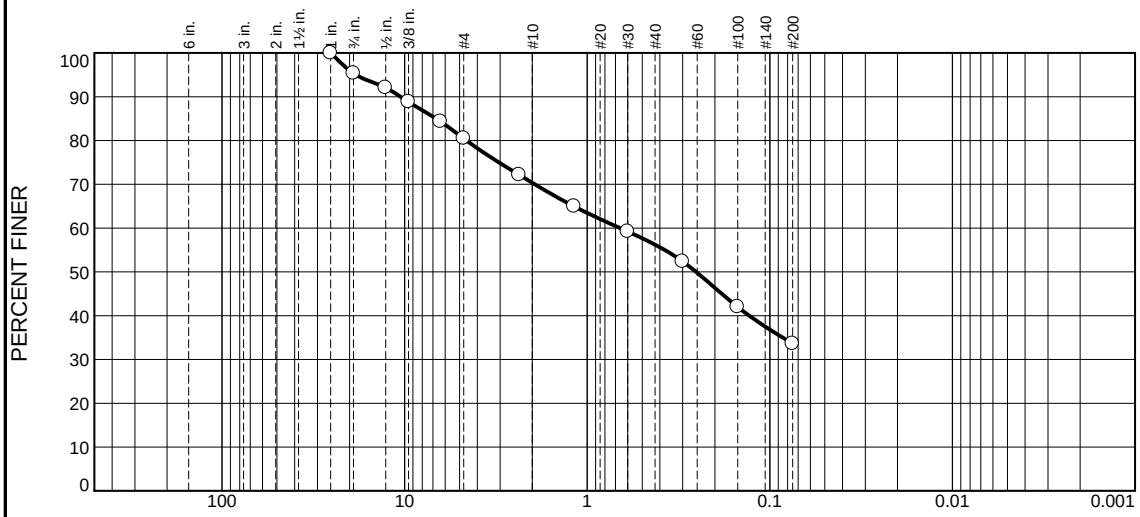
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-22-24

Sample No: S-5 **Source of Sample:** B-6

Location: in-place **Elev./Depth:** 8.0'-9.9'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.7	14.8	10.1	14.2	22.6	33.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1	100.0		
.75	95.3		
.5	92.1		
.375	88.8		
.25	84.3		
#4	80.5		
#8	72.2		
#16	65.0		
#30	59.2		
#50	52.4		
#100	42.0		
#200	33.6		

Soil Description

Brown cmf SAND;some SILT & CLAY;little cf Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 6.7161 D_{60}= 0.6614 D_{50}= 0.2534

D_{30}= D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 7.2 %

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

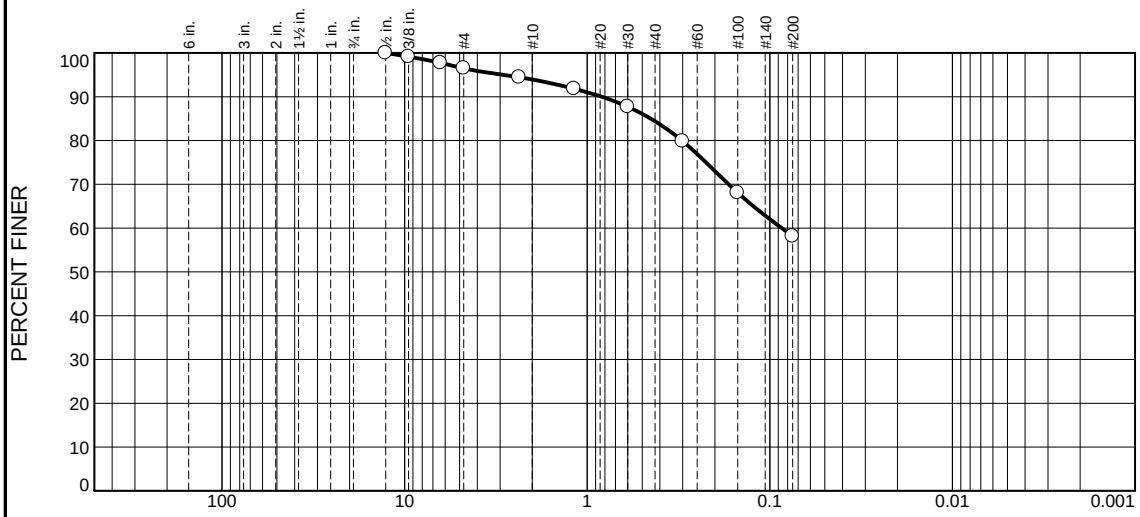
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-22-24

Sample No: S-3 & S-4 **Source of Sample:** B-7

Location: in-place **Elev./Depth:** 4.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.5	2.6	9.5	26.2	58.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.5	100.0		
.375	99.2		
.25	97.7		
#4	96.5		
#8	94.5		
#16	91.8		
#30	87.7		
#50	79.8		
#100	68.1		
#200	58.2		

Soil Description

Brown CLAY & SILT;and cmf Sand;trace f Gravel

Atterberg Limits

PL= 16 LL= 33 PI= 17

Coefficients

D_{85}= 0.4489 D_{60}= 0.0861 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 18.4 %

* (no specification provided)

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

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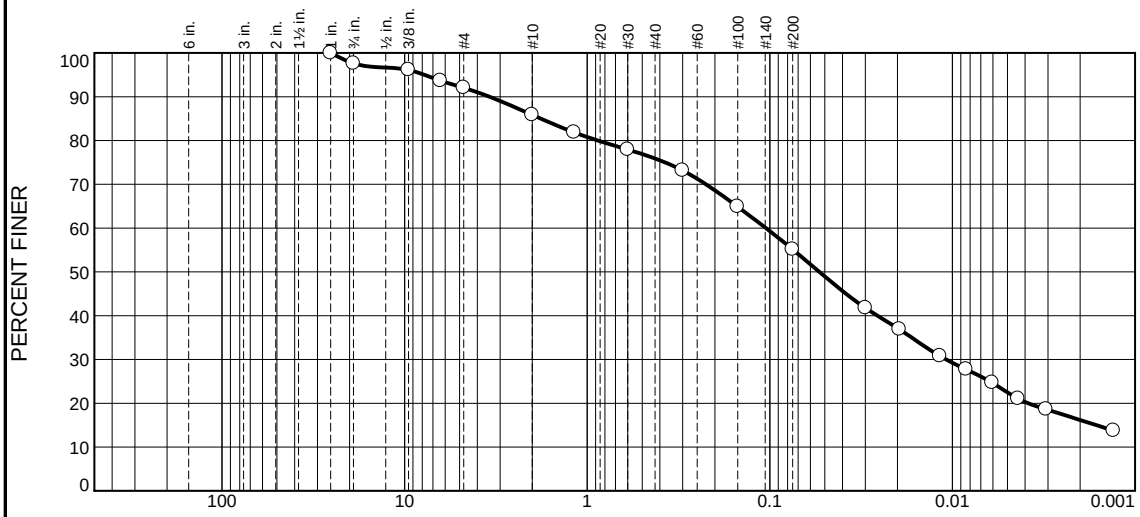
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-26-24

Sample No: S-5 & S-6 **Source of Sample:** B-7

Location: in-place **Elev./Depth:** 8.0'-11.3'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.4	5.5	6.2	10.0	20.8	32.6	22.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
1	100.0		
.75	97.6		
.375	96.1		
.25	93.7		
#4	92.1		
#10	85.9		
#16	81.9		
#30	77.9		
#50	73.2		
#100	64.9		
#200	55.1		

* (no specification provided)

Soil Description

Brown SILT & CLAY;and cmf Sand;trace cf Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.7948 D_{60}= 0.1050 D_{50}= 0.0536

D_{30}= 0.0108 D_{15}= 0.0016 D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 8.6 %

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

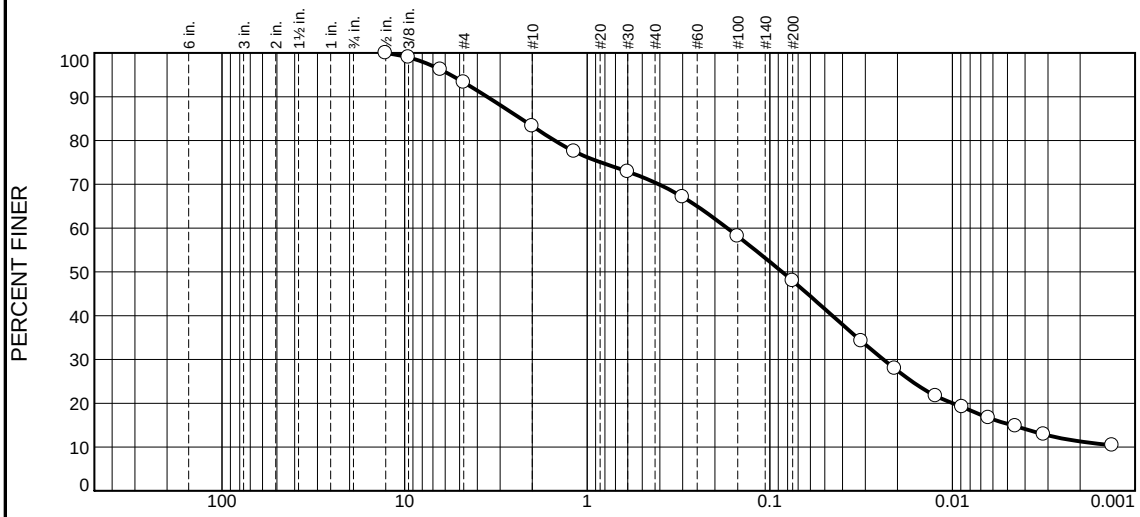
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-26-24

Sample No: S-3 & S-4 **Source of Sample:** B-8

Location: in-place **Elev./Depth:** 4.0'-8.0'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.7	10.0	12.9	22.4	32.7	15.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.5	100.0		
.375	99.0		
.25	96.2		
#4	93.3		
#10	83.3		
#16	77.5		
#30	72.9		
#50	67.1		
#100	58.1		
#200	48.0		

* (no specification provided)

Soil Description

Brown cmf SAND;and Silt & Clay;trace f Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 2.3084 D_{60}= 0.1712 D_{50}= 0.0857

D_{30}= 0.0239 D_{15}= 0.0047 D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 11.7 %

Figure

ATLANTIC TESTING LABORATORIES, LIMITED

Reviewed by: P.Gregorczyk Date: 9-9-24

ATLANTIC TESTING LABORATORIES

WBE certified company

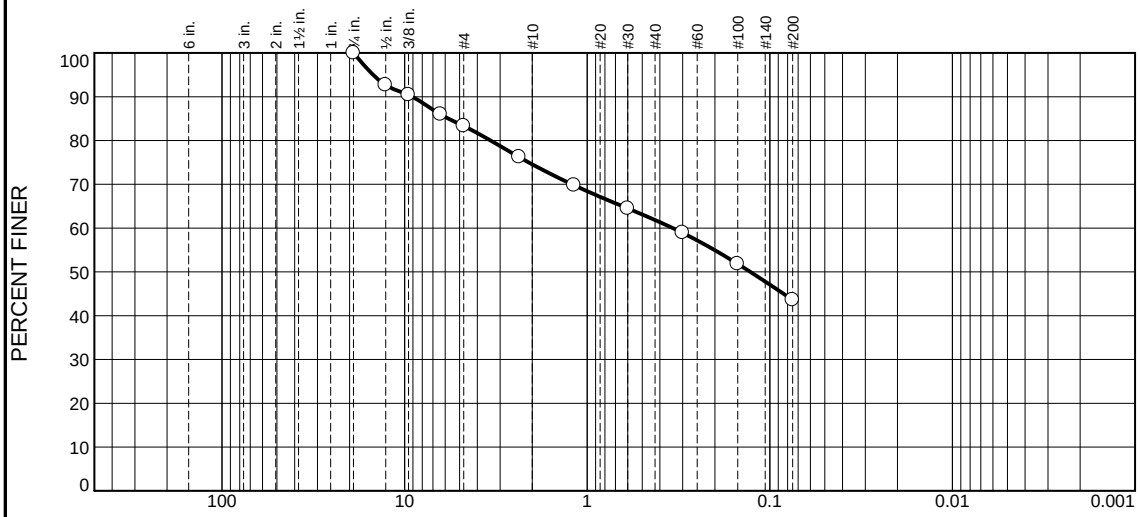
Particle Size Distribution Report

Project: Buffalo Sewer Authority - Edison Martha OLS **Report No.:** BD162SL-01-09-24

Client: TY Lin - Greeley & Hansen Water Solutions **Date:** 8-22-24

Sample No: S-5 & S-6 **Source of Sample:** B-8

Location: in-place **Elev./Depth:** 8.0'-11.2'



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.7	8.7	12.8	18.2	43.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	OUT OF SPEC. (X)
.75	100.0		
.5	92.7		
.375	90.4		
.25	86.0		
#4	83.3		
#8	76.2		
#16	69.8		
#30	64.5		
#50	58.9		
#100	51.8		
#200	43.6		

* (no specification provided)

Soil Description

Brown CLAYEY SILT;and cmf Sand;little f Gravel

Atterberg Limits

PL= 11 LL= 14 PI= 3

Coefficients

D_{85}= 5.7561 D_{60}= 0.3399 D_{50}= 0.1279

D_{30}= D_{15}= D_{10}=

C_u= C_c=

Classification

USCS= AASHTO=

Remarks

moisture content = 6.6 %

Figure

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Reviewed by: P.Gregorczyk Date: 9-9-24