Preliminary Geotechnical Engineering Report
RLI Project
Hartford/Windsor, CT

Riverfront Recapture Inc.
Hartford, Connecticut

October 2020

FUSS & O'NEILL

146 Hartford Road
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Project No. 20170277A30

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Executive Summary

A preliminary geotechnical engineering report has been completed for the proposed Deckers Brook stream crossing and multi-use trail within the RLI Project limits. Seven soil borings were advanced to depths ranging 17 to 45 feet below existing grade to provide geotechnical information.

Site subsurface conditions generally consist of approximately two feet of existing top soil underlain by banded layers of loose to medium dense fine grained lacustrine deposits overlying soft varved clay overlying glacial till and bedrock. The following geotechnical considerations for project design and construction were identified and are discussed in the report:

- The proposed Deckers Brook stream crossing is recommended to be supported on deep foundations to transfer the loads to the underlying bedrock. Based on the subsurface conditions, we consider driven H piles seated into bedrock to be the appropriate deep foundation option.

- If wingwalls are provided, they may be supported on conventional spread footings bearing on a minimum 12 inches of crushed stone, wrapped in a geotextile separation fabric, over the native soil.

- Groundwater was encountered at depths ranging from 12 to 15 feet from ground level.

- Temporary water cutoff and dewatering systems will likely be required to construct the stream crossing wingwalls and pile caps, if applicable.

- The proposed bituminous walkway is recommended to be supported on a compacted base and subbase course. The existing material onsite is susceptible to frost heave. In order to mitigate the potential for frost heave, it is recommended that the underlying silt be removed to frost depth and replaced with compacted, free draining material. In lieu of removing and replacing the existing subgrade soils, it may be more to accepted reduced pavement service life.

- Close monitoring of the construction operations discussed herein will be critical in achieving subgrade support. We therefore recommend that Fuss & O'Neill be retained to observe this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. Details are not included or fully developed in this summary; the report must be read in its entirety for a comprehensive understanding of the information contained herein. The contents of this report are subject to the attached limitations.

1 Introduction

1.1 Scope of Report

This preliminary geotechnical report presents the results of our geotechnical engineering services performed for the RLI Project to be located in Hartford/Windsor, Connecticut. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil and rock conditions
- Groundwater conditions
- Foundation design
- Lateral earth pressures
- Earthwork

The geotechnical engineering Scope of Services for this project included the advancement of seven test borings to depths ranging from approximately 15 to 45 feet below existing site grades.

Drawings depicting the site and exploration locations are shown in *Figure 1*. The boring logs from the current investigation are included in *Appendix C*.

1.2 Project Understanding

Item	Description
Structure	The proposed replacement structure for the stream crossing unknown. Based on the subsurface conditions, driven piles, achieving resistance through a combination of tip and friction are recommended.
Maximum Loads	Not provided at time of report.
Grading/Slopes	Expected to approximately match existing grades.

The RLI Project reportedly consists of an asphalt paved multi-use trail over an approximately 80 acre open field of state land adjacent to the Connecticut River.

1.3 Site Description

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

Item	Description
Location	The site is bordered by Deckers Brook to the north, Meadow Brook to the south, Meadow Road to the west, and the Connecticut River to the east.
Existing Conditions	Approximately 80 acre farm field with mowed paths and trees
Current Ground Cover	Gravel pathway, grass and brush
Existing Topography	The site is relatively flat at approximately El. 18 feet (aerial survey, 4/10/2016, by Robinson Aerial Surveys, Inc.)
Geology	Available surficial geological maps depict the soils in the vicinity of the site as consisting of bands of fine grained lacustrine deposits overlaying glacial till and bedrock consisting of shale, siltstone, sandstone, conglomerate, or basalt.

2 Subsurface Conditions

2.1 Description of Local Geology

The *USGS Surficial Materials Map of Connecticut (1992)* identifies the geology immediately adjacent to the site as a lacustrine deposit. The geology is composed of well-sorted, thin layers of alternating silt and Connecticut Valley Varved Clay, or thicker layers of very fine sand and silt. *USGS Bedrock Geology Hartford South Quadrangle (2012)* depicts bedrock in the vicinity of the site as black and gray shale, reddish-brown siltstone/sandstone, conglomerate and basalt. The soils and bedrock encountered in our explorations are consistent with this description.

2.2 Subsurface Exploration Program

Fuss & O'Neill subcontracted General Borings, Inc. of Prospect, Connecticut, to advance seven test borings at the site. Borings were performed on September 16 through September 18, 2020. The locations of the test borings are depicted on *Figure 1.* Boring locations were selected based on the proposed Deckers Brook crossing and trail extension.

Fuss & O'Neill personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet). Elevations were interpolated from base mapping obtained from an aerial survey (flight date 4/10/2016, by Robinson Aerial Surveys, Inc.). If a more precise boring layout and elevations are desired, we recommend that the boring locations be surveyed following completion of fieldwork.

Borings were advanced using an ATV rig. Test borings B(FO)-1 and B(FO)-2 were completed in the vicinity of the proposed stream crossing and advanced to a maximum depth of 45 feet below the existing ground surface. In general, four samples were obtained in the upper ten feet of each boring and at intervals of five feet thereafter. Test borings B(FO)-1 and B(FO)-2 used a combination of hollow stem augers, steel casing, and rotary wash to advance the boring. At B(FO)-1, roller bit refusal was encountered at 34 feet below ground surface. Two (2) five foot rock cores were completed from 35-45 feet. An NQ2-sized core barrel was used. At test boring B(FO)-2, a Shelby tube was advanced at a depth of 35 feet to collect an undisturbed clay sample. B(FO)-2 was terminated at 45 feet upon roller bit refusal on probable bedrock. B(FO)-3 through B(FO)-7 were advanced with hollow stem augers and terminated without refusal at 17 feet.

In the split-barrel sampling procedure, which was used to take soil samples in the test borings, the number of blows required to advance a standard 2-inch outer diameter split-barrel sampling spoon typically the middle 12 inches of the total 24-inch penetration by means of a 140-pound automatic hammer with a free fall of 30 inches is the Standard Penetration Test (SPT) resistance value "N". This "N" value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

Field logs of the borings were prepared by a Fuss & O'Neill field representative. These logs included visual classification of the materials encountered during the explorations as well as interpretations by our field representative of the subsurface conditions between samples. The soil samples were placed in labeled jars and the rock core in a wooden core box, and taken to our office for further review, possible testing, and classification. Information provided on the boring logs attached to this report includes soil/rock descriptions, relative density and/or consistency evaluations, boring depth, sampling intervals, and groundwater conditions. The borings were backfilled with soil cuttings

The soil/rock samples were examined by a geotechnical engineer. Based on the material's texture, we described and classified the soil samples in accordance with the modified Burmister and Unified Soil Classification Systems. Unified Soil Classification System (USCS) symbols are shown on the logs. Rock classification was conducted using rock core samples and locally accepted practices for engineering purposes.

2.3 Laboratory Testing

Laboratory testing was conducted to determine particle size, atterburg limits, moisture content and undrained shear strength. The results of the tests are included in *Appendix E* and summarized below. Particle size testing was completed in order to verify visual classifications during the subsurface evaluation. Moisture content and atterberg limits testing was completed for geotechnical analysis purposes. An undrained unconsolidated tri-axial test (UU-Test) was completed to determine the in-situ shear strength of cohesive soil.

Table 1
Particle Distribution Testing Summary (ASTM D6913)

Boring/Sample No./Depth	Material Type	Percent Passing Particle Size (%)		
		Gravel	Sand	Fines
B(FO)-2 S-2 , 2-4 ft	Lacustrine Deposit	0.0	12.5	87.5
B(FO)-1, S-9, 30-32 ft	Glacial Till	15.2	42.7	42.1
B(FO)-3 S-2, 0-2 ft	Lacustrine Deposit	0	15.0	85.0

Table 2
Atterberg Limits and Moisture Content Testing (ASTM D4318 & ASTM D2216)

Boring/Sample No./Depth	Material Type	Geotechnical Soil Property (%)		
		Water Content	Liquid Limit	Plastic Limit
B(FO)-1 S-8, 25-27 ft	Clay	47.9	48	25
B(FO)-2 S-9, 30-32 ft	Clay	52.3	54	24
B(FO)-5 S-3, 5-7 ft	Silt	35.1	NA	NA
B(FO)-7 S-6, 15-17 ft	Sand	18.2	NA	NA

Table 3
Unconsolidated Undrained Tri-axial Test (ASTM D2850)

Boring/Sample No./Depth	Material Type	UU-Test Parameters (psf)	
		Confining Pressure	Undrained Shear Strength
B(FO)-2 U-10 , 35-37 ft	Clay	9,403	2,293

2.4 Subsurface Profile

The soil encountered generally consisted of 30 feet of loose to medium dense, dry, fine grained lacustrine deposits. The materials ranged from silts, silty sands to poorly graded sands stratified in thin layers. Beneath the lacustrine deposits, a soft to very soft layer of Connecticut Valley Varved Clay was encountered to depths ranging from 30 to 37 feet. Beneath the clay deposit, glacial till was encountered from 30 to 40 feet.

Bedrock, classified as shale, was encountered beneath the glacial till deposit at depths of approximately 34 to 45 feet below existing grade in B(FO)-1 and B(FO)-2, respectively. B(FO)-2 terminated with spoon and roller bit refusal at a depth of 45 feet below ground surface. At B(FO)-1, bedrock was encountered at 34 feet below ground surface. Two rock cores were obtained utilizing an NQ sized core barrel. The rock quality descriptions at their corresponding depths are summarized below:

Boring No.	Core Depth (feet)	RQD Value (percent)	RQD Description
B(FO)-1	35-40	59	Fair
B(FO)-1	40-45	56	Fair

Conditions encountered at each exploration location are indicated on the individual exploration logs. Stratification boundaries on the exploration logs represent the approximate location of changes in soil/rock types; *in situ*, the transition between materials may be gradual. Further details of the explorations can be found on the exploration logs.

Drilling mud was used as drilling fluid to advance the tricone roller bit and core barrel in the explorations. Ground water was encountered at a depth of 12 to 15 feet. Ground water levels may not be accurate due to use of drilling mud. No observation wells were installed as part of our field exploration.

2.5 Previous Subsurface Investigations

On August 17, 2020 an environmental subsurface investigation was completed by Fuss & O'Neill personnel using a truck mounted drilling rig and shovel to obtain grab samples. The previous subsurface investigation boring logs are included in *Appendix D*. The boring logs indicate medium to fine sands, silts and traces of clay ranging from 4 to 8 feet in depth. Fuss & O'Neill has completed other subsurface programs within the property limits, however the data is not pertinent to the RLI Project.

3 Foundation Recommendations

Due to the presence of the loose sands and compressible clays, and unknown potential for scour, we recommend that the proposed stream crossing be supported on deep foundations design to bear on bedrock. Based on the presence of loose sands and soft clays, we consider driven H piles to be an economical deep foundation option.

3.1 Deep Foundations

The proposed stream crossing may be supported on deep foundations to provide adequate transfer of the proposed structure to the underlying soil and to support in the event of scour from the stream. The overburden soil is generally loose to medium dense sands and silts and soft to very soft varved clays. Bedrock was encountered at a depth of approximately 34 feet at B(FO)-1 and 45 feet at B(FO)-2, respectively. Obstructions or boulders were not encountered. Driven steel H-piles are considered a feasible option to support the proposed stream crossing. Driven H-pile foundations do not require deep soil excavation and backfilling. The installation does not generate soil spoils. Surface water control, excavation, and controlled backfill is recommended during installation of the pile cap.

3.1.1 Pile Design Recommendations

Driven piles foundations should be designed to develop the required load carrying capacity from end bearing in the bedrock, which was encountered at a depth of up to 34 to 45 feet below ground surface. Estimated axial capacities are provided in the table below.

Pile Type	HP 14 x 117	
	Ultimate Axial Capacity (kips)	Factored Capacity (kips)
Total Axial (downward)	50	25
Tip Resistance (downward)	11	Not evaluated
Side Resistance (downward)	40	Not evaluated

Notes:

1. Capacities do not consider group effects. Piles should be spaced 2.5 diameters apart.
2. Pile capacity was calculated utilizing AllPile software by CivilTech Software. The calculation is based on a static analysis procedures described in the in the Foundations & Earth Structures, Design Manual 7.02, published by Department of Navy, Naval Facilities Engineering Command. This method considered a combination of tip and side resistance for the downward ultimate bearing capacity.
3. Skin friction was not considered in the top 42 inches of the piles.
4. Lateral pile resistance was not evaluated.
5. The structural resistance of the proposed pile cross section under axial loading should be verified.
6. A safety factor of 2 was applied for end bearing and skin friction.
7. Skin friction was limited to 200 psf, which is equivalent to the estimated effective vertical stress at a depth of 20 pile diameters.

Load testing of piles will be required in accordance with the AASHTO specifications. An initial verification load test on a sacrificial pile is recommended prior to installing production piles. The allowable pile capacity should be determined by analyzing the verification test data in consideration of AASHTO Section 10.7.3.8.2. In addition, at least one pile per abutment or five percent of the total number of piles, whichever is greater, should be proof tested. All testing should be conducted in accordance with ASTM D3689-07 (tension) or ASTM D1143 (compression). Test piles should be instrumented in a manner that allows analysis to determine that at least 100 percent of the design load is carried in the bearing stratum.

3.1.2 Pile Construction Considerations

Prior to driving any pile, the Contractor should submit a Wave Equation Analyses for Piles (WEAP), prepared and stamped by a Connecticut Registered Professional Engineer. The WEAP should take into account the proposed hammer assembly, pile cap blocks and cushion characteristics, the pile properties and estimated lengths, and the anticipated soil properties. The Contractor should submit a separate WEAP for each specific model and energy of pile hammer proposed for use on the project. The WEAP should demonstrate that the piles will not be damaged during driving and should determine the safe level of energy transmission to the pile and indicate the blow count necessary to achieve the required ultimate static pile capacities.

3.2 Shallow Foundations

3.2.1 Shallow Foundation Design Recommendations

The proposed wingwalls may be supported on shallow spread footings bearing on a minimum 12 inches of crushed stone, wrapped in geotextile separation fabric (Mirafi 140N or equivalent), placed over the native soil. The recommended net allowable bearing pressure for the proposed wing walls is 1,500 psf, This recommendation is based on the presumptive load-bearing values provided in Table 1806.2 in the International Building Code for silt, sandy silt, and clay, consistent with the soil type encountered in the vicinity of the proposed stream crossing.

Strip footings should be no smaller than 20 inches in width. For frost protection, place exterior footings areas at least 3.5 feet below grade.

3.2.2 Shallow Foundation Construction Considerations

The base of foundation excavations should be free of water and loose soil before placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become wet, disturbed, or frozen, the affected soil should be removed prior to placing concrete. The geotechnical engineer should be retained to observe the condition of the foundation bearing materials and a third-party testing agency be retained to test these materials.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear on properly seated crushed stone wrapped in geotextile separation fabric (Mirafi 140N or equivalent) extending down to the suitable soils, or on lean concrete backfill placed in the excavations. Overexcavation for crushed stone placement below footings should extend laterally beyond all edges of the footings at least 12 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with crushed stone placed in lifts of 8 inches or less in loose thickness and seated with a minimum four passes with a vibratory plate compactor.

Based on the nature of the project, water level at the time of construction may be above foundation level. We expect construction of the stream crossing will require temporary cofferdams used to provide dry conditions for construction. Temporary dewatering will be required inside the cofferdams to allow for subgrade preparation and placement of the footings. Crushed stone should be wrapped in geotextile separation fabric to reduce the likelihood of migration of fines. The contractor should be required to maintain a stable subgrade during construction. The contractor should prevent groundwater and surface water runoff from collecting in the excavation. Subgrade soils that become unstable because of water and/or reworking by construction activity should be replaced with wrapped and seated crushed stone, as necessary.

The predominant soil type at the anticipated subgrade levels will be the silt, sandy, silt, and clay, portions of which may have an elevated silt content, or bedrock. Soils with a higher silt content will be sensitive to excess moisture and lose strength quickly during wet periods. Contractors experienced in earthwork construction in New England should be aware of the silty soil behavior and the effect that moisture and inclement weather can have on workability. If a contractor bids construction knowing that earthwork must begin during the winter or wet months, the contractor should include a contingency in his bid to use off-site suitable fill, and to remove and dispose of on-site soils that become unsuitable.

4 Lateral Earth Pressures

Retaining walls should be designed to resist the superimposed effects of the total lateral soil pressures, including the effects of surcharges. The magnitude of lateral earth pressure against retaining walls is dependent upon the type of backfill, method of fill placement, drainage provisions, and the amount of yielding the wall is permitted to undergo after the placement of the backfill. Fuss & O'Neill recommends that the retaining walls be backfilled with a free draining "Granular Fill", as defined herein.

Structural walls located below grade are expected to be relatively rigid and non-yielding. Fuss & O'Neill recommends at-rest lateral earth pressures for design. For flexible structures, active and/or passive lateral earth pressures are recommended. However, each wall should be checked during design to determine if wall movement relative to the height, H, of the wall, is such that at-rest, active, or passive lateral earth pressures are more appropriate. The amount of wall rotation necessary to develop the active pressure state (i.e., wall rotates away from backfill) is about 0.001H to 0.004H. The amount of wall rotation to develop the passive pressure state (i.e., wall rotates toward backfill) is about 0.005H to 0.01H.

The lateral earth pressure distribution against retaining walls should be computed using the appropriate value of K, the coefficient of lateral earth pressure. Recommended values of K are presented in the table below and assume an internal soil friction angle (ϕ) of 35°. Friction factors are also presented for use in checking resistance to unbalanced forces on walls.

Recommended Earth Pressure			
Material	At-Rest Coefficient (K)	Active Coefficient (Ka)	Passive Coefficient (Kp)
Gravel Borrow	0.42	0.27	3.69

Friction Coefficients	
Cast in place concrete poured on imported Gravel Borrow or Crushed Stone	δ = 24 deg. tan δ = 0.45
Pre-cast concrete placed on imported Gravel Borrow or Crushed Stone	δ = 17 deg. tan δ = 0.30

Traffic loads and other anticipated loadings that could occur behind the walls should be considered. In addition, the effect of adjacent footings on lateral walls should be accounted for during design.

5 Pavement Recommendations

The table below presents recommended pavement layer thickness:

Recommended Flexible Pavement Layer Thickness	
Pavement Section	Layer Thickness (inches)
Wearing Course	1-1/2
Binder Course	2
Base Course – Processed Aggregate, CTDOT Form 818, M.05.01	6
Subbase Course – Granular Fill, CTDOT Form 818, M.02.06, Grading B	8

In areas where concrete and asphalt paving meet, it would be advantageous to provide a strip of free draining soil below the concrete and bituminous interface. The free draining strip should consist of a twenty-four (24) inch layer of "Gravel Borrow" extending a minimum of 3 feet laterally below the concrete apron. This should control any minor frost heaving that may occur if water enters the subgrade through this joint.

Subbase and base courses should be compacted in 1-foot (maximum) lifts to 95% of the maximum dry density as determined in accordance with ASTM D1557 (modified Proctor test). Fill below the subbase should be compacted to at least 92% of the maximum dry density as determined in accordance with ASTM D1557 (Modified Proctor test).

Heave of silty material is a possibility unless all silty material is removed from within the pavement footprint for the full-recommended frost depth. To reduce the chance of pavement damage due to potential frost heaving and/or excessive settlements, subgrade soils founded below the pavement section to frost depths (i.e., 42 inches) should ideally be free draining and free of organics. However, in lieu of removing and replacing the existing subgrade soils with drainable and organic free material, it may be more feasible to accept a reduced pavement service life. Laboratory testing indicated silt contents exceed 85% percent. Free draining material is considered to have less than 10% silt and clay content.

6 Earthwork

6.1 Site Preparation

Prior to construction of the proposed stream crossing, vegetation, topsoil, subsoil, trees, stumps, roots, stream bottom deposits, and any otherwise unsuitable materials should be removed prior to placing fill.

Following the grubbing and stripping operation, areas that are above the design subgrade elevations could then be cut to grade. The exposed subgrade that is at grade or will receive fill should be proofrolled with at least 6 passes of a minimum 10-ton vibratory roller compactor. The proofrolling should be performed under the observation of a Geotechnical Engineer. Unstable subgrades and any deleterious material should be removed and replaced with crushed stone wrapped in geotextile separation fabric, as necessary. Crushed stone should be placed in loose lifts not exceeding 8 inches and seated with a minimum four passes of a vibratory plate compactor. Additional fill may then be placed to attain the required grade as needed.

Construction of the new stream crossing is in an undeveloped, wooded area. Therefore, the use of temporary excavation support system on the landward side of the streambanks is not anticipated.

In areas where an open cut is possible without a temporary support system, the final side slopes should conform to Local, State, and Federal safety requirements.

As a minimum, temporary excavations should be sloped or braced, as required by Occupational Safety and Health Administration (OSHA) regulations, to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The contractor, by their contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations, as required, to maintain stability of both the excavation sides and bottom. Contractor is required to engage a licensed Professional Engineer for the shoring design.

6.2 Fill Material Types

Fill as needed for structural backfill should meet the following material property requirements:

Fill Type/Specification [1]	USCS Classification	Application
Crushed Stone (CTDOT Form 818 - M.02.05, M.02.06 – Grading C)	GW or SW	All fill placed below foundation level. Uniform ¾-inch angular crushed stone (GP) wrapped in a geotextile separation fabric.
Gravel Borrow for Bridge Foundation (CTDOT Form 818, Section 2.16 and M.02.05)	GW or SW	Free-draining abutment and wingwall backfill. On-site soils are not suitable for re-use for this application
Embankment Fill	Varies	All locations and elevations, except as retaining wall backfill. Excavated soils may be selectively re-used
Granular Fill (CTDOT form 818, Section 2.13 and M.02.01)		Embankment fill, provided they meet the gradation requirements of CTDOT M.02.06, Grading A

1. Compacted fill should consist of approved materials that are free of organic matter, debris, soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, mud, dirt, or other deleterious materials. Frozen material should not be used. Fill should not be placed on a frozen subgrade.

6.3 Fill Compaction Requirements

Structural and Embankment Fill should meet the following compaction requirements.

Item	Description
Fill Lift Thickness	8 inches or less in compacted thickness
Compaction Requirements [1] Pervious Structure Backfill Embankment Fill	98 percent maximum dry density (AASHTO T 180, Method D) 95 percent maximum dry density (AASHTO T 180, Method D)
Moisture Content	Workable moisture levels
1. We recommend that fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.	

6.4 Grading and Drainage

In conjunction with the proposed stream crossing and wing walls, permanent slopes will be constructed to transition to finished grade. Design of permanent soil slopes should be based on a grade no steeper than 2H:1V, which would be suitable for slopes constructed of Embankment Fill placed in accordance with CTDOT Section 2.02. Permanent soil slopes in areas subject to flooding should be covered with stone/rip-rap or otherwise protected from erosion during flooding and/or surface sloughing during drawdown of the flood pool. Vegetated slopes should be protected with erosion mats until the vegetation is established. Temporary sedimentation and erosion control methods should be implemented during construction and left in place until the slope surfaces have become stabilized.

6.5 Earthwork Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, wet, or disturbed, the affected material should be removed, or should be scarified, moisture conditioned, and recompacted.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork. Also, a third-part testing agency should be retained to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations in the completed subgrade; and just prior to construction of foundations.

6.6 Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas of unsuitable soils, should they be identified during proofrolling.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test per lift or every 500 square feet of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the observation of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should recommend mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Appendix A

Limitations

GEOTECHNICAL LIMITATIONS

Explorations

1. The analyses and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil/rock profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil/rock transitions are probably more erratic. For specific information, refer to the boring logs.

3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made.

Review

4. In the event that any changes in the nature, design or location of the proposed stream crossing is planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by Fuss & O'Neill, Inc. It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

Construction

5. It is recommended that this firm be retained to provide soil engineering services during construction of the excavation and foundation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

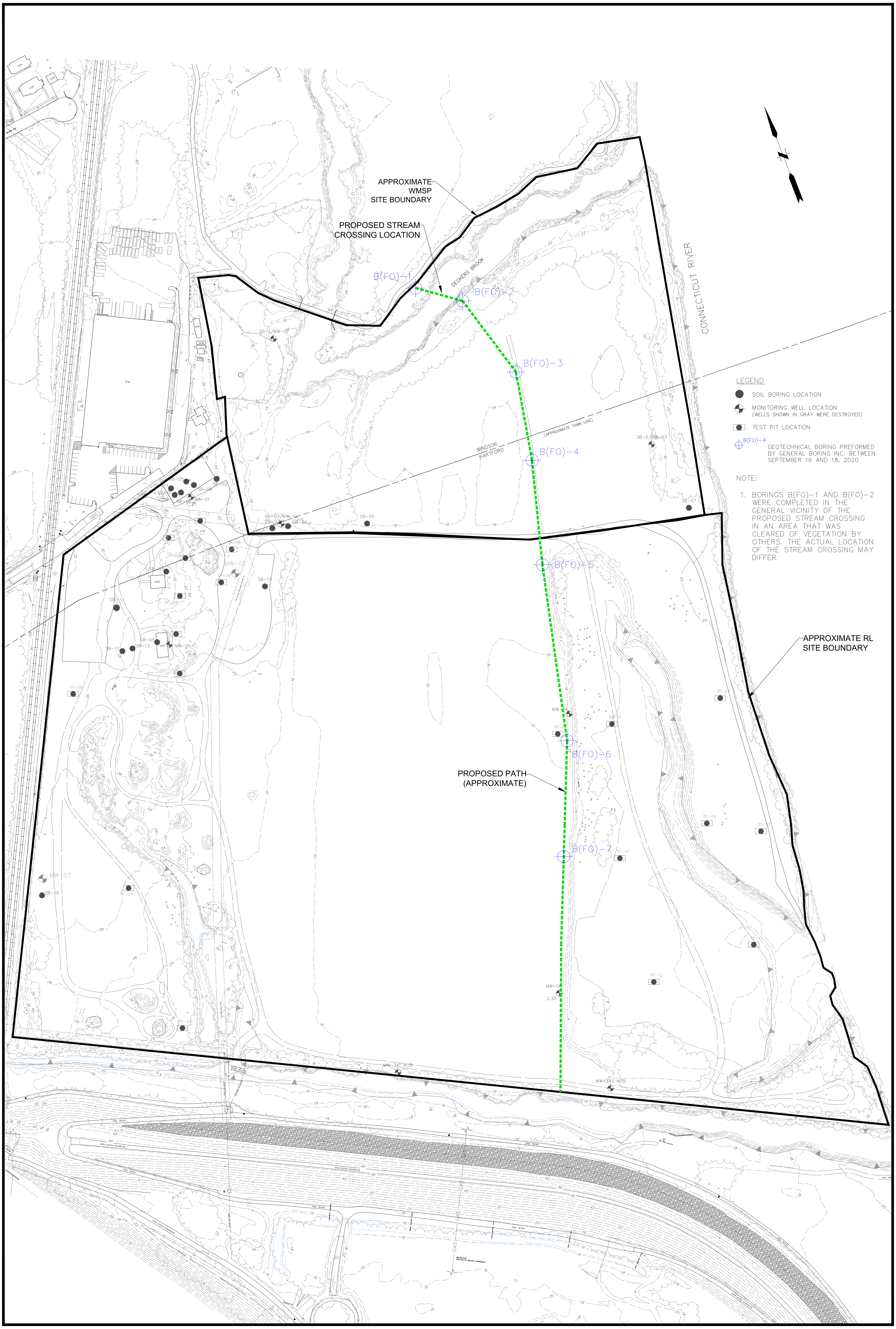
Use of Report

6. This preliminary geotechnical engineering report has been prepared for the exclusive use of Riverfront Recapture Inc. of Hartford CT for specific application to the RLI Project in accordance with generally accepted geotechnical engineering practices. No other warranty, express or implied, is made.

7. This preliminary geotechnical report has been prepared for this project by Fuss& O'Neill. This report is for design purposes only and is not sufficient to prepare an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to design considerations only.

Appendix B

Figure



PROJ. No.: 20170277A30 DATE: OCTOBER 2020 FIGURE 1	BORING LOCATION PLAN RLI PROJECT HARTFORD & WINDSOR CONNECTICUT	FUSS & O'NEILL 146 HARTFORD ROAD MANCHESTER, CONNECTICUT 06040 860.646.2469 www.fando.com

SCALE:
HORZ.: 1" = 100'
VERT.:
DATUM:
HORZ.:
VERT.:
50 100 0 50
GRAPHIC SCALE

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

File Path: J:\DWG\P2017\0277\A30\Environmental\Plan\20170277A30_BOR04.dwg Layout: 24X36-P Plotted: Fri, October 30, 2020 - 4:12 PM User: kberchelli
Plotter: DWG TO PDF.PC3 CTB File: FO HALF.STB
MS VIEW:
LAYER STATE:

Appendix C

Subsurface Exploration Logs – Current Investigation

SOIL BORING LOG

FUSS & O'NEILL

BORING NO.: **(FO)-1**

Page **1** of **2**

Project:	RLI Project	**Project No.:**	20170277A30
Location:	Hartford/Windsor CT	**Project Mgr:**	Andrea Judge
Client:	Riverfront Recapture	**Field Eng. Staff:**	Ken Berchielli
Drilling Co.:	General Borings Inc.	**Date Started:**	September 17, 2020
Driller:	Jim Casson	**Date Finished:**	September 17, 2020

Elevation: 18 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** See Plan **Coord.:** **N:** 854864.929 **E:** 1027131.002

Horizontal Datum: NAD 1983

Item	**Casing**	**Sampler**	**Core Barrel**
Type	HSA	SS	NQ
Length (ft)	5	2	5
Inside Dia. (in.)	4	1.375	1.875
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: Diedrich D-50

☐ Truck ☐ Tripod ☐ Cat-Head
☐ Rubber Tire ☐ Geoprobe ☑ Winch
☑ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐

Drilling Fluid: ☑ Bentonite ☐ Polymer ☐ Water ☐ None

Drill Rod Size:

Casing Advance: HSA to 15 feet, then casing/roller bit to 45 feet.

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	14/24	2 4 3 3		ML	Loose, gray, SILT, little fine Sand, dry	-	-	-	-	
	S-2 2.0'- 4.0'	12/24	2 5 5 4		ML	Loose to medium dense, gray, SILT, little fine Sand, dry	-	-	-	-	
5	S-3 5.0'- 7.0'	24/24	3 4 5 5		ML	Loose, gray, SILT, and fine Sand, trace Clay, dry	-	-	-	-	
10 (elev.)	S-4 7.0'- 9.0'	18/24	3 4 5 5		ML	Loose, gray, SILT, and fine Sand, trace Clay, dry	-	-	-	-	
10	S-5 10.0'- 12.0'	12/24	6 7 6 8		ML	Medium dense, light brown to gray, SILT, and fine Sand, trace Clay, dry	-	-	-	-	
						15.0					
15	S-6 15.0'- 17.0'	12/24	6 10 12 10		SM	Medium dense, brown, fine to medium SAND some Silt, trace fine Gravel, wet	-	-	-	-	
0 (elev.)											
20	S-7 20.0'- 22.0'	10/24	11 11 12 10		SM	Medium dense, brown, fine to medium SAND, some Silt, trace fine Gravel, wet	-	-	-	-	
						25.0					

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet: Bottom of Hole	Depth in feet: Water

Minor Constituent Proportions	
And	35 - 50%
Some	20 - 35%
Little	10 - 20%
Trace	<10%

Soil Density	
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Soil Consistency	
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

Sample Type	
SS	Split Spoon
ST	Shelby Tube
GS	Grab Sample
ET	Extruded Tube
C	Rock Core

Notes: Water Level Measurement: 12' from ground level

Boring No.: **(FO)-1**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks*
	S-8 25.0'-27.0'	24/24	2 2 2 2		CL	Soft to medium stiff, red to brown, Lean CLAY, wet	-	-	-	-	
-10											
30	S-9 30.0'-32.0'	6/24	10 10 12 50/5"		SC	30.0 Medium dense, brown, fine to coarse SAND, and Clay, little Gravel, wet - **Till**	-	-	-	-	
						34.0 SHALE, Moderate to slighty fractured, medium hard, slightly weathered, dark gray to black, fine grained, laminated, close joints	-	-	-	-	
35	R-1 35.0'-40.0'	59/60	1 2 3 2 2				-	-	-	-	Roller bit refusal in between sampling intervals at 34' RQD = 59%
-20											
40	R-2 40.0'-45.0'	53/60	2 2 2 2 2			SHALE, Moderate to slighty fractured, medium hard, slightly weathered, dark gray to black, fine grained, laminated, close joints	-	-	-	-	RQD = 56%
45						45.0 Boring Terminated at 45'	-	-	-	-	
-30											
50											
55											
-40											

NOTES:

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

SOIL BORING LOG

FUSS & O'NEILL

BORING NO.: **(FO)-2**

Project:	RLI Project	**Project No.:**	20170277A30
Location:	Hartford/Windsor CT	**Project Mgr:**	Andrea Judge
Client:	Riverfront Recapture	**Field Eng. Staff:**	Ken Berchielli
Drilling Co.:	General Borings Inc.	**Date Started:**	September 16, 2020
Driller:	Jim Casson	**Date Finished:**	September 16, 2020

Elevation: 20 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** See Plan **Coord.: N:** 854794.276 **E:** 1027227.015 **Horizontal Datum:** NAD 1983

Item	**Casing**	**Sampler**	**Core Barrel**
Type	HSA	SS	-
Length (ft)	5	2	-
Inside Dia. (in.)	4	1.375	-
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: Diedrich D-50

- ☐ Truck ☐ Tripod ☐ Cat-Head
- ☐ Rubber Tire ☐ Geoprobe ☑ Winch
- ☑ Track ☐ Air Track ☑ Roller Bit
- ☐ Skid ☐ ______ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ ______

Drilling Fluid: ☑ Bentonite ☐ Polymer ☐ Water ☐ None

Drill Rod Size:

Casing Advance: HSA to 15 feet, then casing/roller bit to 45 feet.

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
20	S-1 0.0'- 2.0'	4/24	2 4 4 5		ML	Loose, dark brown, SILT, little fine Sand, dry	-	-	-	-	
	S-2 2.0'- 4.0'	16/24	3 3 3 3		ML	Loose, light brown, SILT, little fine Sand, dry	-	-	-	-	
5	S-3 5.0'- 7.0'	24/24	3 2 3 4		ML	Loose, light brown to gray, SILT, and fine Sand, trace Clay, dry	-	-	-	-	
	S-4 7.0'- 9.0'	20/24	4 4 5 6		ML	Loose, light brown to gray, SILT, and fine Sand, trace Clay, dry	-	-	-	-	
10 / 10	S-5 10.0'- 12.0'	13/24	5 4 5 5		SM	10.0 Loose, light brown to gray, fine SAND, and Silt, dry	-	-	-	-	
15	S-6 15.0'- 17.0'	18/24	7 9 9 10		SP	15.0 Medium dense, brown, fine to medium SAND, little Silt, trace fine Gravel, dry	-	-	-	-	
20 / 0	S-7 20.0'- 22.0'	8/24	7 7 9 8		SP	Medium dense, gray, fine to medium SAND, trace Silt, trace fine Gravel, Wet	-	-	-	-	

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet: Bottom of Hole	Depth in feet: Water

Minor Constituent Proportions

And	35 - 50%
Some	20 - 35%
Little	10 - 20%
Trace	<10%

Soil Density

Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Soil Consistency

Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

Sample Type

SS	Split Spoon
ST	Shelby Tube
GS	Grab Sample
ET	Extruded Tube
C	Rock Core

Notes: Water Level Measurement: 15' from ground level

Boring No.: **(FO)-2**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid Plasticity: NP - Non-Plastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

SOIL BORING LOG

(continued)

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Field Tests: Dilatancy	Toughness	Plasticity	Dry Strength	Remarks*
	S-8 25.0'-27.0'	12/24	7 7 6 6		SP	Medium dense, gray, fine to medium SAND, trace Silt, trace fine Gravel, wet	-	-	-	-	
30 -10	S-9 30.0'-32.0'	24/24	WOH 12" 2 1		CL	30.0 Very soft, red to brown, lean CLAY, wet	-	-	-	-	
35	U-10 35.0'-37.0'	24/24	P U S H		CL	Thin walled shelby tube sample	-	-	-	-	Driller indicated end of clay layer at the bottom of the tube (37')
	S-11 37.0'-39.0'	7/24	6 7 10 11		SM	37.0 Medium dense, brown, fine SAND and Silt, some fine Gravel, some Clay, wet - **Till**	-	-	-	-	
40 -20	S-12 40.0'-42.0'	9/24	7 10 9 12		SM	Medium dense, brown, fine SAND, some Silt, some fine Gravel, some Clay. wet - **Till**	-	-	-	-	
45						45.0 Rollerbit Refusal at 45 feet on Probable Bedrock					
50 -30											
55											

NOTES:

PROJECT NO.: **20170277A30**

BORING NO.: **(FO)-2**

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

SOIL BORING LOG

FUSS & O'NEILL

BORING NO.: **(FO)-3**
Page **1** of **1**

Project:	RLI Project	**Project No.:**	20170277A30
Location:	Hartford/Windsor CT	**Project Mgr:**	Andrea Judge
Client:	Riverfront Recapture	**Field Eng. Staff:**	Ken Berchielli
Drilling Co.:	General Borings Inc.	**Date Started:**	September 16, 2020
Driller:	Jim Casson	**Date Finished:**	September 16, 2020

Elevation: 19 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** See Plan **Coord.: N:** 854585.097 **E:** 1027286.457
Horizontal Datum: NAD 1983

Item	Casing	Sampler	Core Barrel
Type	HSA	SS	-
Length (ft)	5	2	-
Inside Dia. (in.)	4	1.375	-
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: Diedrich D-50
☐ Truck ☐ Tripod ☐ Cat-Head
☐ Rubber Tire ☐ Geoprobe ☑ Winch
☑ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ ______ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ ______
Drilling Fluid: ☐ Bentonite ☐ Polymer ☐ Water ☑ None
Drill Rod Size:
Casing Advance: HSA

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	10/24	3 4 4 4	SM	Loose, light gray, fine SAND and Silt, dry	-	-	-	-	
					2.0					
	S-2 2.0'- 4.0'	10/24	3 3 3 2	ML	Loose, light gray, SILT, little fine Sand, dry	-	-	-	-	
5	S-3 5.0'- 7.0'	12/24	1 2 3 4	ML	Loose, gray, SILT, some fine Sand, little Clay, dry	-	-	-	-	
	S-4 7.0'- 9.0'	24/24	5 4 4 5	ML	Loose, gray, SILT, some fine Sand, little Clay, dry	-	-	-	-	
10 / 10					10.0					
	S-5 10.0'- 12.0'	19/24	WOH 12" 1 1	CL-ML	Very loose, gray to light brown, SILT, and Clay, some medium to fine Sand, dry	-	-	-	-	
15					15.0					
	S-6 15.0'- 17.0'	12/24	4 4 6 7	SM	Loose, gray, fine to medium SAND, some silt, wet	-	-	-	-	
					17.0					
					Boring Terminated Without Refusal at 17'					
0										
20										

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet: Bottom of Hole	Depth in feet: Water

Minor Constituent Proportions

And	35 - 50%
Some	20 - 35%
Little	10 - 20%
Trace	<10%

Soil Density

Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Soil Consistency

Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

Sample Type

SS	Split Spoon
ST	Shelby Tube
GS	Grab Sample
ET	Extruded Tube
C	Rock Core

Notes: Water Level Measurement: 15' from ground level

Boring No.: **(FO)-3**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

FUSS & O'NEILL

SOIL BORING LOG

BORING NO.: **(FO)-4**

Project:	RLI Project	**Project No.:**	20170277A30
Location:	Hartford/Windsor CT	**Project Mgr:**	Andrea Judge
Client:	Riverfront Recapture	**Field Eng. Staff:**	Ken Berchielli
Drilling Co.:	General Borings Inc.	**Date Started:**	September 16, 2020
Driller:	Jim Casson	**Date Finished:**	September 16, 2020

Elevation: 18 ft. | **Vertical Datum:** NAVD 1988 | **Boring Location:** See Plan | **Coord.:** **N:** 854369.551 **E:** 1027246.023

Horizontal Datum: NAD 1983

Item	**Casing**	**Sampler**	**Core Barrel**
Type	HSA	SS	-
Length (ft)	5	2	-
Inside Dia. (in.)	4	1.375	-
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: Diedrich D-50

Rig			**Hammer Type**	**Drilling Fluid**
☐ Truck	☐ Tripod	☐ Cat-Head	☐ Safety	☐ Bentonite
☐ Rubber Tire	☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer
☑ Track	☐ Air Track	☑ Roller Bit	☑ Automatic	☐ Water
☐ Skid	☐	☐ Cutting Head	☐	☑ None

Drill Rod Size:

Casing Advance: HSA

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	19/24	5 5 5 5		SM	Loose to medium dense, gray, fine SAND, and Silt, dry	-	-	-	-	
	S-2 2.0'- 4.0'	16/24	4 4 3 4		SM	Loose, gray, fine SAND, and Silt, dry	-	-	-	-	
						5.0					
5	S-3 5.0'- 7.0'	24/24	3 3 2 2		ML	Loose, gray, SILT and fine Sand, trace clay, dry	-	-	-	-	
10	S-4 7.0'- 9.0'	15/24	3 3 5 7		ML	Loose, gray, SILT, some fine Sand, trace Clay, dry	-	-	-	-	
10	S-5 10.0'- 12.0'	24/24	3 3 5 7		ML	Loose, gray, SILT, some fine Sand, trace Clay, dry	-	-	-	-	
						15.0					
15	S-6 15.0'- 17.0'	24/24	5 7 9 10		SM	Medium dense, gray, fine to medium SAND, some Silt, wet	-	-	-	-	
						17.0					
						Boring Terminated Without Refusal at 17'					
0											
20											

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet: Bottom of Hole	Depth in feet: Water

Minor Constituent Proportions		**Soil Density**		**Soil Consistency**		**Sample Type**	
And	35 - 50%	Very Loose	0 - 4	Very Soft	0 - 2	**SS**	Split Spoon
Some	20 - 35%	Loose	4 - 10	Soft	2 - 4	**ST**	Shelby Tube
Little	10 - 20%	Medium Dense	10 - 30	Medium Stiff	4 - 8	**GS**	Grab Sample
Trace	<10%	Dense	30 - 50	Stiff	8 - 15	**ET**	Extruded Tube
		Very Dense	>50	Very Stiff	15 - 30	**C**	Rock Core
				Hard	>30		

Notes:
Water Level Measurement: 14' from ground level

Boring No.: **(FO)-4**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

SOIL BORING LOG

FUSS & O'NEILL

BORING NO.: **(FO)-5**
Page **1** of **1**

Project:	RLI Project	**Project No.:**	20170277A30
Location:	Hartford/Windsor CT	**Project Mgr:**	Andrea Judge
Client:	Riverfront Recapture	**Field Eng. Staff:**	Ken Berchielli
Drilling Co.:	General Borings Inc.	**Date Started:**	September 18, 2020
Driller:	Jim Casson	**Date Finished:**	September 18, 2020

Elevation: 18 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** See Plan **Coord.: N:** 854122.275 **E:** 1027177.977
Horizontal Datum: NAD 1983

Item	**Casing**	**Sampler**	**Core Barrel**
Type	HSA	SS	-
Length (ft)	5	2	-
Inside Dia. (in.)	4	1.375	-
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: Diedrich D-50
☐ Truck ☐ Tripod ☐ Cat-Head
☐ Rubber Tire ☐ Geoprobe ☑ Winch
☑ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ ______ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ ______

Drilling Fluid: ☐ Bentonite ☐ Polymer ☐ Water ☑ None

Drill Rod Size:
Casing Advance: HSA

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	22/24	4 7 6 5		SM	Medium dense, gray, fine SAND and Silt, dry	-	-	-	-	
	S-2 2.0'- 4.0'	13/24	5 4 4 3		SM	Very Loose to Loose, gray, fine SAND, and Silt, trace Clay, dry	-	-	-	-	
5						5.0					
	S-3 5.0'- 7.0'	17/24	1 2 2 3		ML	Loose, gray, SILT, and fine Sand, trace Clay, dry	-	-	-	-	
10	S-4 7.0'- 9.0'	18/24	2 3 5 4		ML	Loose, gray, SILT, and fine Sand, trace Clay, dry	-	-	-	-	
10						10.0					
	S-5 10.0'- 12.0'	17/24	5 5 6 6		SM	Medium dense, gray to brown, fine SAND and Silt, dry	-	-	-	-	
15	S-6 15.0'- 17.0'	13/24	1 2 3 6		SM	Loose, gray to brown, fine to medium SAND, some Silt, wet	-	-	-	-	
						17.0					
						Boring Terminated Without Refusal at 17'					
0											
20											

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet: Bottom of Hole	Depth in feet: Water

Minor Constituent Proportions

And	35 - 50%
Some	20 - 35%
Little	10 - 20%
Trace	<10%

Soil Density

Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Soil Consistency

Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

Sample Type

SS	Split Spoon
ST	Shelby Tube
GS	Grab Sample
ET	Extruded Tube
C	Rock Core

Notes: Water Level Measurement: 15' from ground level

Boring No.: **(FO)-5**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

SOIL BORING LOG

FUSS & O'NEILL

BORING NO.: **(FO)-6**

Project:	RLI Project	**Project No.:**	20170277A30
Location:	Hartford/Windsor CT	**Project Mgr:**	Andrea Judge
Client:	Riverfront Recapture	**Field Eng. Staff:**	Ken Berchielli
Drilling Co.:	General Borings Inc.	**Date Started:**	September 18, 2020
Driller:	Jim Casson	**Date Finished:**	September 18, 2020

Elevation: 18 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** See Plan **Coord.:** **N:** 853698.99 **E:** 1027080.15

Horizontal Datum: NAD 1983

Item	Casing	Sampler	Core Barrel
Type	HSA	SS	-
Length (ft)	5	2	-
Inside Dia. (in.)	4	1.375	-
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: Diedrich D-50

- ☐ Truck ☐ Tripod ☐ Cat-Head
- ☐ Rubber Tire ☐ Geoprobe ☑ Winch
- ☑ Track ☐ Air Track ☑ Roller Bit
- ☐ Skid ☐ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐

Drilling Fluid: ☐ Bentonite ☐ Polymer ☐ Water ☑ None

Drill Rod Size:

Casing Advance: HSA

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	24/24	3 4 5 4		SM	Loose, gray to brown, fine SAND, and Silt, dry	-	-	-	-	
	S-2 2.0'- 4.0'	18/24	3 3 3 2		SM	Loose, gray to brown, fine SAND, and Silt, dry	-	-	-	-	
5	S-3 5.0'- 7.0'	20/24	1 1 1 1		ML	5.0 Very Loose, SILT, some fine Sand, some Clay, dry	-	-	-	-	
10	S-4 7.0'- 9.0'	14/24	3 4 5 6		SM	7.0 Loose, fine SAND, and Silt, dry	-	-	-	-	
10	S-5 10.0'- 12.0'	14/24	5 6 6 5		SM	Medium dense, fine SAND, and Silt, wet	-	-	-	-	
15	S-6 15.0'- 17.0'	15/24	4 5 7 9		SW	15.0 Medium dense, brown, fine to coarse SAND, trace Silt, trace Clay, wet	-	-	-	-	
0						17.0 Boring Terminated Without Refusal at 17'					
20											

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet: Bottom of Hole	Depth in feet: Water

Minor Constituent Proportions	
And	35 - 50%
Some	20 - 35%
Little	10 - 20%
Trace	<10%

Soil Density	
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Soil Consistency	
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

Sample Type	
SS	Split Spoon
ST	Shelby Tube
GS	Grab Sample
ET	Extruded Tube
C	Rock Core

Notes: Water Level Measurement: 12' from ground level

Boring No.: **(FO)-6**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

FUSS & O'NEILL

SOIL BORING LOG

BORING NO.: **(FO)-7**

Project:	RLI Project	**Project No.:**	20170277A30
Location:	Hartford/Windsor CT	**Project Mgr:**	Andrea Judge
Client:	Riverfront Recapture	**Field Eng. Staff:**	Ken Berchielli
Drilling Co.:	General Borings Inc.	**Date Started:**	September 18, 2020
Driller:	Jim Casson	**Date Finished:**	September 18, 2020

Elevation: 18 ft. | **Vertical Datum:** NAVD 1988 | **Boring Location:** See Plan | **Coord.:** **N:** 853437.457 **E:** 1026970.89

Horizontal Datum: NAD 1983

Item	Casing	Sampler	Core Barrel
Type	HSA	SS	-
Length (ft)	5	2	-
Inside Dia. (in.)	4	1.375	-
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: Diedrich D-50

			Hammer Type	**Drilling Fluid**
☐ Truck	☐ Tripod	☐ Cat-Head	☐ Safety	☐ Bentonite
☐ Rubber Tire	☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer
☑ Track	☐ Air Track	☑ Roller Bit	☑ Automatic	☐ Water
☐ Skid	☐ ______	☐ Cutting Head	☐ ______	☑ None

Drill Rod Size:

Casing Advance: HSA

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec / Pen. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description* (density/consistency, color, Group Name & Symbol, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	16/24	5 5 5 5		SM	Medium dense, brown to gray fine SAND, and Silt, dry	-	-	-	-	
	S-2 2.0'- 4.0'	12/24	3 4 5 3		SM	Loose, brown to gray, fine SAND, and Silt, dry	-	-	-	-	
5						5.0					
	S-3 5.0'- 7.0'	22/24	2 2 2 3		ML	Very Loose to Loose, gray, SILT, little fine Sand, trace Clay, dry	-	-	-	-	
10	S-4 7.0'- 9.0'	18/24	2 2 3 4		ML	Loose, gray, SILT, little fine Sand, trace Clay, dry	-	-	-	-	
10	S-5 10.0'- 12.0'	20/24	2 3 4 5		ML	Loose, gray, SILT, little fine Sand, trace Clay, dry	-	-	-	-	
15						15.0					
	S-6 15.0'- 17.0'	13/24	3 4 6 7		SW	Medium dense, brown, fine to coarse SAND, trace Silt, trace Clay, wet	-	-	-	-	
						17.0					
						Boring Terminated Without Refusal at 17'					
0											
20											

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet: Bottom of Hole	Depth in feet: Water

Minor Constituent Proportions

And	35 - 50%
Some	20 - 35%
Little	10 - 20%
Trace	<10%

Soil Density

Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Soil Consistency

Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	>30

Sample Type

SS	Split Spoon
ST	Shelby Tube
GS	Grab Sample
ET	Extruded Tube
C	Rock Core

Notes: Water Level Measurement: 15' from ground level

Boring No.: **(FO)-7**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: Soil identifications and field tests based on visual-manual methods per ASTM D2488 and using the modified Burmister System

Appendix D

Subsurface Exploration Logs – Previous Investigations

FUSS & O'NEILL

BORING LOG

Project Name: RLI and Windsor Meadows State Park

Project Location: Hartford and Windsor, CT

Location ID: SB-05
Sheet #: 1 of 1
Project #: 20170277.A30
Weather: 70s, clear

Contractor: Cisco Geotech
Operator: Chris
F&O Representative: BSC/AF
Drilling Method: Truck Mount
Sampling Method: Dedicated gloves/terracores
Hammer Weight: N/A Hammer Fall (inches): N/A

Location Description: See map
Date Started: 8/17/2020
Date/Time Completed: 8/17/2020 @ 1010
Depth to Saturated Zone: >4'
Sample # Prefix: 13052008 17 - 07/-08

DRILLING DETAILS			MATERIAL DESCRIPTION				ANALYTICAL SAMPLES		
START DEPTH (FT)	BLOWS 6"	REC/ PEN (IN)	DEPTH RANGE (FT)	DESCRIPTION	PID	LITHO-LOGIC CODE	SAMPLE NO. & TIME	DEPTH INTERVAL (FT)	JARS & PRESERV.
0		44/48	0-3.75	Sand f-m, tr grass, tr silt, loose, dry, no odor, light brown	0				
			3.75-4	no recovery 4' EOB			-07 1015	0-0.5	1x 8oz
							-08 1020	1.5-2 (HOLD)	1x 8oz

BORING DIAMETER	BORING METHOD	BORING DEPTH
2"	GEOPROBE	4'

REMARKS
Field Instrument = PID/OVM
If refusal is encountered, describe all efforts used to confirm.

Field Decon: Yes / No / Dedicated Device

PROPORTIONS USED:

Trace (tr)	0 to 10%	Some (sm)	20 to 35%
Little (ltl)	10 to 20%	And	35 to 50%

EXAMPLE DESCRIPTION:
SAND, F-M; sm F angular gravel; ltl silt; tr clay; (10R 5/4), wet at 7 ft. Loose. No odor.

Reviewed by Staff:

BACKFILL

Asphalt / Concrete		To	
Bentonite Grout/Chips		To	
Cuttings/Native Material	4	To	0
Other		To	

See Monitoring Well Completion Report

BORING LOG

FUSS & O'NEILL

Project Name: RLI and Windsor Meadows State Park	Location ID: SB-07
Project Location: Hartford and Windsor, CT	Sheet #: 1 of 1
	Project #: 20170277.A30
	Weather: 70s, clear

Contractor: Cisco Geotech
Operator: Chris + Noah
F&O Representative: BSC/AF
Drilling Method: Truck Mount
Sampling Method: Dedicated gloves/terracores
Hammer Weight: N/A Hammer Fall (inches): N/A

Location Description: See map
Date Started: 8/17/2020
Date/Time Completed: 8/17/2020 @ 1030
Depth to Saturated Zone: 5'
Sample # Prefix: 13052008 17 - 09/10 Dup

DRILLING DETAILS			MATERIAL DESCRIPTION				ANALYTICAL SAMPLES		
START DEPTH (FT)	BLOWS 6"	REC/ PEN (IN)	DEPTH RANGE (FT)	DESCRIPTION	PID	LITHO-LOGIC CODE	SAMPLE NO. & TIME	DEPTH INTERVAL (FT)	JARS & PRESERV.
0		38/48	0-0.4	Sand f, tr gravel, tr grass, loose, dry, light brown, no odor					
			0.4-1.7	Sand f-c, ltl gravel, tr brick, tr asphalt, loose, dry, no odor, brown					
			1.7-3.2	Sand f-m, tr silt, loose, dry, tan, no odor			-09 1030	0.5-1.75	1x G802
			3.2-4	no recovery			-10 1035	0.5-1.75	1x G802
4		38/48	4-4.5	same as 1.7-3.2					
			4.5-5	Sand f-m, some silt/clay, loose, dry, brown, no odor					
			5-7.2	same as 4.5-5, wet					
			7.2-8	no recovery					
				8' EOB					

BORING DIAMETER	BORING METHOD	BORING DEPTH
2"	Truck Mount	8'

REMARKS
Field Instrument = PID/OVM
If refusal is encountered, describe all efforts used to confirm.
Field Decon: Yes / No / Dedicated Device

PROPORTIONS USED:

Trace (tr)	0 to 10%	Some (sm)	20 to 35%
Little (ltl)	10 to 20%	And	35 to 50%

EXAMPLE DESCRIPTION:
SAND, F-M; sm F angular gravel; ltl silt; tr clay; (10R 5/4), wet at 7 ft. Loose. No odor.

Reviewed by Staff:

BACKFILL

Asphalt / Concrete		To	
Bentonite Grout/Chips		To	
Cuttings/Native Material	8	To	0
Other		To	

See Monitoring Well Completion Report

BORING LOG

FUSS & O'NEILL

Project Name: RLI and Windsor Meadows State Park	Location ID: SB-06 (MW-03)
	Sheet #: 1 of 1
	Project #: 20170277.A30
Project Location: Hartford and Windsor, CT	Weather: 70s, clear

Contractor: Cisco Geotech	Location Description: See map
Operator: Chris + Noah	Date Started: 8/17/2020
F&O Representative: BSC/AF	Date/Time Completed: 8/17/2020 @
Drilling Method: Truck Mount	Depth to Saturated Zone:
Sampling Method: Dedicated gloves/terracores	
Hammer Weight: Hammer Fall (inches):	Sample # Prefix: 13052008 17 - 11/12

DRILLING DETAILS			MATERIAL DESCRIPTION				ANALYTICAL SAMPLES		
START DEPTH (FT)	BLOWS 6"	REC/ PEN (IN)	DEPTH RANGE (FT)	DESCRIPTION	PID	LITHO-LOGIC CODE	SAMPLE NO. & TIME	DEPTH INTERVAL (FT)	JARS & PRESERV.
0		36/48	0-3	Sand (F-M), tr gravel, tr grass, dry, loose, no odor, tan	0	SP	-11 -12 1046/1047	0-0.75 2-3	8oz G 8oz G
			3-4	No Recovery					
4		42/48	4-5.5	Same as 0-3		SP			
			5.5-7.5	Same as 0-3, ~~wet~~ moist		SP			
			7.5-8	No Recovery					
8		40/48	8-9.75	Same as 5.5-7.5		SP			
			9.75-11.25	Same as 0-3, wet, ltl. silt clay		SP			
			11.25-12	No Recovery					
				EOB @ 12'					

BORING DIAMETER	BORING METHOD	BORING DEPTH
2"	Truck Mount	

REMARKS

Field Instrument = PID/OVM

If refusal is encountered, describe all efforts used to confirm.

Field Decon: Yes / No / Dedicated Device

PROPORTIONS USED:

Trace (tr)	0 to 10%	Some (sm)	20 to 35%
Little (ltl)	10 to 20%	And	35 to 50%

EXAMPLE DESCRIPTION:
SAND, F-M; sm F angular gravel; ltl silt; tr clay; (10R 5/4), wet at 7 ft. Loose. No odor.

Reviewed by Staff:

BACKFILL

Asphalt / Concrete	To	See Monitoring Well
Bentonite Grout/Chips	To	Completion Report
Cuttings/Native Material	To	
Other	To	

Q:\EA&R Resources\04 - Field Operations\Field Data Sheets\BoringLog.doc
Revised 6/8/2017

Soil Sampling Field Data

Client/Project Name: RLI and Windsor Meadows State Park Project Location: Hartford and Windsor, CT Date: 8/17/2020 Weather:	**PROJECT #:** 20170277.A30	FUSS & O'NEILL

Sample #: 1305200817 - 18 Sample Location ID: SS-19	Container	Quantity	Preservative
Sample Location Description: See map Sampler: BSC/AF Time: 1330 Sampling Device: Auger / Core Sampler / Shovel / Hammer Drill / Trowel / Other Field Decon: Yes / No / Dedicated Type of Sample: Grab / Composite / Other Generic Soil Description: Sand f-m Sample Depth: 1-1.5 PetroFLAG/OVM ND	G 8oz	1	ICE

Sample #: 1305200817 - 19 Sample Location ID: SS-20	Container	Quantity	Preservative
Sample Location Description: See map Sampler: BSC/AF Time: 1335 Sampling Device: Auger / Core Sampler / Shovel / Hammer Drill / Trowel / Other Field Decon: Yes / No / Dedicated Type of Sample: Grab / Composite / Other Generic Soil Description: Sand f-m Sample Depth: 1-1.5 PetroFLAG/OVM ND	G 8oz	1	ICE

Sample #: 1305200817 - 20 Sample Location ID: SS-21	Container	Quantity	Preservative
Sample Location Description: See Map Sampler: BSC/AF Time: 1353 Sampling Device: Auger / Core Sampler / Shovel / Hammer Drill / Trowel / Other Field Decon: Yes / No / Dedicated Type of Sample: Grab / Composite / Other Generic Soil Description: Sample Depth: 1-1.5 PetroFLAG/OVM	G 8oz VOA VOA	1 1 2	ICE MeOH H2O

Sample #: 1305200817 - 21 Sample Location ID: Stockpiles W, 8X	Container	Quantity	Preservative
Sample Location Description: See map Sampler: BSC/AF Time: 1415 Sampling Device: Auger / Core Sampler / Shovel / Hammer Drill / Trowel / Other Field Decon: Yes / No / Dedicated Type of Sample: Grab / Composite / Other Generic Soil Description: sand & brick, asphalt concrete Sample Depth: 0-1 PetroFLAG/OVM ND	G 8oz VOA VOA	1 1 2	ICE MeOH H2O

Appendix E

Laboratory Data

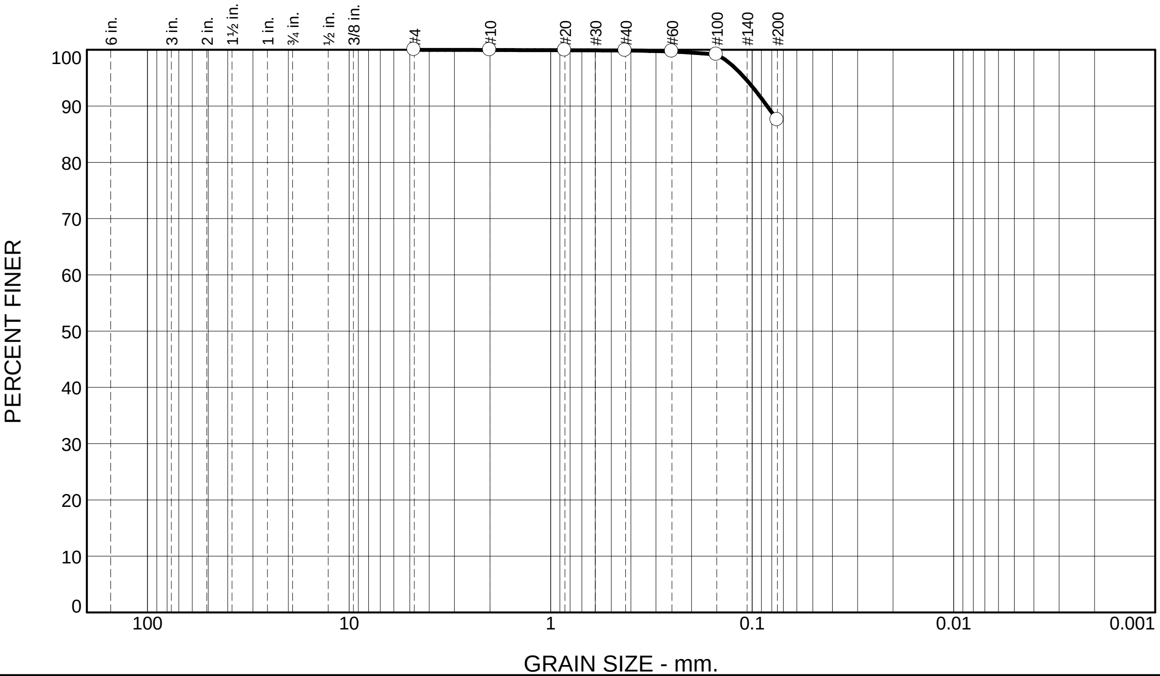
THIELSCH ENGINEERING	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 thielsch.com *Let's Build a Solid Foundation*	Client Information: Fuss & O'Neill Providence, RI PM: Ken Berchielli Assigned By: Ken Berchielli Collected By: Client	Project Information: **Hartford Windsor Riverwalk** **Windsor and Hartford, CT** F&O Project Number: 20170277.A30 Summary Page: 1 of 2 Report Date: 10.15.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-K-102

Boring No.	Sample No.	Depth (Ft)	Laboratory No.	Identification Tests								Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Test Water Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318		D6913			D2974	D854			D1557						
B-2	S2		20-S-2900				0.0	12.5	87.5											Brown silt
B-1	S9		20-S-2901				15.2	42.7	42.1											Red Brown clayey sand with gravel
B-3	S2		20-S-2902				0.0	15.0	85.0											Brown silt with sand
B-1	S8		20-S-2903	47.9	48	25														Red Brown lean clay
B-2	S9		20-S-2904	52.3	54	24														Red Brown lean clay
B-5	S3		20-S-2905	35.1																Moisture Content Only
B-7	S6		20-S-2906	18.2																Moisture Content Only

Date Received: *10.02.2020* Reviewed By: Date Reviewed: *10.15.2020*

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	12.4	87.5	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.7		
#100	99.1		
#200	87.5		

* (no specification provided)

Material Description

Brown silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4(0)

Coefficients

D_{90}= 0.0842 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 10.02.2020 **Date Tested:** 10.06.2020

Tested By: JM

Checked By: Steven Accetta

Title: Laboratory Coordinator

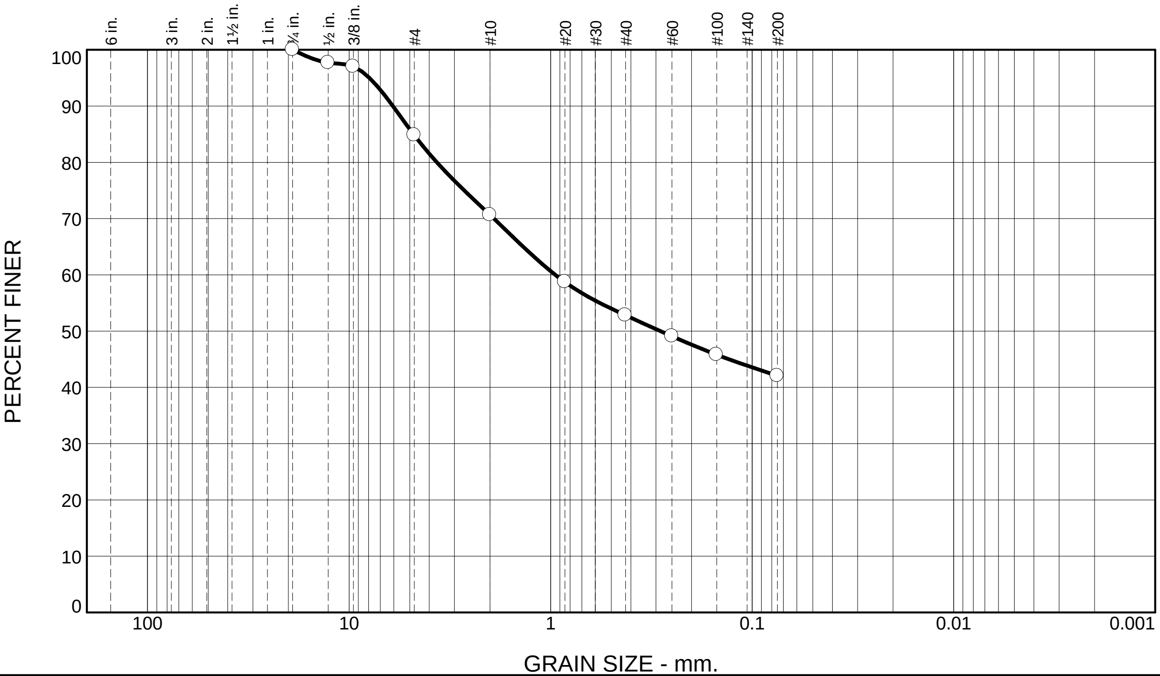
Source of Sample: Boring **Date Sampled:** 09.18.2020
Sample Number: B-2 / S2

Thielsch Engineering Inc.

Cranston, RI

Client: Fuss & O'Neill
Project: Hartford Windsor Riverwalk
Windsor and Hartford, CT
Project No: 20170277.A30 **Figure** 20-S-2900

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	15.2	14.1	17.9	10.7	42.1	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	97.7		
0.375"	97.0		
#4	84.8		
#10	70.7		
#20	58.7		
#40	52.8		
#60	49.1		
#100	45.8		
#200	42.1		

* (no specification provided)

Material Description

Red Brown clayey sand with gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SC **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 6.0588 D_{85}= 4.7902 D_{60}= 0.9470
D_{50}= 0.2852 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Date Received: 10.02.2020 **Date Tested:** 10.06.2020

Tested By: JM

Checked By: Steven Accetta

Title: Laboratory Coordinator

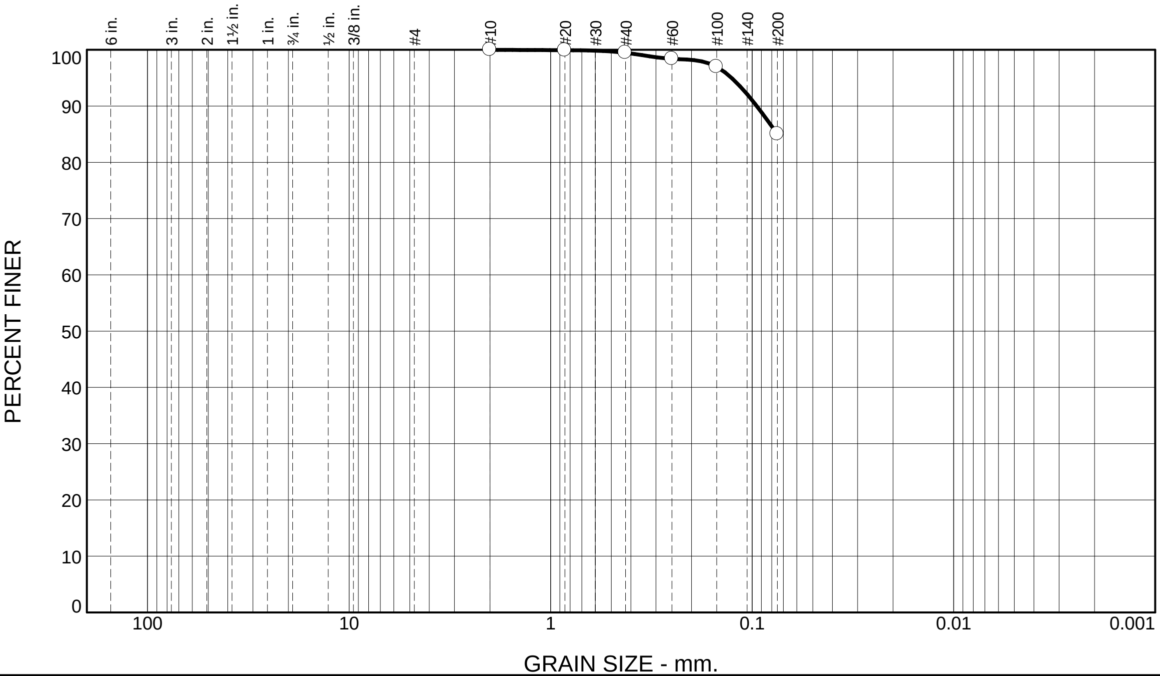
Source of Sample: Boring **Date Sampled:** 09.17.2020
Sample Number: B-1 / S9

Thielsch Engineering Inc.

Cranston, RI

Client: Fuss & O'Neill
Project: Hartford Windsor Riverwalk
Windsor and Hartford, CT
Project No: 20170277.A30 **Figure** 20-S-2901

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	14.5	85.0	

Test Results (D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#20	99.9		
#40	99.5		
#60	98.4		
#100	97.0		
#200	85.0		

* (no specification provided)

Material Description

Brown silt with sand

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 0.0950 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as non-plastic.

Date Received: 10.02.2020 **Date Tested:** 10.06.2020

Tested By: JM

Checked By: Steven Accetta

Title: Laboratory Coordinator

Source of Sample: Boring
Sample Number: B-3 / S2

Date Sampled: 09.17.2020

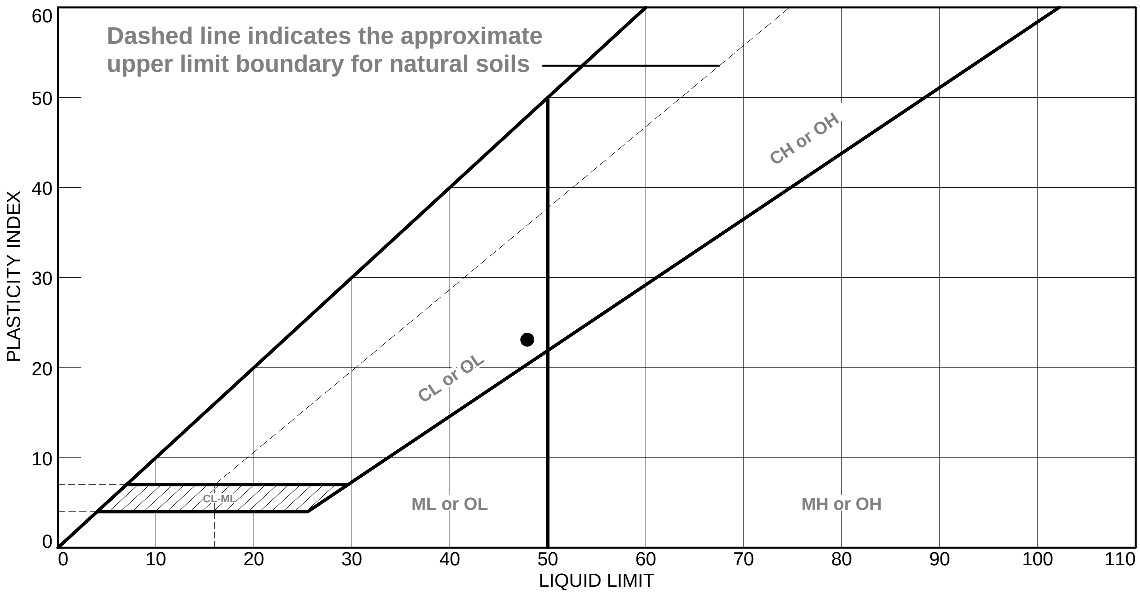
Thielsch Engineering Inc.

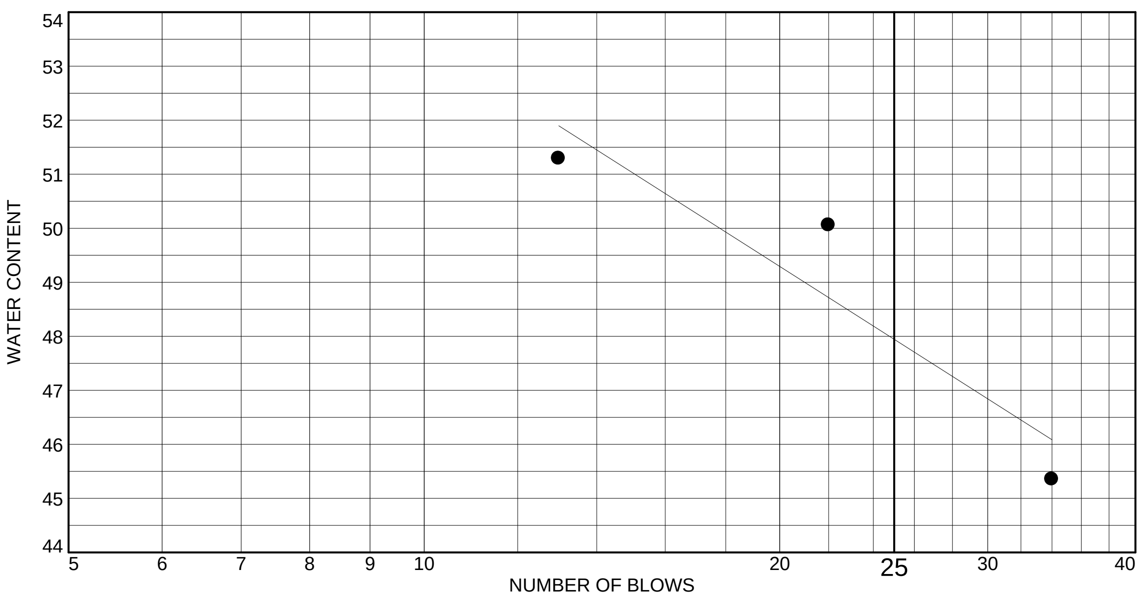
Cranston, RI

Client: Fuss & O'Neill
Project: Hartford Windsor Riverwalk
Windsor and Hartford, CT

Project No: 20170277.A30 **Figure** 20-S-2902

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red Brown lean clay	48	25	23			

Project No. 20170277.A30 **Client:** Fuss & O'Neill

Project: Hartford Windsor Riverwalk

Windsor and Hartford, CT

Source of Sample: Boring

Sample Number: B-1 / S8

Remarks:

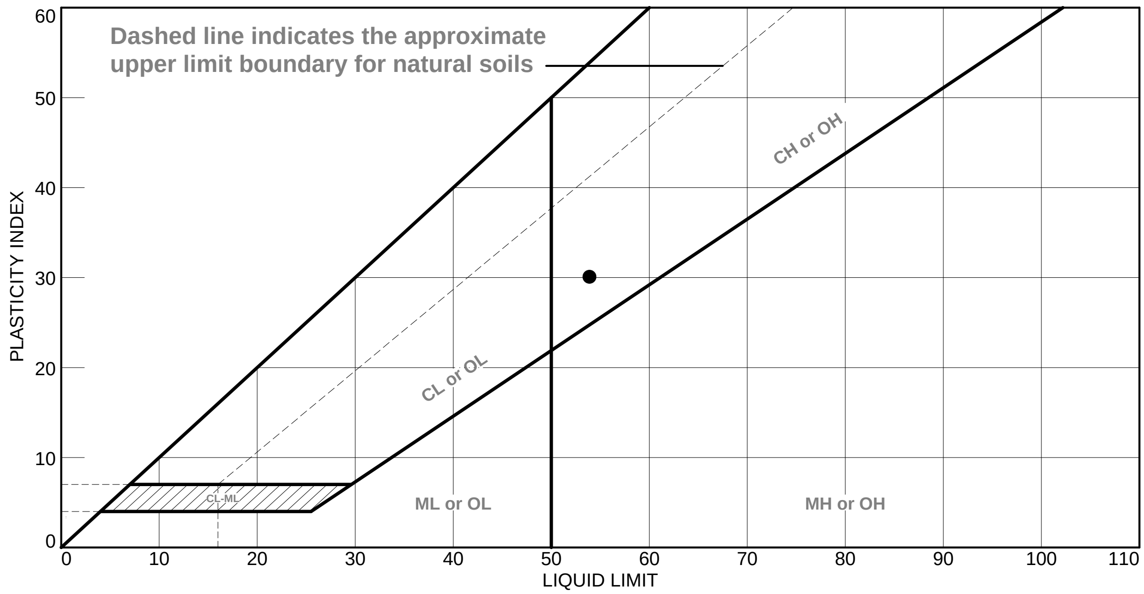
Thielsch Engineering Inc.

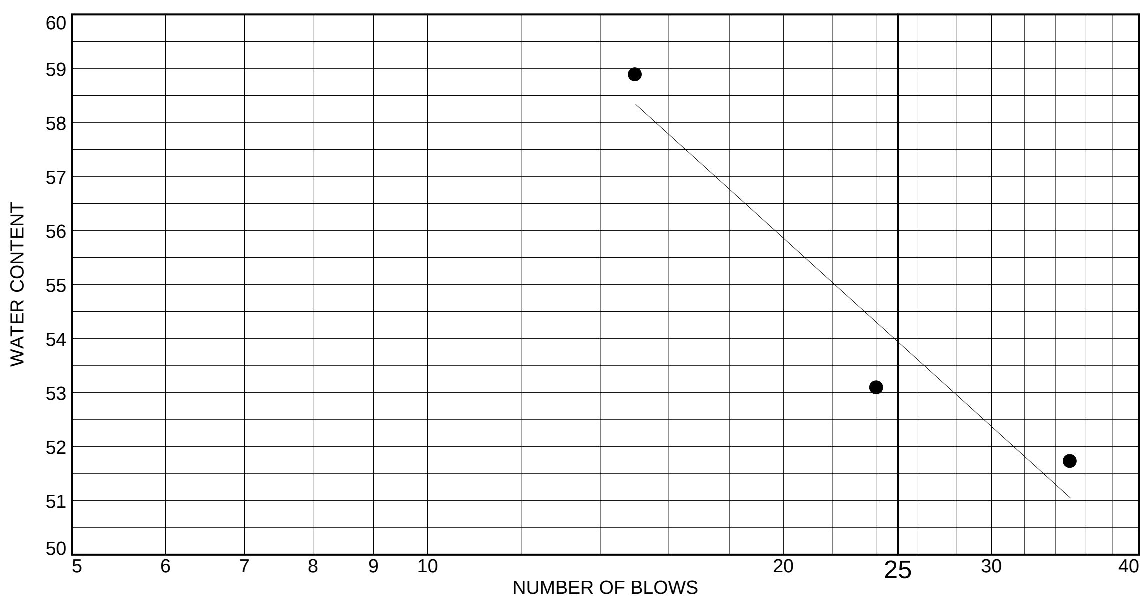
Cranston, RI

Figure 20-L-2903

Tested By: JM **Checked By:** SA

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Red Brown lean clay	54	24	30			

Project No. 20170277.A30 **Client:** Fuss & O'Neill

Project: Hartford Windsor Riverwalk

Windsor and Hartford, CT
Source of Sample: Boring
Sample Number: B-2 / S9

Thielsch Engineering Inc.

Cranston, RI

Remarks:

Figure 20-L-2904

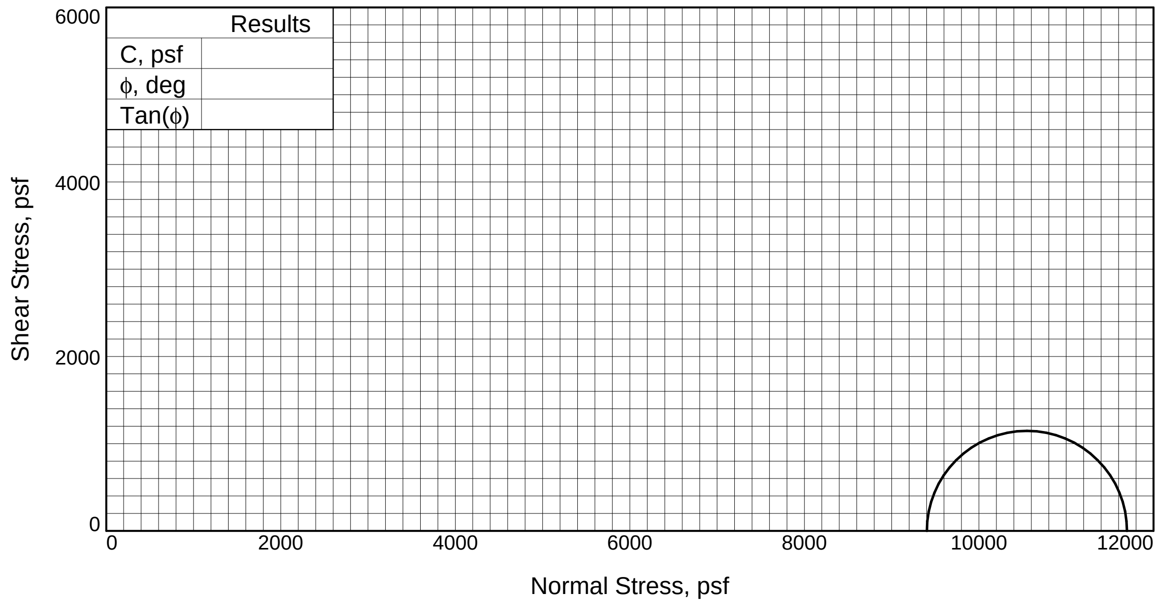
Tested By: JM **Checked By:** SA

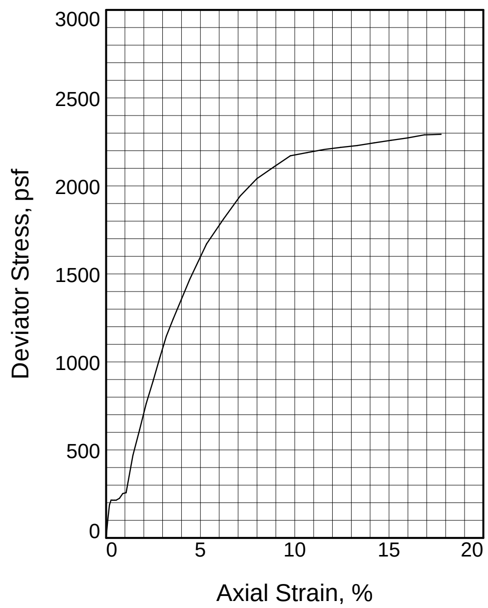
THIELSCH ENGINEERING	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 thielsch.com *Let's Build a Solid Foundation*	Client Information: Fuss & O'Neill Providence, RI PM: Ken Berchielli Assigned By: Ken Berchielli Collected By: Client	Project Information: **Hartford Windsor Riverwalk** **Hartford and Windsor, CT** F&O Project Number: 20170277.A30 Summary Page: 2 of 2 Report Date: 10.14.2020

LABORATORY TESTING DATA SHEET, Report No.: 7420-K-102

				Identification Tests								Shear / Consolidation Tests								
Boring ID	Sample No.	Depth (ft)	Laboratory No.	As Received Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Dry unit wt. pcf	Torvane or Type Test	σ_c psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	EST. Internal Friction Angle	CR / RR	Laboratory Log and Soil Description
B1-2	UD	35-37	20-S-2907		Average Total Unit Weight (35-37') = 106.6 pcf															
		35.0-35.1																		Disturbed
		35.1-35.2	20-WC-2907a	41.6									Tv = 0.12 tsf							Red-Brown clay
		35.2-35.7																		Specimen Saved
		35.7-36.2	20-UU-2907	56.4								71.1	UU	9403	σ_1-σ_3 Max	2293	17.8			Red-Brown clay
		36.2-36.3	20-WC-2907b	42.5									Tv = 0.30 tsf							Red-Brown clay
		36.3-36.8																		Specimen Saved

Date Received: *10.02.2020* Reviewed By: Date Reviewed: *10.15.2020*





Sample No.		1
Initial	Water Content, %	56.4
	Dry Density, pcf	71.1
	Saturation, %	111.0
	Void Ratio	1.3719
	Diameter, in.	2.86
	Height, in.	5.63
At Test	Water Content, %	50.8
	Dry Density, pcf	71.1
	Saturation, %	100.0
	Void Ratio	1.3719
	Diameter, in.	2.86
	Height, in.	5.63
Strain rate, in./min.		0.030
Back Pressure, psf		0
Cell Pressure, psf		9403
Fail. Stress, psf		2293
Strain, %		17.8
Ult. Stress, psf		2293
Strain, %		17.8
σ_1 Failure, psf		11696
σ_3 Failure, psf		9403

Type of Test:
Unconsolidated Undrained

Sample Type: Intact tube

Description: Red-Brown clay

Assumed Specific Gravity= 2.7

Remarks: Specimen taken at 35.7-36.2 feet.

Figure 20-UU-2907

Client: Fuss & O'Neill

Project: Hartford Windsor Riverwalk
Windsor and Hartford, CT

Source of Sample: Tube **Depth:** 35-37'

Sample Number: B1-2 / UD

Proj. No.: 20170277.A30 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Thielsch Engineering Inc.
Cranston, RI

Tested By: JM **Checked By:** sa