# **Attachment** 19

# GEOTECHNICAL REPORT

# CARLIN • SIMPSON & ASSOCIATES

Consulting Geotechnical and Environmental Engineers

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8 March 2018

Suburban Consulting Engineers, Inc.
96 U.S. Highway 206, Suite 101
Flanders, NJ 07836

Attn: Mr. Thomas Mulligan

Re: Report on Subsurface Soil and Foundation Investigation
Proposed Lagoon Crossing
Brick Municipal Utilities Authority
Project #717002
Brick, NJ (CSA Job #17-23)

Dear Mr. Mulligan:

In accordance with our proposal dated 14 November 2017 and your subsequent authorization, we have completed a Subsurface Soil and Foundation Investigation for the referenced site. The purpose of this study was to determine the nature and engineering properties of the subsurface soil and the groundwater conditions for the new construction, to provide recommendations for temporary sheeting and shoring, and to provide information and recommendations for directional drilling.

We understand that the planned construction will consist of new water main installed using horizontal directional drilling across an existing lagoon. To guide us in our study, you have provided us with a site plan that indicates the location of the planned pipeline.

Our scope of work for this project included the following:

1. Reviewed the existing site conditions, the expected soil conditions, and planned this study.

2. Retained Environmental Technical Drilling to advance two (2) test borings at the subject site.

3. Laid out the boring locations in the field, visually identified the soil layers encountered, obtained soil samples, and prepared detailed boring logs and a Boring Location Plan.

4. Performed laboratory soil identification tests on selected representative samples.

5. Analyzed the field and laboratory test data and prepared this report containing the results of this study.

## 1.0 SITE DESCRIPTION

The project site is located at a lagoon along the western portion of the Barnegat Bay in Brick, New Jersey. The western portion of the proposed crossing is at East Granada Drive. The eastern portion of the proposed crossing is at Cartagena Drive. Both portions of the site are occupied by asphalt paved roads. Site grades are relatively flat.

## 2.0 PROPOSED CONSTRUCTION

We understand that the planned construction will consist of new water main installed using horizontal directional drilling across an existing lagoon. Construction will include two 20 foot by 50 foot horizontal directional drilling access pits. At the time of this report the proposed elevations had not been finalized.

The recommendations in this report are based on the preliminary lagoon crossing plans prepared by Suburban Consulting. The following evaluation is based on information that has been provided to our office as of the date of this report. Once the planned construction has been further completed, a copy of the final plans should be forwarded to our office so that we can review it along with the recommendations in this report. At that time, any changes or additional recommendations can be provided, if required.

## 3.0 SUBSURFACE CONDITIONS

To determine the subsurface soil and groundwater conditions at the site, two (2) test borings were advanced by Environmental Technical Drilling at the locations shown on the enclosed Boring Location Plan. The borings were performed using hollow stem augers and split spoon sampling. Detailed boring logs have been prepared and are included in this report. The borings were completed in January 2018 under the full-time inspection of Carlin-Simpson & Associates. Our field engineer visually identified all of the soil samples obtained during the boring operations and selected samples were tested in our laboratory.

### 3.1 Soils

The soil descriptions shown on the boring logs are based on the Burmister Classification System. In this system, the soil is divided into three components: Sand (S), Silt ($) and Gravel (G). The major component is indicated in all capital letters, the lesser in lower case letters. The following modifiers indicate the quantity of each lesser component:

| Modifier | Quantity |
|---|---|
| trace (t) | 0 -10% |
| little (l) | 10% - 20% |
| some (s) | 20% - 35% |
| and (a) | 35% - 50% |

When the site soils are plastic, the following indicators are used:

| Plasticity | Plasticity Index | Indicator |
|---|---|---|
| None | 0 - 1 | SILT |
| Slight | 1 - 5 | Clayey SILT |
| Low | 5 - 10 | SILT & CLAY |
| Medium | 10 - 20 | CLAY & SILT |
| High | 20 - 40 | Silty CLAY |
| Very High | 40+ | CLAY |

The subsurface soil conditions encountered in the test borings can be summarized as follows:

**Stratum 1** Asphalt — The surface layer in each of the borings consist of asphalt that is approximately 6 inches in thickness.

**Stratum 2** Existing Fill — Beneath the asphalt in boring B-2 is existing fill that consists of medium dense orange brown coarse to fine SAND, trace Silt, little coarse to fine Gravel. The existing fill extends to a depth of 2'0" below the existing ground surface.

**Stratum 3** Silty Sand or Sand — Below the asphalt in boring B-1 and below the existing fill in boring B-2 is loose to medium dense brown, gray brown coarse to fine Sand, trace (to some) Silt, little coarse to fine Gravel. This stratum extends to depths of 5'0" and 5'6" in borings B-1 and B-2, respectively.

**Stratum 4** Organic Clayey Silt or Silty Sand — Underlying Stratum 3 in both borings is very soft black Organic Clayey Silt, little medium to fine Sand with plant fibers and peat, or very loose dark brown coarse to fine SAND, some Silt, trace fine Gravel with plant fibers. The organic stratum extends to depths of 8'0" and 10'6" in borings B-1 and B-2, respectively.

**Stratum 5** Gravelly Sand — Below the organic stratum is medium dense brown, light gray coarse to fine SAND, trace Silt, little (to and) coarse to fine Gravel. The Gravelly Sand extends to depths of 26'0" and 21'6" in borings B-1 and B-2, respectively.

**Stratum 6** Sandy Clay and Silt — Beneath the Gravelly Sand is medium stiff to hard gray CLAY and SILT or SILT and CLAY trace (to little), medium to fine Sand. Both borings were terminated in this stratum at depths of 29'0" below the existing ground surface.

### 3.2 Groundwater

Observations for groundwater were made during sampling and upon completion of the drilling operations at each boring location. During this investigation, groundwater was encountered in each of the borings at a depth of 2'0" below the existing ground surface. Groundwater levels at the project site are influenced by tidal changes in the nearby Atlantic Ocean. In addition, variations in the location of the long-term water table may occur as a result of changes in precipitation, major storm events (tropical storms and nor'easters), and other factors not immediately apparent at the time of this exploration.

Based on the groundwater observations and anticipated construction, groundwater will be encountered during construction. Dewatering with sumps and pumps or a well point system will be required for construction.

### 3.3 Summary of Boring Observations

Boring B-1 was performed at East Granada Drive. Boring B-2 was performed at Cartagena Drive. A summary of the boring observations is provided in Table 1 below.

**Table 1 – Summary of Boring Observations**

| Boring No. | Depth of Organic and Soft Soils | Depth to Groundwater |
|---|---|---|
| B-1 | 5'0" to 8'0" | 2'0" |
| B-2 | 5'6" to 10'6" | 2'0" |

## 4.0 EVALUATION

We understand that the planned construction will consist of a new water main crossing an existing lagoon. We also understand that horizontal directional drilling will be used for this project. The depths of the water main and other construction details were not finalized at the time of this report. Recommendations for utilities, excavation protection, groundwater control, backfill of the access pits, and the suitability of the existing site soils for reuse as compacted fill are provided in the following sections of the report.

### 4.1 Utilities

The existing site soils are generally suitable for support of the new water main. However, a layer of soft/loose organic soils was encountered at depths of 5'0" to 8'0" below the existing ground surface in boring B-1 and 5'6" to 10'6" below the existing ground surface in boring B-2. Additional recommendations can be provided regarding the organic layer once the pipe invert elevation has been determined.

Where the water main is installed in an excavated trench, the bottom of the trench should be excavated clean and shaped so a hard bottom is provided for pipe support. If any soft or unsuitable soil conditions are encountered during construction, the unsuitable materials must be removed and replaced with new compacted fill.

In the event that groundwater is encountered or if the trench bottom becomes soft due to the inflow of surface or trapped water, the soft soil shall be removed and the excavation filled with a minimum of six (6) inches of 3/4-inch clean crushed stone to provide a firm base for support of the pipe. Sump pits and pumps should be used to keep the excavations dry.

After the utility is installed, the trench must be backfilled with compacted fill. The fill shall consist of suitable on-site soil or imported sand and gravel. Imported sand and gravel shall contain less than 20% by weight passing a No. 200 sieve. Controlled compacted fill shall be placed in six (6) inch layers and each layer shall be compacted to at least 92% of its Maximum Modified Dry Density (ASTM D1557). The backfill must be free of topsoil and debris.

Based on the boring data, horizontal directional drilling should be feasible at the subject site. Although the subsurface conditions may vary in between the borings, the sandy soils encountered at the site are suitable for directional drilling.

### 4.2 Excavation Protection

We anticipate that access pits will be required in order to perform horizontal directional drilling. The proposed depth of the water main and the access pits was unknown at the time of this report. At the time of our exploration, groundwater was observed in the borings at a depth of 2’0” below the existing ground surface and the excavations for the access pits are expected to extend below the groundwater table.

Where the soil conditions at the bottom of the excavation are saturated, stabilization of the subgrade surface may be required to provide a firm-working surface for the directional drilling equipment. Where required, the subgrade should be stabilized with geotextile filter fabric (Mirafi 500x or equivalent) and crushed stone. An additional cut of 12 to 18 inches may be required to install the geotextile filter fabric and gravel layer at the bottom of the excavation.

We expect that a temporary support system will be required to excavate down to the planned access pit subgrade elevation. Interlocking steel sheet piles or similar engineered earth support system should be used as the shoring method. Depending on the excavation depth, a raker or tieback system may be required to restrain the horizontal force on the walls.

To control groundwater within the excavation, the sheeting should be installed completely around the excavation. The sandy soils and the difference in water head pressure between the inside and outside of the sheeting could cause basal instability or bottom heaving in the excavation. The sheeting designer must take this into consideration and the sheeting must be installed deep enough to prevent bottom heaving. All temporary

and permanent support systems must be designed by a New Jersey State licensed Professional Engineer. The designer should submit the design calculations for the proposed temporary shoring method to Carlin-Simpson & Associates for review.

Temporary construction excavations should be conducted in accordance with the most recent OSHA guidelines or applicable federal, state or local codes. A qualified person should evaluate the excavations at the time of construction to determine the appropriate soil type and allowable slope configuration. Based on the boring data, we believe the site soils and rock would have the following classifications as defined by the OSHA guidelines.

| Soil/Rock Type | Possible Classification | Maximum Slope or Bench |
|---|---|---|
| Existing Fill | Type "C" | 1H:1V |
| Virgin Soil | Type "B" or "C" | 1H:1V to 1½H:1V |

Temporary support (i.e. trench boxes, sheeting and shoring, etc.) should be used for any excavation that cannot be sloped or benched in accordance with the applicable regulations, where necessary to protect adjacent utilities and structures, or where saturated soils or water seepage is encountered within the excavation.

A New Jersey licensed professional engineer must design all temporary and permanent support systems. The contractor will select the shoring type and submit design calculations for the proposed shoring method to Carlin-Simpson & Associates for review. The soil adjacent to the temporary support system will exert a horizontal pressure against the system. This pressure is based on the soil unit weight, coefficient of active earth pressure, and depth of the excavation. Support of Excavation design parameters are listed in Table 2 below.

**Table 2 – Temporary Sheeting and Shoring Design Parameters**

| Stratum – Description | Moist Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Buoyant Unit Wt. (pcf) | Friction Angle (φ, deg) | Cohesion (c, psf) |
|---|---|---|---|---|---|
| 2 – Existing Fill | 120 | 125 | 62.6 | 30 | 0 |
| 3 – Sand or Silty Sand | 125 | 130 | 67.6 | 30 | 0 |
| 4 – Organic Soils | 115 | 120 | 57.6 | 25-26 | 0 |
| 5 – Gravelly Sand | 130 | 135 | 72.6 | 32-33 | 0 |
| 6 – Clay & Silt w/ Sand | 120 | 125 | 62.6 | 30 | 0 |

### 4.3 Groundwater Control

Groundwater was observed in each of the test borings at a depth of 2'0" below the existing ground surface. Groundwater will be encountered in the access pits during construction. Proper groundwater control measures will be required during the construction of the access pits.

The temporary groundwater control measures must be combined with the temporary excavation protection that will be required to construct the access pits. Specifically, steel sheet piling should be installed to "cut-off" the groundwater and sump pits and pumps or a well point system should be installed within the excavation area to pump out any water that seeps into the excavation.

The access pits must be designed to prevent bottom heave and the sheeting designed for hydrostatic pressure. The design groundwater level should be assumed to be 2'0" higher than the groundwater level observed at each boring location to account for flooding and tidal high groundwater conditions.

### 4.4 Backfilling of Access Pits

Upon the completion of the directional drilling and new water main installation, the access pits should be backfilled with suitable on-site soil or imported sand and gravel placed in layers up to one (1) foot in thickness. The new fill should be compacted with small hand guided "jumping jack" tampers or trench compactors to at least 92% of its Maximum Modified Dry Density (ASTM D1557). Some of the material excavated from the access pits will be suitable for reuse as compacted fill provided that it remains relatively dry enough to be adequately compacted to the required density.

### 4.5 Suitability of the In-Situ Soils for Use as Compacted Fill

The suitability of each soil stratum for use as compacted fill is discussed below.

| | |
|---|---|
| **Stratum 1** Asphalt | Asphalt is not suitable for use as compacted fill. During construction, it shall be stripped and removed from the site. |
| **Stratum 2** Existing Fill | The existing fill generally consists of orange brown coarse to fine SAND, trace Silt, little coarse to fine Gravel. The existing fill is generally suitable for reuse re-use as compacted fill in provided that it remains relatively dry for optimum compaction and all debris has been removed prior to its reuse. |
| **Stratum 3** Silty Sand or Sand | The Sand or Silty Sand generally consists of brown, gray brown coarse to fine Sand, trace (to some) Silt, little coarse to fine Gravel. This material is generally suitable for re-use as compacted fill. It should be noted that these soils extend below the groundwater table and will be saturated upon excavation. As a result, these soils must be dried before their reuse as compacted fill. |
| **Stratum 4** Organic Clayey Silt or Silty Sand | The organic soils generally consist of black Organic Clayey Silt, little medium to fine Sand with plant fibers and peat, or loose dark brown coarse to fine SAND, some Silt, trace fine Gravel with plant fibers. These soils are unsuitable for reuse as compacted fill. |
| **Stratum 5** Gravelly Sand | The Gravelly Sand generally consists of brown, light gray coarse to fine SAND, trace Silt, little (to and) coarse to fine Gravel. This material is |

generally suitable for re-use as compacted fill. It should be noted that these soils extend below the groundwater table and will be saturated upon excavation and must be dried before use as compacted fill.

**Stratum 6** Sandy Clay and Silt — The Sandy Clay and Silt generally consist of CLAY and SILT or SILT and CLAY trace (to little), medium to fine Sand. This material is unsuitable for reuse as compacted fill due to it's high fines content.

The boring observations indicate that the on-site soils contain a low to high percentage of silt (3.3% to 80%). The moderate to high silt content soils will be moisture sensitive. If the soil becomes too wet, it will be difficult to achieve adequate compaction. In addition, the site soils that extend below the groundwater table are completely saturated and therefore, will require drying before reuse as compacted fill.

Proper moisture conditioning of the soil will be required. New compacted fill should be within 2% (+/-) of its optimum moisture content at the time of placement. In the event that the on-site material is too wet at the time of placement and cannot be adequately compacted, the soil should be aerated and allowed to dry or the material removed and a drier cleaner fill material used. In the event that the on-site material is too dry at the time of placement and cannot be adequately compacted, water may be needed to increase the soil moisture content for proper compaction.

The in-situ soils which exist throughout the site may become soft and weave if exposed to excessive moisture and construction traffic. The instability will occur quickly when exposed to these elements and it will be difficult to stabilize the subgrade. We recommend that adequate site drainage be implemented early in the construction schedule and if the subgrade becomes wet, the contractor should limit construction activity until the soil has dried.

## GENERAL

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our site work and should not be relied on to represent conditions at later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific boring locations during the study and our past experience. If additional information becomes available that might impact our geotechnical opinions, it will be necessary for Carlin-Simpson & Associates to review the information, reassess the potential concerns, and re-evaluate our conclusions and recommendations.

Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between borings will differ from those encountered at specific boring locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process have altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

The professional opinions presented in this geotechnical report are not final. Field observations and foundation installation monitoring by a qualified geotechnical engineer, as well as soil density testing and other quality assurance functions associated with site earthwork and foundation construction, are an extension of this report. Therefore, either Carlin-Simpson & Associates or a qualified geotechnical engineering firm should be retained by the Owner to observe all earthwork and foundation construction, to document that the conditions anticipated in this study actually exist, and to finalize or amend our conclusions and recommendations. Carlin-Simpson & Associates is not responsible or liable for the conclusions and recommendations presented in this report, if Carlin-Simpson & Associates does not perform these observation and testing services.

Full time geotechnical related monitoring and testing services shall be provided by a qualified geotechnical engineering firm during construction. These services shall include, but not be limited to, the observation and testing of the following: 1) the proofrolling of the subgrade soil prior to the placement of new compacted fill; and 2) the placement and compaction of controlled fill.

This report has been prepared in accordance with generally accepted geotechnical engineering practice. No other warranty is expressed or implied. The evaluations and recommendations presented in this report are based on the available project information, as well as on the results of the exploration. Carlin-Simpson & Associates should be given the opportunity to review the final drawings and site plans for this project to determine if changes to the recommendations outlined in this report are needed. Should the nature of the project change, these recommendations should be reevaluated.

This report is provided for the exclusive use of Suburban Consulting Engineers, Inc. and the project specific design team and may not be used or relied upon in connection with other projects or by other third parties. Carlin-Simpson & Associates disclaims liability for any such third-party use or reliance without express written permission. Use of this report or the findings, conclusions or recommendations by others will be at the sole risk of the user. Carlin-Simpson & Associates is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations or opinions.

If the conditions encountered during construction vary significantly from those stated in this report, this office should be notified immediately so that additional recommendations can be made.

Thank you for allowing us to assist you with this project. Should you have any questions or comments, please contact this office.

Very truly yours,

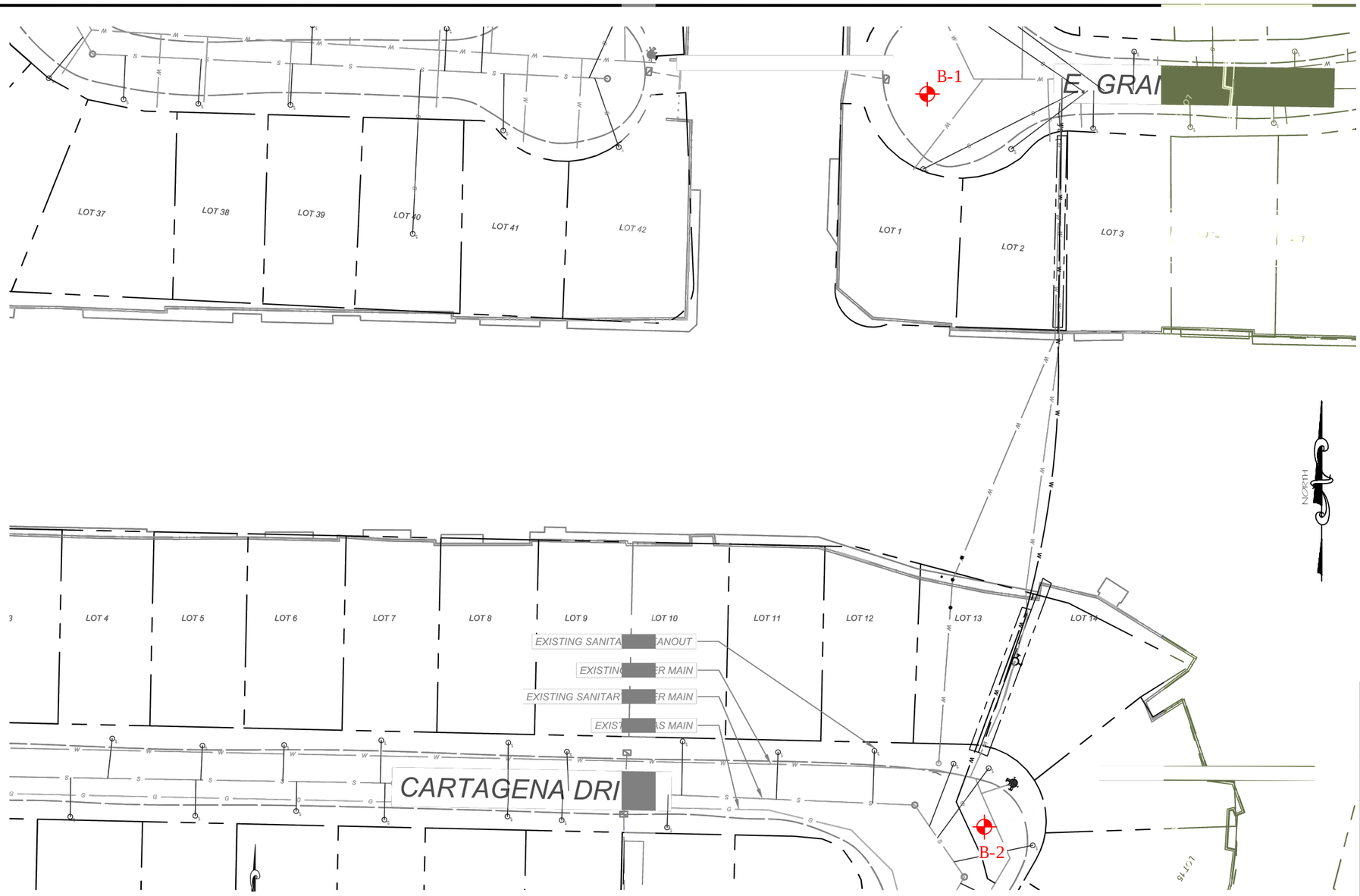
CARLIN-SIMPSON & ASSOCIATES

Stephen Rossi

STEPHEN ROSSI, E.I.T.
Project Manager

ROBERT B. SIMPSON, P.E.

File No. 17-284




GENERAL NOTES:

1. GENERAL LAYOUT WAS OBTAINED FROM A DRAWING THAT WAS PREPARED BY AN UNDATED DRAWING PREPARED BY SUBURBAN CONSULTING.
2. BORING LOCATIONS WERE LAID OUT IN THE FIELD BY CARLIN-SIMPSON & ASSOCIATES (CSA).
3. THE BORING WAS PERFORMED BY GENERAL BORINGS INC. ON 31 JANUARY 2018 UNDER THE FULL TIME INSPECTION OF CSA.
4. LOCATIONS ARE APPROXIMATE.

LEGEND:

- BORING LOCATION

**ROBERT B. SIMPSON, P.E.**
**PROFESSIONAL ENGINEER**

LICENSE NO. | SIGNATURE | DATE

# BORING LOCATION PLAN

PROPOSED LAGOON CROSSING
CARTAGENA DRIVE & EAST GRANADA DRIVE
BRICK, NEW JERSEY

| | |
|---|---|
| DRAWN: SR | SCALE: 1" = 60' |
| CHECKED: RBS | DATE: 6-MAR-18 |
| PROJECT NO.: 17-284 | DWG NO.: FIG - 1 |
| APPROVED: | |

CARLIN-SIMPSON AND ASSOCIATES
61 Main Street
Sayreville, NJ 08872

Consulting Geotechnical and Environmental Engineers

| CARLIN - SIMPSON & ASSOCIATES Sayreville, N.J. | | | | | TEST BORING LOG | | | | | BORING NUMBER B-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Project: Prop. Lagon Crossing, Project #717002, E. Granada Dr, Brick, NJ | | | | | | | | | | SHEET NO.: 1 of 2 |
| Client: Suburban Consulting Engineers, Inc | | | | | | | | | | JOB NUMBER: 17-284 |
| Drilling Contractor: Environmental Technical Drilling | | | | | | | | | | ELEVATION: |
| GROUNDWATER | | | | | | CASING | SAMPLE | CORE | TUBE | DATUM: |
| DATE | TIME | DEPTH | CASING | | TYPE | HSA | SS | | | START DATE: 31-Jan-18 |
| 31-Jan-18 | 1200 | 2'0" | HSA | | DIA. | 3 1/4" | 1 3/8" | | | FINISH DATE: 31-Jan-18 |
| | | | | | WGHT | | 140# | | | DRILLER: VINNY |
| | | | | | FALL | | 30" | | | INSPECTOR: SR |

| Depth (ft.) | Casing Blows per Foot | Sample Number | Blows on Sample Spoon per 6" | Sym | IDENTIFICATION | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | **Asphalt** 0'6" | |
| 1 | | | | | **Dark brown coarse to fine SAND, some** | |
| | | | 3 | | **Silt, little coarse to fine Gravel** | |
| 2 | | **S-1** | 4 | | Dr br cf S, s $, l cf G | Rec = 13" |
| | | | 3 | | | moist to wet |
| 3 | | | 5 | | 3'0" | |
| | | | 4 | | | |
| 4 | | **S-2** | 5 | | Br cf S, t $, l cf G | Rec = 15" |
| | | | 3 | | **Brown coarse to fine SAND, trace Silt,** | wet |
| 5 | | | 3 | | **little coarse to fine Gravel** 5'0" | |
| | | | 2 | | | |
| 6 | | **S-3** | 1 | | Bk O Cy $ l, mf S, w/plant fibers | Rec = 18" |
| | | | 1 | | **Black Organic CLAYEY SILT little,** | wet |
| 7 | | | 1 | | **medium to fine Sand, with plant fibers** | |
| | | | 1 | | | |
| 8 | | **S-4** | 2 | | same 8'0" | Rec = 16" |
| | | | 9 | | Br cf S, t $, a cf G | wet |
| 9 | | | 12 | | | |
| 10 | | | | | | |
| | | | 10 | | | |
| 11 | | **S-5** | 10 | | same | Rec = 20" |
| | | | 13 | | | wet |
| 12 | | | 15 | | | |
| | | | 13 | | | |
| 13 | | **S-6** | 13 | | same | Rec = 22" |
| | | | 15 | | **Brown coarse to fine SAND, trace Silt,** | wet |
| 14 | | | 20 | | **and coarse to fine Gravel** | |
| | | | | | | |
| 15 | | | | | | |
| | | | 6 | | | |
| 16 | | **S-7** | 6 | | Lt Gr cf S, t $, l cf G | Rec = 20" |
| | | | 12 | | | wet |
| 17 | | | 15 | | | |
| | | | | | | |
| 18 | | | | | | |
| | | | | | | |
| 19 | | | | | | |
| | | | | | | |
| 20 | | | | | | |
| | | | 11 | | | |
| 21 | | **S-8** | 13 | | same | Rec = 22" |
| | | | 16 | | | wet |
| 22 | | | 20 | | | |

| CARLIN - SIMPSON & ASSOCIATES Sayreville, N.J. | TEST BORING LOG | BORING NUMBER B-1 |
|---|---|---|
| **Project:** | **Prop. Lagon Crossing, Project #717002, E. Granada Dr, Brick, NJ** | **SHEET NO.:** 2 of 2 |
| **Client:** | **Suburban Consulting Engineers, Inc** | **JOB NUMBER:** 17-284 |

| Depth (ft.) | Casing Blows per Foot | Sample Number | Blows on Sample Spoon per 6" | Sym | IDENTIFICATION | | REMARKS |
|---|---|---|---|---|---|---|---|
| 23 | | | | | | | |
| 24 | | | | | **Light gray coarse to fine SAND, trace Silt, little coarse to fine Gravel** | | |
| 25 | | | | | | | |
| 26 | | **S-9** | 6<br>4 | | Lt gr cf S, t $, l cf G | 26'0" | Rec = 20" |
| 27 | | | 6<br>7 | | Gr C & $, t mf S | | wet |
| 28 | | **S-10** | 5<br>5 | | **Gray CLAY and SILT, trace medium to fine Sand** same | | Rec = 22" |
| 29 | | | 8<br>15 | | **Gray varved CLAYEY SILT** | 28'6"<br>29'0" | wet |
| 30 | | | | | **End of Boring @ 29'0"** | | |
| 31 | | | | | | | |
| 32 | | | | | | | |
| 33 | | | | | | | |
| 34 | | | | | | | |
| 35 | | | | | | | |
| 36 | | | | | | | |
| 37 | | | | | | | |
| 38 | | | | | | | |
| 39 | | | | | | | |
| 40 | | | | | | | |
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| 44 | | | | | | | |
| 45 | | | | | | | |
| 46 | | | | | | | |
| 47 | | | | | | | |

| CARLIN - SIMPSON & ASSOCIATES Sayreville, N.J. | | | | | TEST BORING LOG | | | | | BORING NUMBER B-2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Project: Proposed Lagon Crossing, Project #717002, Cartagena Dr., Brick, NJ | | | | | | | | | | SHEET NO.: 1 of 2 |
| Client: Suburban Consulting Engineers, Inc | | | | | | | | | | JOB NUMBER: 17-284 |
| Drilling Contractor: Environmental Technical Drilling | | | | | | | | | | ELEVATION: |
| GROUNDWATER | | | | | | CASING | SAMPLE | CORE | TUBE | DATUM: |
| DATE | TIME | DEPTH | CASING | | TYPE | HSA | SS | | | START DATE: 31-Jan-18 |
| 31-Jan-18 | 0845 | 2'0" | HSA | | DIA. | 3 1/4" | 1 3/8" | | | FINISH DATE: 31-Jan-18 |
| | | | | | WGHT | | 140# | | | DRILLER: VINNY |
| | | | | | FALL | | 30" | | | INSPECTOR: SR |

| Depth (ft.) | Casing Blows per Foot | Sample Number | Blows on Sample Spoon per 6" | Sym | IDENTIFICATION | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | **Asphalt** 0'6" | |
| 1 | | | | | **FILL (Orange brown coarse to fine SAND, trace Silt, little coarse to fine Gravel)** | |
| | | | 7 | | | |
| 2 | | **S-1** | 11 | | FILL (Or br cf S, t $, l cf G) 2'0" | Rec = 16" |
| | | | 9 | | Gr br cf S, t $, l cf G | moist to wet |
| 3 | | | 9 | | | |
| | | | 6 | | **Gray brown coarse to fine SAND,** | |
| 4 | | **S-2** | 6 | | same **trace Silt, little coarse to fine** | Rec = 18" |
| | | | 5 | | **Gravel** | wet |
| 5 | | | 5 | | | |
| | | | 3 | | same 5'6" | |
| 6 | | **S-3** | 1 | | Bk O Cy $, w/Peat | Rec = 16" |
| | | | 1 | | **Black Organic CLAYEY SILT, with Peat** | wet |
| 7 | | | 1 | | | |
| | | | 1 | | same 7'6" | |
| 8 | | **S-4** | 1 | | Dk br cf S, s $, t f G, w/plant fibers | Rec = |
| | | | 1 | | | |
| 9 | | | 3 | | **Dark brown coarse to fine SAND,** | |
| | | | | | **trace fine Gravel, with plant fibers** | |
| 10 | | | | | | |
| | | | 3 | | same 10'6" | |
| 11 | | **S-5** | 6 | | Br cf S, t $, l (+) cf G | Rec = 19" |
| | | | 12 | | | wet |
| 12 | | | 12 | | | |
| | | | 11 | | | |
| 13 | | **S-6** | 10 | | same, s (+) cf G | Rec = 20" |
| | | | 10 | | | wet |
| 14 | | | 14 | | | |
| | | | | | | |
| 15 | | | | | | |
| | | | 8 | | **Brown coarse to fine SAND,** | |
| 16 | | **S-7** | 10 | | same **little Silt, little (+) coarse to** | Rec = 14" |
| | | | 10 | | **fine Gravel** | wet |
| 17 | | | 7 | | | |
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| 18 | | | | | | |
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| 19 | | | | | | |
| | | | | | | |
| 20 | | | | | | |
| | | | 9 | | | |
| 21 | | **S-8** | 7 | | same | Rec = 13" |
| | | | 9 | | 21'6" | wet |
| 22 | | | 15 | | Gr $ & C t, mf S | |

| CARLIN - SIMPSON & ASSOCIATES Sayreville, N.J. | TEST BORING LOG | BORING NUMBER B-2 |
|---|---|---|
| **Project:** | **Proposed Lagon Crossing, Project #717002, Cartagena Dr., Brick, NJ** | **SHEET NO.:** 2 of 2 |
| **Client:** | **Suburban Consulting Engineers, Inc** | **JOB NUMBER:** 17-284 |

| Depth (ft.) | Casing Blows per Foot | Sample Number | Blows on Sample Spoon per 6" | Sym | IDENTIFICATION | | REMARKS |
|---|---|---|---|---|---|---|---|
| 23 | | | | | | | |
| 24 | | | | | **Gray SILT and CLAY trace, medium to fine Sand** | | |
| 25 | | | | | | | |
| 26 | | **S-9** | 5<br>4 | | Br cf S, t $, t cf G | 26'0" | Rec = 17" |
| 27 | | | 6<br>4 | | Gr C & $ l, mf S | | wet |
| 28 | | **S-10** | 6<br>9 | | same **Gray CLAY and SILT little, medium to fine Sand** | | |
| 29 | | | 9<br>13 | | | 29'0" | |
| 30 | | | | | **End of Boring @ 29'0"** | | |
| 31 | | | | | | | |
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