March 8, 2017

Subject: Sealed Bid 17-00010-AMZK

Dear Sir/Madam:

Attached is the AGES/Geotechnical Report dated March 2016.

This information is not a part of the Contract or any Addenda. This is provided for informational purposes only and is to be used at your own risk.

Sincerely,

Marian Keating
Contract Administrator
Procurement, Supply Chain & DBE Division

mzk/attachment

Cc: G. Morris
    L. McCray
    C. McInnes
    J. Coombs
FOR DESIGN PURPOSES ONLY

GEOTECHNICAL ENGINEERING REPORT

SEPTA 103 VICTORY AVENUE REDEVELOPMENT
UPPER DARBY TOWNSHIP, DELAWARE COUNTY,
 PENNSYLVANIA

Prepared for
Southeastern Pennsylvania Transportation Authority (SEPTA)

and

Pennoni
Philadelphia, Pennsylvania

Prepared by
American Geotechnical & Environmental Services, Inc.
King of Prussia, Pennsylvania

MARCH 2016
A.G.E.S., INC. PROJECT NO. 15046
March 31, 2016

Mr. James P. Markham, P.E.
Associate Vice President
Pennoni
One Drexel Plaza
3001 Market Street, 2nd Floor
Philadelphia, Pennsylvania 19104

Re: Geotechnical Engineering Report
Southeast Pennsylvania Transportation Authority (SEPTA)
SEPTA – 103 Victory Avenue Redevelopment
SEPTA Work Order No: 860-5129
Upper Darby Township, Delaware County, Pennsylvania
A.G.E.S. Project No. 15046

Dear Mr. Markham:

American Geotechnical & Environmental Services (A.G.E.S.), Inc. is pleased to present our Geotechnical Engineering Report for the above referenced project. This report contains the data obtained from the drilling and laboratory testing programs and an evaluation of the existing materials as foundation bearing materials for the buildings and retaining walls.

We wish to extend our appreciation for this opportunity to be of service to you. Should you have any questions, or require additional information, please contact us.

Very truly yours,

American Geotechnical & Environmental Services, Inc.

Patrick Pendergast
Geologic Specialist

Michael Giovannitti, P.E.
Senior Geotechnical Engineer
Branch Manager
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1.0 INTRODUCTION

1.1 Purpose of Investigation

The objective of this investigation was to evaluate the engineering characteristics and distribution of the subsurface soils, bedrock, and groundwater at the site. Based on this evaluation, geotechnical design parameters for the recommended foundations are provided. The general location of the project is in Upper Darby Township, Delaware County, Pennsylvania as shown in Figure 1.

1.2 Scope of Investigation

The scope of work performed during this investigation consisted of the following:

- Reviewed the available geologic, soils, and topographic literature for the project location.
- Reviewed boring logs from a previous subsurface exploration conducted on the property.
- Conducted a geologic field reconnaissance of the project location to identify surface features that may have an impact on the construction of the proposed buildings and retaining walls.
- Provided a PennDOT certified inspector to log visual classifications of the soil and rock cores.
- Drilled eighteen (18) borings to obtain information on the subsurface conditions and collected samples for laboratory testing;
- Completed laboratory tests on selected samples;
- Interpreted the subsurface data and prepared geologic cross-sections at the as-drilled boring locations;
• Evaluated the suitability of the existing subsurface material for building and retaining wall foundations, floor slab, and pavement support;

• Prepared this report, documenting the data collected and analyses performed and provided relevant foundation design parameters and site preparation criteria.

1.3 Proposed Construction

The general location of the proposed construction is shown on Figure 1. The proposed construction consists of a two-story 30,801 square foot shops building and a two-story 12,346 square foot administration building. Proposed site grading will require a retaining wall running along the south and west side of the project area. The proposed construction will also include parking and driveway areas, and a salt dome.

Conceptual plans showing the proposed location of the buildings, retaining walls, parking and driveway areas, and salt dome at the project location are provided in Appendix A.
2.0 SUBSURFACE INVESTIGATION

2.1 Drilling Program

A subsurface investigation consisting of eighteen (18) test borings conducted to identify subsurface conditions and collect soil and rock samples for laboratory testing. The boring locations were selected by American Geotechnical & Environmental Services (A.G.E.S.), Inc., and staked by Pennoni prior to drilling. The as-drilled locations are provided on the Boring Location Plan in Appendix B. The borings were completed by Allied Well Drilling, Inc. between January 18, 2016 and February 12, 2016. A.G.E.S, Inc. provided the services of a PennDOT certified boring inspector for the duration of the drilling operations to log the samples immediately after their acquisition and to delineate changes in the soil and rock strata encountered. The results of the subsurface exploration are summarized in Table 1.

Each boring was advanced continuously using a 2-inch O.D. split-spoon sampler and hollow stem augers to the specified depth or until auger refusal. In certain situations where hollow stem auger had difficulty advancing, 3-inch flush joint spin casing was used in its place. The split-spoon sampler was driven 18 inches using a 140-pound hammer falling 30 inches. Blows required to drive the sampler each 6-inch increment were recorded. The first 6-inch interval is to penetrate loose soil disturbed by the advancing auger. The cumulative number of blows required to drive the sampler through the last two 6-inch increments is designated as the Standard Penetration Resistance. Penetration resistance provides an indication as to the in-place relative density of granular soils and the consistency of fine-grained soils. Relative densities and consistencies are an indication of the shear strength and compressibility of the soils. Penetration resistance values along with our visual identification of the soils with the laboratory test results are included on the Engineer’s Field Boring Logs in Appendix C.

Continuous bedrock core samples were obtained using an NQ core barrel with a solid inner barrel. All rock samples were visually identified and core recovery and Rock Quality Designations (RQD) were measured in the field by the inspector. The description of the bedrock along with percentage core recoveries and RQD values are presented on the Engineer’s Field Boring Logs in Appendix C. The depth at which groundwater was initially encountered was noted on the logs. Groundwater levels
were generally measured in each boring immediately after its completion and approximately 24 hours afterwards. The borings were backfilled with a cement grout after the final level water reading except for borings completed on the final day of drilling or where groundwater was not encountered which were grouted upon completion. Groundwater readings are presented on the Engineer’s Field Boring Logs in Appendix C.

2.2 Previously Drilled Borings

A subsurface investigation was conducted in October 2014 at the project location. The borings were drilled by Allied Well Drilling and the Inspection and Engineering was done by Fidelis Engineering. Five (5) borings (Borings B-3, B-4, B-5, B-6, and B-7) were drilled near the proposed structures and referenced in this report. Each of these borings was terminated at auger refusal and no rock samples were obtained. Auger refusal ranged from 10 to 14 feet. The material described in Borings B-3 through B-7 was generally silty sand. Copies of the borings logs are presented in Appendix D.
3.0 LABORATORY TESTING

A laboratory soils testing program was conducted to provide information regarding the engineering characteristics of the existing soils and rock. The results of the testing are presented on the boring logs in Appendix C, the laboratory test reports in Appendix D, and summarized in Table 2.

3.1 Moisture Content Tests

Moisture content tests were conducted on sixteen (16) jar samples in accordance with ASTM Method D 2216-92 and are expressed as the ratio of the weight of water to the weight of the dry solids. Results of the tests indicate the natural moisture content varies from 4.5 to 19.4 percent. The moisture contents are representative of the conditions at the time of drilling. Variations in the soil moisture contents can be expected depending upon seasonal precipitation and local conditions.

3.2 Classification Tests

Gradation and Atterberg Limits tests are used as the basis for classifying both granular and fine-grained soils. Gradation tests consisting of sieve and hydrometer tests were conducted in accordance with ASTM Method D422-63, and the Atterberg Limits tests were conducted in accordance with ASTM Method D 4318-83. A total of sixteen (16) composite jar samples from the borings were tested. Based on the particle size distribution test results, the soils were primarily classified as silty sands with variable amounts of gravel (sm).

3.3 Unconfined Compression Test

Ten (10) Unconfined Compression strength tests were performed in accordance with ASTM Method D-7012 on rock samples obtained from the test borings in order to characterize the strength of the underlying bedrock. The unconfined compression tests indicate a strength ranging from 2,694 to 23,209 pounds per square inch.
3.4 Corrosion Testing

Corrosion testing on soil was conducted to determine if the existing soils are a corrosive environment to steel and concrete. One (1) corrosion test was conducted on a bag sample collected from Boring T-2. The testing includes pH, sulfate, chloride, and resistivity. These test results will allow for the determination as to whether corrosion protection is required for the proposed foundations based on the requirements of Section 10.7.5 of AASHTO LRFD Bridge Design Specifications. Section 10.7.5 indicates a corrosive environment if soil has a resistivity less than 2,000 ohm-cm, pH less than 5.5, pH between 5.5 and 8.5 in soils with high organic content, and sulfate concentrations greater than 1,000 ppm. The results of the corrosion testing indicate the soil is not a corrosive environment based on the criteria outlined above.
4.0 SUBSURFACE CONDITIONS

The intent of this section is to discuss the specific subsurface conditions at the proposed structure locations. Refer to the Boring Location Plan included in Appendix B and the summary of the subsurface conditions presented in Table 1. Generalized Subsurface Cross-Sections are also provided in Appendix B.

4.1 Proposed Shops Building

A total of seven (7) borings (Borings SB-1, SB-2, SB-3, SB-5, SB-6, SB-8, and SB-9) were drilled for the proposed shops building. One (1) previously drilled boring (Boring B-3) from October 2014 was also drilled within the footprint of the existing structure. Asphalt pavement and existing building structures cover most of the existing ground surface at the Shops Building location.

Fill material was encountered below the pavement in each of the borings and varied in thickness from 1.0 to 8.0 feet. The fill material generally consists loose to medium dense sand and gravel, little silt. Residual soils were encountered beneath the fill material and ranged in thickness from 2.5 to 9.1 feet. The residual soils consisted of medium to very dense sand, some silt with variable amounts of gravel.

Top of rock was encountered in Borings SB-1, SB-2, SB-3, SB-5, SB-6, SB-8, and SB-9 at elevations ranging from 78.9 to 97.2 feet. Bedrock generally consisted of gneiss, and is medium hard to very hard. Percent recoveries of the bedrock varied from 20 to 100 percent while the strata RQD values varied from 0 to 87 percent. Hardness generally increases with depth. The disparities in depths to bedrock, recovery and RQD values are attributed to the differential weathering throughout the rock strata.

4.2 Proposed Administration Building

A total of four (4) borings (SB-7, SB-8, SB-10, and SB-11) were drilled for the proposed administration building. Two (2) previously drilled borings from October 2014 (Borings B-5 and B-6) were drilled within the footprint of the proposed structure.
Fill material was encountered at the surface of each of the borings and varied in thickness from 1.5 to 4.5 feet. The fill material generally consists of loose to medium dense sand and gravel, little silt. Residual soils were encountered beneath the fill material and ranged in thickness from 4.3 to 10.7 feet. The residual soils consisted of medium to very dense sand, some silt with variable amounts of gravel.

Top of rock was encountered at elevations ranging from 90.8 to 102.9 feet. Bedrock generally consisted of gneiss, and is described as medium hard to very hard. Percent recoveries of the bedrock varied from 2 to 100 percent while the strata RQD values varied from 0 to 62 percent. Hardness generally increases with depth. The disparities in depths to bedrock, recovery and RQD values are related to the differential weathering throughout the rock strata.

### 4.3 Proposed Retaining Wall

A total of six (6) borings (SB-4, SB-7, SB-10, SB-11, SB-12 and SB-13) were drilled for the proposed retaining wall. The subsurface conditions at the proposed wall locations consist of fill material underlain by residual soils and bedrock.

Fill material was encountered at the surface of each of the borings and varied in depth from 1.5 to 4.5 feet below ground surface. The fill material consists of loose to medium sand gravel and gravel with variable amounts of clay. Residual soils were encountered beneath the fill material and ranged in thickness from 5.1 to 11.0 feet. The residual soils consisted of medium to very dense sand, some silt with variable amounts of gravel.

Top of rock was encountered at an elevation ranging from 90.8 to 102.9 feet. Bedrock generally consists medium hard to very hard gneiss. Percent core recoveries of the bedrock varied from 2 to 100 percent while the strata RQD values varied from 0 to 90 percent. Hardness generally increases with depth. The disparities in depths to bedrock, recovery and RQD values are related to the differential weathering throughout the rock strata.
4.4 Proposed Salt Dome

One (1) boring (SB-14/SB-14A) was drilled for the proposed Salt Dome structure. An offset boring (Boring SB-14A) was necessary to continue the boring (Boring SB-14) due to an obstruction. The subsurface conditions at the salt dome consisted of a thin fill layer beneath a thin veneer of pavement. The fill layer is 5.0 feet thick. The fill is underlain by 7.6 feet of loose to very dense residual soils which derive from weathered bedrock. The bedrock at the salt dome was schist belonging to the Wissahickon Formation. The depth to bedrock is 10.6 feet (Elevation 84.4 feet). Core recovery percentages ranged from 40 to 100 percent. The low recovery was in the first run and is likely due to a higher degree of weathering in the top two feet of bedrock. The percentage of RQD in the bedrock ranged from 0 to 52 percent.
5.0 EVALUATION OF SUBSURFACE CONDITIONS

5.1 Soil and Bedrock Conditions

Subsurface conditions at the project location exhibit a loose to medium dense fill layer ranging in thickness from 1.0 feet to 8.0 feet. The fill is underlain by medium dense to very dense residual material ranging in thickness from 1.5 feet to 11.0 feet.

Based on the proposed site grading, the Shops Building will be supported on existing and proposed fill. Based on the borings, the fill soils were likely placed with some compaction effort or have densified because they are generally in a dense to medium dense state. The average standard penetration value of the fill at the Shops Building is approximately 24. Accordingly, the fill soils likely provide adequate support for foundations but can expose the proposed Shops building to differential movement and cracking of walls and floor slabs. A reduced allowable bearing pressure is recommended for the fill soils so that differential settlement of the building is minimized. It is assumed that soft soils encountered in the excavations for the foundations and floor slabs will be removed and replaced with properly compacted granular material.

The Administration Building will be bearing on residual soil or bedrock. The residual soil material is medium to very dense granular material derived from the weathering of the underlying bedrock. This material should provide adequate support and limited susceptibility to differential settlement from loading from continuous strip footings. If soft residual soils are encountered at the foundation elevation, they should be undercut and replaced with properly compacted granular material to ensure the building is not subject to differential settlement.

At the salt dome, the foundations will likely be bearing on fill based on the proposed site grading and the boring drilled at the structure’s location. Loads at the salt dome are expected to be somewhat large if filled to capacity with salt so settlement is a design concern; particularly the floor slab that will be supporting the salt. Therefore, the existing fill should be overexcavated and backfilled with properly compacted coarse aggregate to ensure the floor slab and walls are properly supported and do not settle significantly.
5.2 Groundwater

Based on Borings SB-1 through SB-14 at the proposed facility, groundwater reading levels varied from an elevation of 86.7 feet to 107.2 feet immediately after completion of the boring and, from an elevation of 84.9 feet to 100.4 feet at 24 hours or more after the completion of drilling. Shallow water readings were generally recorded on the west side of the project location. Therefore, due to the variable groundwater elevations, it is expected that groundwater may be encountered during the foundation excavations. Drainage should be installed below floor slabs and behind the retaining walls to outlet water and prevent buildup of water pressure. Water is likely to pond in cut locations where rock is shallow unless positive surface drainage is provided.

5.3 Seismic Site Classification

In accordance with Section 20 of ASCE Standard ASCE/SEI 7-10, the existing subsurface conditions are classified as Site Class C.

5.4 Settlement

As discussed in Section 5.1, allowable bearing pressures for the Shops Building have been reduced to ensure the fill soils can support the applied foundation pressures but also minimize differential settlement between the foundations. Total settlement at the Administration Building is less of a concern because it will be constructed in a cut and the foundations will be bearing on very dense residual soil, weathered bedrock, or intact rock. Differential settlement could be a concern if localized areas of soft residual soils are encountered in the foundation excavations. In this case, the soft soils should be overexcavated and replaced with properly compacted coarse aggregate.

5.5 Retaining Wall

5.5.1 Selection of Wall Type

The proposed retaining wall is to be constructed in a cut. The portion of the wall adjacent to Victory
Avenue is expected to require top-down construction because space is not available to provide a temporary cut and construct the wall from the bottom-up. Based on the existing plans and staging, it may be possible to provide a temporary cut slope to construct the portion of the wall adjacent to the access driveway. In this case, a wall constructed from bottom-up could be feasible. Otherwise, a wall type constructed from the top-down is feasible. It is typical to use the same type of wall throughout a construction project for convenience to the Contractor.

Top-down walls usually consist of soldier pile and lagging or sheet pile walls. It is our opinion that a sheet pile wall will not be feasible because shallow bedrock will prevent driving sheet piles to an adequate depth to provide stability. Also, it is assumed that based on a maximum exposed height of about 12 feet, anchors will not be required to provide wall stability for a soldier beam and lagging wall. Installation of anchors would require an easement below Victory Avenue and additional considerations for impacts to adjacent underground utilities.

For the portion of the wall along the access driveway and where it is possible to install temporary cuts, conventional cast-in-place concrete, mechanically stabilized earth (MSE), precast modular wall, or similar walls constructed from the bottom-up are considered feasible. Alternatively, temporary shoring could be installed in lieu of the temporary cut slope, but it is our opinion temporary shoring is more costly than temporary cut slopes.

5.5.2 Global Stability

The retaining wall will be constructed in a cut and bedrock will be encountered at or just below the dredge line of the wall. Therefore, global stability of the wall is not a significant concern because there is a very little pathway for failures surfaces to extend from behind the wall and between the bottom of the wall and the top of rock. Live load surcharges due to traffic or other conditions should be included in the analyses for the wall stability.

5.5.3 Foundations

Foundations for soldier beam and lagging walls generally consists of drilled shafts. Drilled shaft lengths should be sized based on the stability analyses and deflection criteria. It is assumed that the
drilled shafts will drilled into bedrock. Soldier beams should not be driven because the passive resistance required for the wall stability will require the full width of a drilled shaft socketed into bedrock. Gneiss bedrock should provide adequate support for drilled shafts because axial loads for unanchored soldier beams generally are low and therefore do not control design.
6.0 RECOMMENDATIONS FOR DESIGN PURPOSES

Based on our evaluation of subsurface conditions, A.G.E.S., Inc. presents the following recommendations as general guidelines to be utilized in the design of the proposed structures.

6.1 Site Preparation

- Remove/strip any topsoil, pavement, and unsuitable soils from the proposed building and retaining wall locations and areas to receive pavement or fill. The Contractor should expect debris such as brick, wood, metal, trash, or concrete in the existing fill soils. Large debris is considered unsuitable for foundation support or reuse as fill which will support pavement or structures.

- Proof-roll all exposed subgrade areas that are to receive fill outside the buildings’ footprints. Specific recommendations for the preparation of existing soils within the buildings’ footprints are provided in Section 6.2 below. Have a geotechnical engineer evaluate any loose/soft areas detected by the proof-rolling. Overexcavate any unsuitable material encountered to a maximum depth of three (3) feet or as directed by the Owner’s Representative and backfill the overexcavation with approved material.

- Place all fill in 8-inch loose lifts, and compact to 97 percent of maximum dry density at plus or minus 2 percent of the optimum moisture content as determined by the Standard Proctor compaction test (ASTM D698). The upper one (1) foot shall be compacted to 100 percent of the maximum dry density.

- All fill should be well graded, inert, free of any degradable or deleterious material, and should not contain particles larger than 6 inches in maximum dimension. If the lift thickness is reduced, a corresponding reduction should be made in the maximum allowable particle dimension.

- The excavated on-site materials are suitable for use as fill except for topsoil, frozen soil,
organic soils, millings, slag, coal, construction debris, or large boulders. Moisture conditioning of the excavated materials may be required to achieve the required degree of compaction.

- Design temporary cut or fill slopes to have a minimum factor of safety of 1.3 against failure. All cut and fill construction shall be in accordance with the Occupational Safety and Health Administration (OSHA) Excavation and Trenching Standards. A registered professional engineer shall perform slope stability analysis when required by OSHA.

- The Contractor should be made aware that gneiss bedrock could be encountered in excavations; particularly excavations associated with the Administration Building and retaining walls. Gneiss bedrock can be hard and difficult to excavate with standard rock ripping equipment.

- Direct surface run-off away from excavations. The Contractor is responsible for providing sufficient dewatering so that the excavations are dry enough to be inspected by the Owner’s Representative. Fill or proposed foundations must not be constructed over wet areas or standing water.

### 6.2 Foundations

Proposed site grading suggests a significant cut will be required construct the administration building. The bearing stratum of the two buildings is expected to vary significantly as the shops building will be constructed on existing fill and residual soil and the administration building will be bearing on rock, weathered bedrock, and residual soil. Therefore, separate foundation recommendations are provided for each of the building areas. During construction, an owner’s representative should thoroughly inspect the excavations and verify the subsurface conditions are similar to those used as the basis of the foundation recommendations.

Loading for the proposed building has not been formally developed. Our recommendations are based on generally lightly loaded two-story buildings. The structural designer is responsible for providing dimensions of foundations to support the loading.
Bearing stratum of the foundations is based on a finished floor elevation of 101.0 feet for the Shops Building and 102.0 feet for the Administration Building.

6.2.1 Shops Building

Based on a preliminary finished floor elevation of 101.0 feet, the foundations are expected to bear on new or existing fill, but residual soil will be encountered in the southwest corner of the proposed structure based on the subsurface conditions encountered in Borings SB-5, SB-8, and B-3.

- Remove existing building structures where they interfere with proposed construction. Remove existing foundations to at least 3 feet below proposed bottom of footing elevations. Backfill excavations with properly compacted granular material. Groundwater may be encountered in excavations.

- Remove/strip pavement and unsuitable soils at the ground surface. Before placing fill to bring the building pad to the subgrade elevation of the finished floor, prepare the existing soils by proof-rolling the existing ground to identify areas of soft or loose material. Soft or loose soils should then be removed to a depth of no greater than three (3) feet. Backfill the overexcavations with properly compacted granular material. The surface soils should then be thoroughly densified with a vibratory roller compactor.

- After preparation of the existing surface soils, place properly compacted granular embankment material to the subgrade elevation of the proposed finished floor elevation of about 101.0 feet.

- After placing fill to floor slab subgrade elevation and bringing the remainder of the site to final proposed ground elevations, excavate for the proposed foundations.

- Use continuous (strip) footings to support the wall loads. Design the continuous strip footings for a maximum allowable foundation pressure of 2,500 psf. Similarly, interior or exterior columns should be supported by a minimum of four (4) feet by four (4) wide footings with a maximum allowable foundation pressure of 2,500 psf.
• Portions of the building may encounter very dense residual soil or weathered bedrock. Where residual soil is encountered at the proposed bottom of footing elevations, the footings should be supported on at least two (2) feet of coarse aggregate. The coarse aggregate should extend at least one (1) foot beyond the edges of the footing. Coarse aggregate should consist of AASHTO No. 57 or approved equivalent. Coarse aggregate is intended to reduce the stiffness of the bearing stratum to minimize differential settlement between foundations bearing of fill.

• Place the bottom of all foundations a minimum of thirty-six (36) inches below the finished grade to protect against heave due to frost penetration.

• Provide drainage below the base of the floor slab.

6.2.2 Administration Building

Based on a preliminary finished floor elevation of 102.0 feet, the foundations are expected to be constructed in a cut so the foundations will likely bear on weathered rock, residual soil, or intact rock.

• Excavate to the proposed finished floor elevation at the Administration Building and then excavate to the proposed bottom of footing elevation at the footing locations and inspect the bearing stratum. Soft, loose, or wet soils should be overexcavated to a maximum depth of 3 feet and replaced with properly compacted coarse aggregate. Groundwater may be encountered at the base of the excavations.

• Use continuous (strip) footings to support the wall loads. Design the continuous strip footings for a maximum allowable foundation pressure of 5,000 psf. Similarly, interior or exterior columns should be supported by a minimum of four (4) feet by four (4) wide footings with a maximum allowable foundation pressure of 5,000 psf.

• Place the bottom of all foundations a minimum of thirty-six (36) inches below the finished grade to protect against heave due to frost penetration.
• Provide drainage below the base of the floor slabs because groundwater conditions are expected to be high.

6.2.3 Salt Dome

Finished floor elevation for the salt dome structure has not been provided. It is assumed the structure will have a finished floor which corresponds to the proposed surrounding ground elevation of about 95.5 feet. Loading has not been provided for the structure but it is assumed the loads on the floor slab will be substantial when filled to capacity with salt.

• Use continuous strip foundations consisting of a minimum of 36 inch wide strip footings bearing on properly compacted coarse aggregate that extends to very dense residual soil to support the structure. Design the floor slab as a structural mat capable of supporting the salt loads. Design the continuous strip footings for a maximum allowable foundation pressure of 5,000 psf.

• Remove/strip pavement and unsuitable soils at the ground surface. Prepare the existing soils by overexcavating the existing fill below the footprint of the structure to very dense residual soil encountered at an elevation of about 88.0 feet. Backfill the excavations with properly compacted coarse aggregate to the bottom of floor slab elevation. Groundwater may be encountered in the excavations.

• After placing coarse aggregate to floor slab subgrade elevation and bringing the remainder of the site to final proposed ground elevations, excavate for the proposed strip footings.

• Place the bottom of all foundations a minimum of thirty-six (36) inches below the finished grade to protect against heave due to frost penetration.

• Provide drainage below the base of the floor slab.
6.2.4 General Building Foundation Recommendations

- Design the area around the proposed building addition to drain away from the foundation. A minimum slope of two (2) percent is recommended. Drainage of the area adjacent to the Administration building is of particular concern because it will be constructed in a cut so surface water will tend to pond.

- Design the building foundations for a maximum allowable settlement of 0.75 inch.

- Excavate for foundations after the site has been brought to the proposed floor slab subgrade elevation.

- Design the buildings for a seismic Site Class C based on ASCE ASCE/SEI 7-10.

6.3 Floor Slabs

- The majority of the proposed floor slabs are expected to be supported by properly compacted granular fill or residual soil. This material should be protected from excess disturbance prior to constructing the floor slabs. If the subgrade soils are exposed to excess moisture from precipitation or subject to disturbance, they should be proof-rolled to identify soft or loose soils. Soft or loose soils identified by the proof-rolling should be excavated to a depth of 2 feet. Potentially expansive cinders or slag material should also be removed. Backfill the excavations with properly compacted granular material.

- Place the floor slab on a minimum of 12 inches of compacted AASHTO No. 57 coarse aggregate. Provide a positive outlet to provide drainage for any trapped water within the granular base.

- Choke the top of the granular base with a minimum of one (1) inch layer of sand. Provide a polyethylene vapor barrier to minimize loss of water during curing of the concrete slab.
• Provide expansion joints between the floor slab and any columns or bearing walls to minimize the potential for structural distress resulting from differential settlement between the floor slab and the building foundations.

6.4 Pavement and Sidewalk Subgrade Soil Design Parameters

• Pavement and sidewalk subgrade soils should be thoroughly proof-rolled. Soft or loose areas should be overexcavated and replaced the properly compacted granular material.

• All subgrade fill should be well graded, inert, free of any degradable or deleterious material, and should not contain particles larger than six (6) inches in maximum dimension.

• Ditches and/or inlets should be constructed along all parking areas and driveways to maintain drainage and divert runoff away from the pavement subgrade. Pavement subgrade should be properly graded during construction to maintain positive drainage after construction.

• Use a frost depth of thirty-six (36) inches to design the pavement section.

6.5 Retaining Wall

For the portion of the wall adjacent to Victory Avenue or where temporary cut slopes are not possible, soldier-beam and lagging walls are recommended.

• Support the soldier beams with drilled shaft foundations with a minimum diameter of 30 inches. Anchors are not expected to be required to provide wall stability provided the drilled shaft foundations are an adequate length. It is not permitted to drive soldier beams in lieu of installing them in drilled shaft foundations.
• Use the following parameters to model earth pressures and design the drilled shafts:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Soil</th>
<th>Intact Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Angle of Friction (degrees)</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>Cohesion (psf)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unit Weight (pcf)</td>
<td>120</td>
<td>140</td>
</tr>
<tr>
<td>Saturated Unit Weight (pcf)</td>
<td>125</td>
<td>140</td>
</tr>
<tr>
<td>Active Earth Pressure Coefficient (kₐ)</td>
<td>0.31</td>
<td>N/A for intact rock</td>
</tr>
<tr>
<td>Subgrade Reaction – Lateral Capacity (pci)</td>
<td>60</td>
<td>800</td>
</tr>
<tr>
<td>Assume groundwater elevation: 98.0 feet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• Include live load surcharges due to traffic.

• Size the length of the caissons using the soil and rock parameters provided above. Lateral deflections at the top of the drilled shafts should be limited to 0.5 inches from unfactored earth pressure loads. Minimum caisson lengths should be 1.5 times the exposed height of the wall or five (5) feet into gneiss bedrock, whichever is less.

• Drilled shafts are expected to be end-bearing on bedrock or very dense residual soil and axial loads are low for an unanchored soldier beam and lagging wall. Therefore, bearing resistance of a 30-inch minimum diameter drilled shaft is not a design concern.

• The bottom of the lagging should be placed 3.0 feet below the dredge line in front of the wall to mitigate heave due to frost penetration. Disregard passive resistance of the lagging below the dredge line of the wall.

• Provide drainage behind the wall to reduce the buildup of hydrostatic water pressure.

Apply the following recommendations for the design of the wall along the access driveway where construction of a temporary cut is feasible and if it is desired to construct the wall from the bottom-up:

• Assume the walls are supported by spread footings on very dense residual soil or bedrock. Use
a maximum allowable bearing pressure of 5,000 ksf.

- Use the following parameters to model earth pressures for the design the wall:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Soil</th>
<th>Intact Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Angle of Friction (degrees)</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>Cohesion (psf)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unit Weight (pcf)</td>
<td>120</td>
<td>140</td>
</tr>
<tr>
<td>Saturated Unit Weight (pcf)</td>
<td>125</td>
<td>140</td>
</tr>
<tr>
<td>Active Earth Pressure Coefficient ($k_a$)</td>
<td>0.31</td>
<td>N/A for intact rock</td>
</tr>
</tbody>
</table>

- Assume groundwater elevation: 98.0 feet

- Include live load surcharges due to traffic.

- The bottom of the footing or leveling pad should be placed 3.0 feet below the dredge line in front of the wall to mitigate heave due to frost penetration.

- Backfill the wall with free-draining coarse aggregate. Provide drainage behind the wall to reduce the buildup of hydrostatic water pressure.

### 6.6 Monitoring and Testing

- The Contractor should divert surface water from entering excavations.

- Have a qualified Geotechnical Engineer present at the site to physically inspect the bearing material for each foundation installation and ensure the proper sequence of fill and foundation placement is followed. It will be his or her responsibility to verify the suitability of the materials exposed for developing the design bearing pressure. Excavations must be free of water so they can be inspected by the Geotechnical Engineer.
• Have a qualified Soils Technician under the direct supervision of the Geotechnical Engineer present at the site to monitor proof-rolling to identify any unsuitable areas. It will be his or her responsibility to identify loose and soft materials and determine the extent of undercutting.

• Have a qualified Soils Technician under the direct supervision of the Geotechnical Engineer present at the site to monitor placement and compaction of fill material and to ensure that the specified density requirements are being achieved and, thus, minimize settlements of the fill material.

6.7 Limitations

• This report has been prepared to present our recommendations with respect to the geotechnical aspects of the specific project discussed herein. In the event that there are any changes in the structures, loads, locations, or grades, which formed the basis of our analysis, these changes should be brought to our attention so that we may determine how such changes may affect our conclusions and recommendations.

• The analysis and recommendations in this report are based on the conditions encountered at the specific times and locations sampled. It should be recognized that despite the use of due professional care, limitations on available data and variations between boring and sampling locations can result in some uncertainty with respect to the interpretation of these conditions and in the resultant recommendations.

• If the actual conditions encountered during construction vary from those reported herein, we are to be contacted to determine if the changes alter these recommendations.

• The conclusions and recommendations presented in this report have been prepared in accordance with the generally accepted professional geotechnical engineering principles and practices. No other warranties are implied or expressed.
REFERENCES


5. Pennsylvania Department of Transportation, Type 10 Map, Delaware County, Pennsylvania.


TABLES
### TABLE 1
**SUMMARY OF SUBSURFACE EXPLORATION**
SEPTA - 103 VICTORY AVENUE REDEVELOPMENT
SEPTA WORK ORDER NO: 860-5129
UPPER DARBY TOWNSHIP, DELAWARE COUNTY, PENNSYLVANIA

<table>
<thead>
<tr>
<th>Boring Designation (Refer to Boring Location Plan)</th>
<th>Ground Surface Elevation (ft)</th>
<th>Pavement/Subbase (ft)</th>
<th>Unsampled (ft)</th>
<th>Fill (ft)</th>
<th>Residual (ft)</th>
<th>Total (ft)</th>
<th>Approximate Top of Rock Elevation (ft)</th>
<th>Rock Cored (ft)</th>
<th>Total Depth (ft)</th>
<th>Bottom of Boring Elevation (ft)</th>
<th>Approximate 24-Hour Water Elevation (ft)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-1</td>
<td>97.5</td>
<td>1.5</td>
<td>-</td>
<td>1.0</td>
<td>2.5</td>
<td>5.0</td>
<td>92.5</td>
<td>10.0</td>
<td>15.0</td>
<td>82.5</td>
<td>89.5</td>
<td>0.6 feet of pavement over subbase.</td>
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<td>SB-2</td>
<td>97.5</td>
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<td>-</td>
<td>3.5</td>
<td>6.0</td>
<td>11.0</td>
<td>86.5</td>
<td>5.0</td>
<td>16.0</td>
<td>81.5</td>
<td>91.8</td>
<td>0.8 feet of pavement over subbase.</td>
</tr>
<tr>
<td>SB-3</td>
<td>95.0</td>
<td>1.5</td>
<td>-</td>
<td>5.5</td>
<td>9.1</td>
<td>16.1</td>
<td>78.9</td>
<td>10.0</td>
<td>26.1</td>
<td>68.9</td>
<td>84.9</td>
<td>1.0 feet of pavement over subbase.</td>
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<td>SB-4</td>
<td>105.5</td>
<td>-</td>
<td>-</td>
<td>3.0</td>
<td>7.7</td>
<td>10.7</td>
<td>94.8</td>
<td>10.0</td>
<td>20.7</td>
<td>84.8</td>
<td>99.4</td>
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<tr>
<td>SB-5</td>
<td>105.0</td>
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<td>-</td>
<td>8.0</td>
<td>7.6</td>
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<td>89.4</td>
<td>10.0</td>
<td>25.6</td>
<td>79.4</td>
<td>96.6</td>
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<tr>
<td>SB-6</td>
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<td>1.5</td>
<td>-</td>
<td>2.5</td>
<td>2.1</td>
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<td>92.4</td>
<td>5.4</td>
<td>11.5</td>
<td>87.0</td>
<td>88.6</td>
<td></td>
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<tr>
<td>SB-7</td>
<td>106.0</td>
<td>-</td>
<td>-</td>
<td>4.5</td>
<td>10.7</td>
<td>15.2</td>
<td>90.8</td>
<td>20.0</td>
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<td>70.8</td>
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<tr>
<td>SB-8</td>
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<td>-</td>
<td>-</td>
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<td>4.3</td>
<td>8.3</td>
<td>97.2</td>
<td>16.0</td>
<td>24.3</td>
<td>81.2</td>
<td>-</td>
<td>Boring grouted upon completion.</td>
</tr>
<tr>
<td>SB-9</td>
<td>97.5</td>
<td>-</td>
<td>-</td>
<td>4.5</td>
<td>6.5</td>
<td>11.0</td>
<td>86.5</td>
<td>9.0</td>
<td>20.0</td>
<td>77.5</td>
<td>88.2</td>
<td></td>
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<tr>
<td>SB-10</td>
<td>113.0</td>
<td>-</td>
<td>-</td>
<td>1.5</td>
<td>10.6</td>
<td>12.1</td>
<td>100.9</td>
<td>20.4</td>
<td>32.5</td>
<td>80.5</td>
<td>97.2</td>
<td></td>
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<tr>
<td>SB-11</td>
<td>112.5</td>
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<td>-</td>
<td>4.5</td>
<td>5.1</td>
<td>9.6</td>
<td>102.9</td>
<td>16.5</td>
<td>26.1</td>
<td>86.4</td>
<td>100.4</td>
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<tr>
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<td>100.5</td>
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<td>76.0</td>
<td>99.8</td>
<td></td>
</tr>
<tr>
<td>SB-13</td>
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<td>-</td>
<td>-</td>
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<td>7.6</td>
<td>9.1</td>
<td>97.9</td>
<td>20.4</td>
<td>29.5</td>
<td>77.5</td>
<td>97.2</td>
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</tr>
<tr>
<td>SB-14</td>
<td>95.0</td>
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<td>-</td>
<td>6.5</td>
<td>-</td>
<td>6.5</td>
<td>88.5</td>
<td>-</td>
<td>-</td>
<td>Encountered underground utility at 6.1 ft. Boring backfilled upon completion and offset to SB-14A.</td>
</tr>
<tr>
<td>SB-14A</td>
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<td>-</td>
<td>3.0</td>
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<td>10.6</td>
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<td>21.1</td>
<td>73.9</td>
<td>86.6</td>
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<td>T-2</td>
<td>105.2</td>
<td>-</td>
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<td>-</td>
<td>8.5</td>
<td>-</td>
<td>-</td>
<td>8.5</td>
<td>96.7</td>
<td>-</td>
<td>-</td>
<td>Boring grouted upon completion.</td>
</tr>
<tr>
<td>T-4</td>
<td>99.1</td>
<td>1.1</td>
<td>-</td>
<td>0.9</td>
<td>2.6</td>
<td>4.6</td>
<td>94.5</td>
<td>2.0</td>
<td>6.6</td>
<td>92.5</td>
<td>Dry</td>
<td>1.1 feet of pavement over fill.</td>
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<tr>
<td>T-5</td>
<td>99.5</td>
<td>1.5</td>
<td>-</td>
<td>1.0</td>
<td>1.5</td>
<td>4.0</td>
<td>95.5</td>
<td>2.0</td>
<td>6.0</td>
<td>93.5</td>
<td>Dry</td>
<td>1.2 feet of pavement over subbase.</td>
</tr>
</tbody>
</table>

| **Total**                                         | 10.1                          | 11.5                  | 52.4           | 102.5      | 176.5       | 191.7     | 368.2                                 |                        |                        |                             |                             |                        |

(1) Boring elevations inferred from topographic survey
Summary of Soil Classification Testing

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Moisture Content (%)</th>
<th>Atterberg Limits</th>
<th>USCS Gradation</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LL (%)</td>
<td>PI (%)</td>
<td>% Gravel</td>
<td>% Sand</td>
</tr>
<tr>
<td>Boring SB-2 S-1 to S-2 1.5 – 4.5 ft Fill</td>
<td>4.5</td>
<td>NP NP</td>
<td>35.5</td>
<td>54.4</td>
</tr>
<tr>
<td>Boring SB-2 S-4, S-5 6.0 – 9.0 ft Residual</td>
<td>9.4</td>
<td>NP NP</td>
<td>0.7</td>
<td>80.7</td>
</tr>
<tr>
<td>Boring SB-3 S-2 to S-3 3.0 – 6.0 ft Fill</td>
<td>10.9</td>
<td>NP NP</td>
<td>62.0</td>
<td>27.0</td>
</tr>
<tr>
<td>Boring SB-3 S-6 to S-7 9.0 – 12.0 ft Residual</td>
<td>8.6</td>
<td>NP NP</td>
<td>28.4</td>
<td>51.7</td>
</tr>
<tr>
<td>Boring SB-5 S-3 to S-4 3.0 – 6.0 ft Fill</td>
<td>16.0</td>
<td>33</td>
<td>5</td>
<td>10.7</td>
</tr>
<tr>
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<td>13.3</td>
<td>NP NP</td>
<td>0.0</td>
<td>76.4</td>
</tr>
<tr>
<td>Boring SB-7 S-7 to S-8 9.0 – 12.0 ft Residual</td>
<td>10.6</td>
<td>NP NP</td>
<td>1.5</td>
<td>80.3</td>
</tr>
<tr>
<td>Boring SB-8 S-1 to S-2 0.0 – 3.0 ft Fill</td>
<td>7.2</td>
<td>23</td>
<td>3</td>
<td>50.0</td>
</tr>
<tr>
<td>Boring SB-9 S-1 to S-2 0.0 – 3.0 ft Fill</td>
<td>6.8</td>
<td>NP NP</td>
<td>13.0</td>
<td>62.9</td>
</tr>
<tr>
<td>Boring SB-10 S-4 to S-5 4.5 – 7.5 ft Residual</td>
<td>12.4</td>
<td>NP NP</td>
<td>2.6</td>
<td>73.6</td>
</tr>
<tr>
<td>Boring SB-11 S-1 to S-2 0.5 – 3.5 ft Fill</td>
<td>19.4</td>
<td>30</td>
<td>10</td>
<td>8.4</td>
</tr>
</tbody>
</table>
### Summary of Soil Classification Testing (Continued)

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Moisture Content (%)</th>
<th>Atterberg Limits</th>
<th>USCS Gradation</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LL (%)</td>
<td>PI (%)</td>
<td>% Gravel</td>
</tr>
<tr>
<td>Boring SB-12 S-3 to S-4 3.0 – 6.0 ft Residual</td>
<td>7.2</td>
<td>NP</td>
<td>NP</td>
<td>1.1</td>
</tr>
<tr>
<td>Boring SB-13 S-5 to S-6 6.0 – 9.0 ft Residual</td>
<td>8.2</td>
<td>NP</td>
<td>NP</td>
<td>4.0</td>
</tr>
<tr>
<td>Boring SB-14A S-1 to S-2 3.0 to 6.0 ft Residual</td>
<td>17.2</td>
<td>NP</td>
<td>NP</td>
<td>9.9</td>
</tr>
<tr>
<td>Boring T-2 BS-1 5.0 – 8.5 ft Residual</td>
<td>1.0</td>
<td>NP</td>
<td>NP</td>
<td>13.5</td>
</tr>
</tbody>
</table>

### Summary of Unconfined Compressive Strength Testing of Rock

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Sample Length/ Capped (in)</th>
<th>Core Dia. (in)</th>
<th>Dry Unit Weight (pcf)</th>
<th>Compressive Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boring SB-1 R-2 7.5 – 7.9 ft Gneiss</td>
<td>3.40</td>
<td>1.97</td>
<td>161.9</td>
<td>6,530</td>
</tr>
<tr>
<td>Boring SB-3 R-3 18.2 – 18.7 ft Gneiss</td>
<td>4.04</td>
<td>1.98</td>
<td>165.4</td>
<td>10,752</td>
</tr>
<tr>
<td>Boring SB-4 R-3 15.9 – 16.3 ft Gneiss</td>
<td>3.91</td>
<td>1.97</td>
<td>161.2</td>
<td>5,242</td>
</tr>
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Summary of Unconfined Compressive Strength Testing of Rock (Continued)

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Sample Length/ Capped (in)</th>
<th>Core Dia. (in)</th>
<th>Dry Unit Weight (pcf)</th>
<th>Compressive Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boring SB-6 R-2 8.5 – 8.9 ft Gneiss</td>
<td>4.02</td>
<td>1.98</td>
<td>164.4</td>
<td>8,157</td>
</tr>
<tr>
<td>Boring SB-7 R-3 22.0 – 22.8 ft Gneiss</td>
<td>4.03</td>
<td>1.98</td>
<td>165.5</td>
<td>8,938</td>
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<td>Boring SB-9 R-1 13.0 – 13.6 ft Gneiss</td>
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<td>165.6</td>
<td>5,677</td>
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<tr>
<td>Boring SB-10 R-2 18.8 – 19.2 ft Gneiss</td>
<td>3.78</td>
<td>1.97</td>
<td>159.5</td>
<td>2,694</td>
</tr>
<tr>
<td>Boring SB-12 R-3 16.2 – 16.9 ft Gneiss</td>
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<td>1.98</td>
<td>166.1</td>
<td>12,703</td>
</tr>
<tr>
<td>Boring SB-13 R-2 11.5 – 12.2 ft Gneiss</td>
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<td>1.98</td>
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<td>7,436</td>
</tr>
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<td>Boring SB-14A R-2 12.8 – 13.4 ft Schist</td>
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Summary of Soil Corrosion Testing

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>pH</th>
<th>Chlorides (ppm)</th>
<th>Sulfates (ppm)</th>
<th>Resistivity (ohm-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-2 BS-1 5.0 – 8.5’ Residual</td>
<td>8.2</td>
<td>329</td>
<td>54.4</td>
<td>38,000</td>
</tr>
</tbody>
</table>

By: PAP 3/16/16
Ckd: KAB 3/18/16
FIGURES
SEPTA 103 VICTORY AVENUE REDEVELOPMENT
UPPER DARBY TOWNSHIP
DELWARE COUNTY, PENNSYLVANIA
PROJECT LOCATION MAP

PROJECT: 15046
DRAWN: RJE
DATE: DEC. 2015
SCALE: 1" = 2000'
FIGURE: 1

SOURCE: US Geological Survey, Quadrangle Map (7.5' Series); Lansdowne PA
SEPTA 103 VICTORY AVENUE REDEVELOPMENT
UPPER DARBY TOWNSHIP
DELWARE COUNTY, PENNSYLVANIA
GENERAL GEOLOGY MAP

PROJECT LOCATION

Wissahickon Formation

Mafic gneiss

Granitic gneiss and granite

Pensauken and Bridgeton Formations, undifferentiated

Pensauken and Bridgeton Formations, undifferentiated

SOURCE: PA Bureau of Topographic & Geologic Survey, DCNR; Bedrock Geology of Pennsylvania
APPENDIX A

CONCEPTUAL PLANS

(PROVIDED BY PENNONI)
GENERAL NOTES:

1. PROJECT LOCATION:
   TAX MAP PARCEL #16-06-01176-00
   103 VICTORY AVENUE
   UPPER DARBY TOWNSHIP
   DELAWARE COUNTY, PA 19082

2. OWNER/APPLICANT:
   SEPTA
   1234 MARKET STREET
   PHILADELPHIA, PA 19107

3. TOPOGRAPHIC INFORMATION OBTAINED FROM A FIELD SURVEY PERFORMED BY
   RODRIGUEZ CONSULTING, LLC BETWEEN AUGUST AND SEPTEMBER OF 2015.

4. OUTBOUND INFORMATION OBTAINED FROM PLAN TITLED "EXISTING CONDITIONS
   PLAN", DRAWING NO. V-1 DATED 9/18/2015, PREPARED BY RODRIGUEZ
   CONSULTING, LLC.

5. THE DRAWINGS INDICATE THE APPROXIMATE LOCATION OF EXISTING
   SUBSURFACE UTILITIES IN THE VICINITY OF THE PROJECT, AND ARE NOT
   GUARANTEED FOR ACCURACY AND/OR COMPLETENESS, PENNSYLVANIA ACT 287
   OF 1974 ENTITLED
   "UNDERGROUND
   UTILITY LINE PROTECTION LAW" REQUIRES
   THAT THE CONTRACTORS DETERMINE THE LOCATION OF ALL UTILITIES BEFORE
   COMMENCING CONSTRUCTION.  THE CONTRACTOR SHALL ALSO NOTIFY ALL
   UTILITY PROVIDERS WITHIN THE WORK AREA VIA THE PA ONE CALL SYSTEMS,
   INC. (800-242-1776) A MINIMUM OF 3 WORKING DAYS BEFORE CONSTRUCTION
   BEGINS.

6. THE SITE IS SERVICED BY PUBLIC SEWER.

7. THE SITE IS SERVICED BY PUBLIC WATER BY AQUA PA.

8. THE SITE IS ZONED COMMERCIAL-INDUSTRIAL (C4) DISTRICT, PER THE UPPER
   DARBY ZONING ORDINANCE OF 2010.

9. VERTICAL DATUM IS BASED UPON NORTH AMERICAN VERTICAL DATUM OF 1988
   (NAVD 88).

10. HORIZONTAL DATUM IS BASED UPON THE PENNSYLVANIA STATE PLANE
    COORDINATE SYSTEM SOUTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD 83).

11. PENNSYLVANIA ONE CALL SYSTEM, INC. SERIAL NO.20153032367.

12. THE SUBJECT PARCEL IS LOCATED WITHIN FLOOD ZONE X (AREAS DETERMINED
    TO BE OUTSIDE OF THE 500-YEAR FLOODPLAIN) OF THE FEMA FLOOD
    INSURANCE DATE MAPS.
GRADING NOTES:
1. A GEOTECHNICAL ENGINEER IS REQUIRED TO INSPECT, TEST AND CERTIFY TO THE COMPACTION OF ALL LOAD BEARING FILLS. ALL EXISTING UNDERGROUND UTILITIES SHALL BE REMOVED OR RELOCATED. THE PREPARED SUBGRADE SHALL BE PROOF ROLLED WITH A SMOOTH-DRUM VIBRATING ROLLER TO DELINEATE SOFT/UNSTABLE AREAS AND COMPACT SOILS DISTURBED DURING EXCAVATION OPERATIONS. AREAS WHICH EXHIBIT INSTABILITY SHALL BE UNDERCUT AND REPLACED WITH LOAD-BEARING FILL.

2. MINIMUM PAVEMENT GRADE SHALL BE 1.0% SLOPE UNLESS NOTED OTHERWISE.

3. BEDDING REQUIREMENTS SPECIFIED HEREIN ARE TO BE CONSIDERED AS MINIMUMS FOR RELATIVELY DRY, STABLE EARTH CONDITIONS. ADDITIONAL BEDDING SHALL BE REQUIRED FOR ROCK TRENCHES AND WET AREAS. CONTRACTOR SHALL HAVE THE RESPONSIBILITY TO PROVIDE SUCH ADDITIONAL BEDDING AS MAY BE REQUIRED TO PROPERLY CONSTRUCT THE WORK.

4. COMPACTION OF THE BACKFILL OF ALL TRENCHES SHALL BE COMPACTED TO THE DENSITY OF 95% OF THEORETICAL MAXIMUM DRY DENSITY (ASTM D698). BACKFILL MATERIAL SHALL BE FREE FROM ROOTS, STUMPS, OR OTHER FOREIGN DEBRIS AND SHALL BE PLACED IN LIFTS NOT TO EXCEED 6 INCHES IN COMPACTED FILL THICKNESS. CORRECTION OF ANY TRENCH SETTLEMENT WITHIN A YEAR FROM THE DATE OF APPROVAL WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.

5. THE CONTRACTOR WILL INSURE THAT POSITIVE AND ADEQUATE DRAINAGE IS MAINTAINED AT ALL TIMES WITHIN THE PROJECT LIMITS. THIS MAY INCLUDE, BUT NOT BE LIMITED TO, REPLACEMENT OR RECONSTRUCTION OF EXISTING DRAINAGE STRUCTURES THAT HAVE BEEN DAMAGED OR REMOVED OR REGRADING AS REQUIRED BY THE ENGINEER, EXCEPT FOR THOSE DRAINAGE ITEMS SHOWN AT SPECIFIC LOCATIONS AND HAVING SPECIFIC PAY ITEMS IN THE DETAILED ESTIMATE. NO SEPARATE PAYMENT WILL BE MADE FOR ANY COSTS INCURRED TO COMPLY WITH THIS REQUIREMENT.

6. THE CONTRACTOR SHALL PROVIDE ANY AND ALL EXCAVATION AND MATERIAL SAMPLES NECESSARY TO CONDUCT REQUIRED SOIL TESTS. ALL ARRANGEMENTS AND SCHEDULING FOR THE TESTING SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

7. SOILS TESTING AND ON-SITE INSPECTION SHALL BE PERFORMED BY AN INDEPENDENT GEOTECHNICAL ENGINEER. THE SOILS ENGINEER SHALL PROVIDE COPIES OF TEST REPORTS TO THE CONTRACTOR, THE OWNER AND THE OWNER'S REPRESENTATIVE AND SHALL PROMPTLY NOTIFY THE OWNER, HIS REPRESENTATIVE AND THE CONTRACTOR, SHOULD WORK PERFORMED BY THE CONTRACTOR FAIL TO MEET THESE SPECIFICATIONS.

8. CONTRACTOR SHALL FURNISH AND MAINTAIN ALL NECESSARY BARRICADES AROUND THE WORK AREA AND SHALL PROVIDE PROTECTION AGAINST WATER DAMAGE AND SOIL EROSION.

9. MAXIMUM SIDEWALK CROSS SLOPE IS 2% AND MINIMUM SIDEWALK CROSS SLOPE IS 1.0%.

10. ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
APPENDIX B
BORING LOCATION PLAN AND
GENERALIZED GEOLOGIC CROSS-SECTIONS
LEGEND

- FILL
- RESIDUAL
- GNEISS

STANDARD PENETRATION RESISTANCE

GWL - GROUND WATER LEVEL

TOR - TOP OF ROCK ELEVATION (FT)
BFE - BUILDING-APPROXIMATE BOTTOM OF FOOTING ELEVATION (FT)

GROUND LINE ELEVATION IN FRONT OF WALL (FT) (FROM CONCEPTUAL PLAN)
TOP OF WALL ELEVATION (FT) (FROM CONCEPTUAL PLAN)

HORIZONTAL 20

0 20

SCALE (FT)

NOTES:

GEOLOGIC CROSS SECTION IS INTERPRETED FROM THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS AND MAY NOT REFLECT ACTUAL CONDITIONS BETWEEN BORINGS.

SEPTA 103 VICTORY AVENUE
REDEVELOPMENT
UPPER DARBY TOWNSHIP
DELaware COUNTY, PENNSYLVANIA
GENERALIZED GEOLOGIC CROSS SECTION A-A
SEPTA 103 VICTORY AVENUE
REDEVELOPMENT
UPPER DARBY TOWNSHIP
DELAWARE COUNTY, PENNSYLVANIA
GENERALIZED GEOLOGIC
CROSS SECTION C-C

NOTES:
GEOLOGIC CROSS SECTION IS INTERPRETED FROM THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS AND MAY NOT REFLECT ACTUAL CONDITIONS BETWEEN BORINGS.

PROJECT: 15046
DRAWN: RJE
DATE: MARCH 2016
SCALE: AS SHOWN
FIGURE: 1

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
Corporate Office: Canonsburg, PA (724) 916-0300
Branch Offices: King of Prussia, PA (610) 354-0333
Holidaysburg, PA (814) 696-7890
Baltimore, MD (410) 814-7552
www.ageinc.com
SAFETY

LEGEND

\( \square \) FILL  \( \square \) RESIDUAL  \( \square \) GNEISS

\( \square \) STANDARD PENETRATION RESISTANCE

\( \square \) GROUND WATER LEVEL

\( \square \) TOP OF ROCK ELEVATION (FT)

\( \square \) BUILDING-APPROXIMATE BOTTOM OF FOOTING ELEVATION (FT)

\( \square \) FINISHED FLOOR ELEVATION (FT) (FROM CONCEPTUAL PLAN)

\( \square \) GROUND LINE ELEVATION IN FRONT OF WALL (FT) (FROM CONCEPTUAL PLAN)

\( \square \) TOP OF WALL ELEVATION (FT) (FROM CONCEPTUAL PLAN)

HORIZONTAL SCALE (FT)

VERTICAL SCALE (FT)

NOTES:

GEOLGIC CROSS SECTION IS INTERPRETED FROM THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS AND MAY NOT REFLECT ACTUAL CONDITIONS BETWEEN BORINGS.

REDEVELOPMENT

SEPTA 103 VICTORY AVENUE

UPPER DARBY TOWNSHIP

DELAWARE COUNTY, PENNSYLVANIA

GENERALIZED GEOLOGIC CROSS SECTION D-D

PROJECT 15046

DRAWN: RJE

DATE: MARCH 2016

SCALE: AS SHOWN

FIGURE

- FILL
- RESIDUAL
- GNEISS
- STANDARD PENETRATION RESISTANCE
- GROUND WATER LEVEL
- TOP OF ROCK ELEVATION (FT)
- BUILDING-APPROXIMATE BOTTOM OF FOOTING ELEVATION (FT)
- FINISHED FLOOR ELEVATION (FT) (FROM CONCEPTUAL PLAN)
- GROUND LINE ELEVATION IN FRONT OF WALL (FT) (FROM CONCEPTUAL PLAN)
- TOP OF WALL ELEVATION (FT) (FROM CONCEPTUAL PLAN)

File: W:\2015\046\exhibits\x-sec\15046_gsec.dwg

Date: 3/30/16

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
Corporate Office: Canonsburg, PA (724) 916-0300
Branch Offices: King of Prussia, PA (610) 354-0333
Holidaysburg, PA (814) 696-7890
Baltimore, MD (410) 814-7552
www.agesinc.com
REDEVELOPMENT
UPPER DARBY TOWNSHIP
DELAWARE COUNTY, PENNSYLVANIA
GENERALIZED GEOLOGIC CROSS SECTION G-G

DEFINITIONS:

TWE - TOP OF WALL ELEVATION (FT) (FROM CONCEPTUAL PLAN)
BWE - GROUND LINE ELEVATION IN FRONT OF WALL (FT) (FROM CONCEPTUAL PLAN)
SB - SUBGRADE (FT) (FROM CONCEPTUAL PLAN)
BPE - BUILDING-APPROXIMATE BOTTOM OF FOOTING ELEVATION (FT)

LEGEND:

FILL - RESIDUAL - GNEISS

- STANDARD PENETRATION RESISTANCE

GWL - GROUND WATER LEVEL

HOURS

NOTES:

GEOLOGIC CROSS SECTION IS INTERPRETED FROM THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS AND MAY NOT REFLECT ACTUAL CONDITIONS BETWEEN BORINGS.

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
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SEPTA 103 VICTORY AVENUE REDEVELOPMENT
UPPER DARBY TOWNSHIP
DELAWARE COUNTY, PENNSYLVANIA
GENERALIZED GEOLOGIC CROSS SECTION G-G

PROJECT: 15046
DRAWN: RJE
DATE: MARCH 2016
SCALE: AS SHOWN
FIGURE: AS SHOWN

File: W:\2015\046\exhibits\x-sec\15046_gsec.dwg
Date: 3/30/16
APPENDIX C

ENGINEER’S FIELD BORING LOGS
Boring SB-1 ECMS

District: __ County: Delaware
SR __________ Section _________
Baseline: SEPTA Victory Avenue
Sta. __________ Offset __________
Segment ______ Offset _______
Coordinates:
Lat. __________ Long. __________
E __ N
Ground Elev. 97.5 ft.
Water Level Elev./Elapsed Time:
Initial 94.3 ft. Elapsed 0.0 hr.
Final 89.5 ft. Elapsed 262.5 hr.
Driller: R. Hoffman
Company: Allied Well Drilling

Drilling Start: 01/29/2016 12:00 pm
Drilling Complete: 01/29/2016 2:00 pm
Grouting Complete: 02/09/2016 3:00 pm
Rig: Acker XLS Track
Hammer Type: Automatic

SPT Hammer Efficiency:
Assumed 0.8 Measured ______
Hammer Calibration Date:
Hole Type: Continuous SPT - Rock Core
Casing Type: Hollow Stem Auger
Casing I.D.: 4.25 in. Casing Depth: 5.0 ft.
Rock Core Method: Dble Tube Wire Ln-NQ
Inspector: Patrick Pendergast
Inspector Cert. No. 366-15

Final Log Checked and Approved By: Michael Giovannitti Date: 3/30/2016

NOTE: N values and all graphical plots are for information only.

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<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO / USCS</th>
<th>SAMPLE DEPTH</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N_r</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
<th>RQD %</th>
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**UNSAMPLED**, 0.0-0.6' Pavement 0.6-1.5' Subbase.

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<td>SAND and GRAVEL, loose, homogeneous, brown, fill. S-1 contained brick.</td>
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Miacaceous GNEISS, gray to black, medium hard to hard, highly weathered to slightly weathered, thin to moderate bedding with shallow dip, widely spaced joints, open joints, shear dip, (RQD=10%).

Unconfined Compression on Rock
R-2 (7.5-7.9')
C_r = 6,530 psi.

Highly weathered from 13.5-15.0'.

Bottom of boring.
**ENGINEER'S LOG**

Boring SB-2  
ECMS  

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**ENGINEER'S LOG**

Boring **SB-2**  
ECMS  
District: ___  
County: **Delaware**  
SR: ___  
Section: ___  
Sta. ___  
Offset ___

NOTE: N values and all graphical plots are for information only.

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS</th>
<th>AASHTO / USCS</th>
<th>SAMPLE DEPTH</th>
<th>SAMPLE No.</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N&lt;sub&gt;60&lt;/sub&gt;</th>
<th>RQD %</th>
<th>REC (fl.)</th>
<th>REC (%)</th>
<th>Soil/Rock Rec %</th>
<th>RQD %</th>
<th>SPT (N&lt;sub&gt;60&lt;/sub&gt;)</th>
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<tr>
<td>16.0'</td>
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<td>Bottom of boring.</td>
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**PENNDOT ENGINEER'S LOG - PENNDOT GINT VERSION 1.2.2.1_2-26-2016.GDT - 3/30/16 15:18 - L:\_GINT\PROJECTS\2015\15046.GPJ**
Boring SB-3 ECMS

District: ___ County: Delaware
SR ______ Section ______
Baseline: SEPTA Victory Avenue
Sta. ______ Offset ______
Segment ______ Offset ______
Coordinates:

Lat. ______ Long. ______

E W

Ground Elev. 95.0 ft. ______

Water Level Elev./Elapsed Time:

Initial 88.9 ft. Elapsed 0.0 hr.

Final 84.9 ft. Elapsed 121.0 hr.

Driller: R. Hoffman

Company: Allied Well Drilling

Drilling Start: 01/22/2016 10:00 am
Drilling Complete: 01/22/2016 2:00 pm

Grouting Complete: 01/27/2016 3:00 pm

Rig: Acker XLS Track

Rig Type: Continuous SPT - Rock Core

Casing Type: Hollow Stem Auger

Casing I.D.: 4.25 in

Casing Depth: 14.0 ft.

Rock Core Method: Dble Tube Wire Ln-NQ

N.M.C. = 10.9%

LL=NP, PL=NP, PI=NP

Hammer Type: Automatic

Assumed 0.8 Measured ______

Hammer Calibration Date: ______

AASHTO / USCS

ELEV. GRAPHIC

MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS

A-1-a

GW-GM

S-1 11-6-10 21 1.0 67

S-2 6-10-10 27 1.1 73

S-3 9-15-18 44 1.0 67

S-4 2-2-2 5 1.2 80

S-5 3-3-10 17 1.5 100

S-6 5-10-11 28 1.5 100

S-7 15-16-25 55 1.4 93

S-8 28-50/.4' >67 0.9 100

S-9 50/.1' >67 0.1 100

UNSAMPLED, 0.0-1.0' Pavement
1.0-1.5' Sub-base.

1.5'/El. 93.5

GRAVEL, some Sand, little Silt, loose to

medium dense, dry, homogeneous, well

graded, angular, black to brown, fill.

Class. on S-2, S-3 (3.0-6.0')

GW-GMA-1-a

N.M.C.=10.9%

LL=NP, PL=NP, PI=NP.

S-3 contained brick, S-4 contained slag.

7.0'/El. 88.0

SAND and GRAVEL, little Silt, micaceous,

medium dense to very dense, dry,

homogeneous, well graded, angular, gray
to

light brown, residual.

Class. on S-6, S-7 (9.0-12.0')

SM/A-1-b

N.M.C.=8.6%

LL=NP, PL=NP, PI=NP.

NOTE: N values and all graphical

plots are for information only.
Micaceous GNEISS, gray to tan, foliated, medium hard to hard, highly weathered to fresh, thin to moderate bedding, wide spacing, sheer dip, open joints, $RD=70-90$, (RQD=52%).

Unconfined Compression on Rock
$R-3$ (18.2-18.7')
$C_0 = 10,752$ psi.
SAND and GRAVEL, loose, moist, homogeneous, well graded, angular, brown to gray, fill.

**SAND**, little Gravel, little Silt, micaceous, moist, homogeneous, well graded, brown to gray, residual.

SAND, some Gravel, micaceous, very dense, dry, homogeneous, well graded, angular, gray to black, residual.

Micaceous GNEISS, foliated, medium hard to hard, highly weathered, thin to moderate bedding with shallow dip, No apparent jointing. (RQD=31%).
Micaceous **GNEISS**, foliated, medium hard to hard, highly weathered, thin to moderate bedding with shallow dip, No apparent jointing, *(RQD=31%)*. *(Layer continued from the previous page.)*

*Unconfined Compression on Rock R-3 (15.9-16.3')*

\[
C_o = 5,242 \text{ psi}
\]

Bottom of boring.
Engineer's Log

Boring SB-5

District: ___ County: Delaware
SR Section: ___
Baseline: SEPTA Victory Avenue
Sta. ______ Offset ______
Segment ______ Offset ______

Coordinates:
Lat. ______ Long. ______

Ground Elev. 105.0 ft.

Water Level Elev./Elapsed Time:
Initial 97.0 ft. Elapsed 0.0 hr.
Final 96.6 ft. Elapsed 138.5 hr.

Driller: C. Lindhorst
Company: Allied Well Drilling

Drilling Start: 02/03/2016 8:30 am
Drilling Complete: 02/03/2016 1:30 pm
Grouting Complete: 02/09/2016 1:00 pm
Rig: CME 45 Truck

Hammer Type: Automatic
SPT Hammer Efficiency:
Assumed 0.8 Measured ___

Hammer Calibration Date:

Hole Type: Continuous SPT - Rock Core
Casing Type: Hollow Stem Auger
Casing I.D.: 4.25 in. Casing Depth: 15.0 ft.
Rock Core Method: Double Tube Wire Line-NQ

Class. on S-3, S-4 (3.0-6.0')
SM/A-2-4 (0)
N.M.C. = 16.0%
LL = 33, PL = 28, PI = 5.
S-3 contained brick.

S-5 contained glass.

Switched to safety hammer at 10.5'.

Class. on S-9, S-10 (12.0-15.0')
SM/A-2-4(0)
N.M.C. = 13.3%
LL = NP, PL = NP, PI = NP.

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**MATERIAL DESCRIPTION**

**COMMENTS - OBSERVATIONS**

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<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO / USCS</th>
<th>SAMPLE</th>
<th>DEPTH</th>
<th>BLOW COUNTS</th>
<th>N&lt;sub&gt;60&lt;/sub&gt;</th>
<th>REC</th>
<th>RQD %</th>
<th>REC %</th>
<th>SOIL/Rock Rec. %</th>
<th>SPT (N&lt;sub&gt;60&lt;/sub&gt;)</th>
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<td>100</td>
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<td>SAND, some Silt, some Gravel, very loose to medium dense, dry, homogeneous, well graded, angular, gray to brown, fill.</td>
<td></td>
<td>S-1</td>
<td>7-6-5</td>
<td>15</td>
<td>1.2</td>
<td>80</td>
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<td>S-3</td>
<td>7-7-4</td>
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<td>S-4</td>
<td>10-6-WOH</td>
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<td>S-7</td>
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<td>S-8</td>
<td>21-50/.4'</td>
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<td>S-10</td>
<td>27-37-50/.4'</td>
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**FEATURES**

**SOIL/LANDFORM**

SAND, some Silt, micaceous, medium dense to very dense, dry, homogeneous, well graded, gray to brown, residual.

---

Final Log Checked and Approved By: Michael Giovannitti
Date: 3/30/2016

Note: N values and all graphical plots are for information only.
Micaceous GNEISS, foliated, hard, weathered to fresh, thin to medium bedding with steep dip. No apparent jointing, (RQD=64%).

25.6'/El. 79.4

Bottom of boring.
**ENGINEER’S LOG**

**Boring SB-6 ECMS**

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<th>County: Delaware</th>
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<tr>
<td>Baseline:</td>
<td>SEPTA Victory Avenue</td>
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<td>Sta.:</td>
<td>Offset:</td>
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<td>Segment:</td>
<td>Offset:</td>
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Coordinates:
- Lat.:__________ Long.:__________
- E__________ N__________
- Ground Elev. 98.5 ft.
- Water Level Elev./Elapsed Time:
  - Initial 97.7 ft. Elapsed 0.0 hr.
  - Final 88.6 ft. Elapsed 27.0 hr.

Driller: R. Hoffman
Company: Allied Well Drilling

Drilling Start: 01/26/2016 10:00 am
Drilling Complete: 01/26/2016 12:00 pm
Hammer Type: Automatic

Hammer Calibration Date:  
Hole Type: Continuous SPT

Hammer Efficiency:  
SPT Depth:

Casing Type: Hollow Stem Auger
Casing I.D.: 4.25 in
Casing Depth: 6.5 ft.

**Unconfined Compression on Rock**

R-2 (8.5-8.9')
C₀ = 8,157 psi.

Micaeous GNEISS, gray to black, medium hard to hard, slightly weathered, thin to moderate bedding with moderate dip, jointed, wide spacing, open joints, very steep dip, (RQD=28%).

**SPT Noon:**

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<tr>
<th>LEM</th>
<th>MATERIAL DESCRIPTION</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO USCS</th>
<th>SAMPLE DEPTH</th>
<th>BLOW COUNTS</th>
<th>N₀</th>
<th>REC</th>
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<td>1.5</td>
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<td>6.1</td>
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<tr>
<td>11.5</td>
<td>Bottom of boring.</td>
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</tbody>
</table>
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**NOTE:** N values and all graphical plots are for information only.
Boring SB-7  ECMS

Drilling Start: 02/04/2016 12:30 pm
Drilling Complete: 02/04/2016 4:30 pm
Grouting Complete: 02/09/2016 2:00 pm

Hammer Type: Safety

SPT Hammer Efficiency:
Assumed 0.6 Measured ___

Hammer Calibration Date:

Hole Type: Continuous SPT - Rock Core

Class. on S-7, S-8 (10.5-13.5')
SM/A-2-4(0)
N.M.C.=10.6%
LL=NP, PL=NP, PI=NP.

SPT (N60) GRAPHIC

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>SAMPLE DEPTH</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N60 % ROD</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1</td>
<td>1.5</td>
<td>5-6-7</td>
<td>13</td>
<td>1.0</td>
<td>67</td>
</tr>
<tr>
<td>S-2</td>
<td>3.0</td>
<td>3-2-3</td>
<td>5</td>
<td>1.2</td>
<td>80</td>
</tr>
<tr>
<td>S-3</td>
<td>4.5</td>
<td>3-3-4</td>
<td>7</td>
<td>1.5</td>
<td>100</td>
</tr>
<tr>
<td>S-4</td>
<td>6.0</td>
<td>5-6-8</td>
<td>14</td>
<td>1.5</td>
<td>100</td>
</tr>
<tr>
<td>S-5</td>
<td>7.5</td>
<td>21-23-36</td>
<td>59</td>
<td>1.2</td>
<td>80</td>
</tr>
<tr>
<td>S-6</td>
<td>9.0</td>
<td>31-50/4'</td>
<td>&gt;50</td>
<td>0.8</td>
<td>89</td>
</tr>
<tr>
<td>S-7</td>
<td>10.5</td>
<td>18-32-36</td>
<td>68</td>
<td>1.2</td>
<td>80</td>
</tr>
<tr>
<td>S-8</td>
<td>12.0</td>
<td>36-42-39</td>
<td>81</td>
<td>1.5</td>
<td>100</td>
</tr>
<tr>
<td>S-9</td>
<td>13.5</td>
<td>42-49-50</td>
<td>99</td>
<td>1.4</td>
<td>93</td>
</tr>
<tr>
<td>S-10</td>
<td>13.9</td>
<td>50/4'</td>
<td>&gt;50</td>
<td>0.4</td>
<td>100</td>
</tr>
</tbody>
</table>
Micaceous GNEISS, banded gray to white, gneissic foliation, pitted, dull luster, hard, moderately weathered to fresh, laminated bedding with shallow to flat dip, foliation joints, narrow to medium spacing, open joints, tight joints, (RQD=60%).
35.2'/El. 70.8

Bottom of boring.
GRAVEL, some Sand, little Silt, loose to medium dense, dry, homogeneous, well graded, angular, gray to brown, fill.

Class. on S-1, S-2 (0.0-3.0')
GM/A-1-b
N.M.C.=7.2%
LL=23, PL=20, PI=3

4.0'/El. 101.5

SAND, some Gravel, micaceous, very dense, dry, homogeneous, well graded, gray to black, residual.

Micaceous GNEISS, gray to light gray, medium hard to hard, highly weathered to fresh, thin to moderate bedding with shallow dip, No apparent jointing, (RQD=18%).

Highly weathered from 6.2' to 18.3'.
Micaceous GNEISS, gray to light gray, medium hard to hard, highly weathered to fresh, thin to moderate bedding with shallow dip, No apparent jointing, \( (RQD=18\%) \).

\( \text{(Layer continued from the previous page.)} \)
Boring SB-9  ECMS

District: ___  County: Delaware
SR ____  Section ____
Baseline: SEPTA Victory Avenue
Sta. _______  Offset _______
Segment _______  Offset _______

Coordinates:
Lat. _______  Long. _______
E  N
Ground Elev.  97.5 ft._____
Water Level Elev./Elapsed Time:
▽ Initial  96.0 ft.  Elapsed  0.0 hr.
▽ Final  88.2 ft.  Elapsed  89.8 hr.
Driller:  C. Lindhorst
Company: Allied Well Drilling

Drilling Start: 02/05/2016 11:15 am
Drilling Complete: 02/05/2016 2:15 pm
Grouting Complete: 02/09/2016 2:00 pm
Rig:  CME 45 Truck
Hammer Type: Safety

SPT Hammer Efficiency:
Assumed 0.6  Measured ______
Hammer Calibration Date:_____
Hole Type: Continuous SPT - Rock Core
Casing Type: Hollow Stem Auger
Casing I.D.: 4.25 in  Casing Depth:_____
Rock Core Method: Dble Tube Wire Ln-NQ

Auger refusal at 11.0'.

SAND, some Silt, little Gravel, very loose to medium dense, wet, heterogeneous, well graded, sub-angular to angular, brown to tan, fill.

Class. on S-1, S-2 (0.0-3.0')
SM/A-1-b
N.M.C.=6.8%
LL=NP, PL=NP, PI=NP.

Loose gravel not retained in spoon.

SAND, some Gravel, little Silt, micaceous, medium dense to very dense, moist to damp, saprolitic, well graded, angular, dark brown to white, residuum.

Auger refusal at 11.0'.

Micaceous GNEISS, banded black to white, gneissic foliation, pitted, dull luster, moderately weathered to slightly weathered, laminated bedding with moderate to shear dip, jointed, close spacing, narrow joint opening, open joints, (RQD=49%).

Unconfined Compression on Rock
R-1 (13.0-13.6')

Fracture zone 13.6-14.7'.

NOTE: N values and all graphical plots are for information only.
4.9
54%

Micaceous **GNEISS**, banded black to white, gneissic foliation, pitted, dull luster, moderately weathered to slightly weathered, laminated bedding with moderate to sheer dip, jointed, close spacing, narrow joint opening, open joints, \((RQD=49\%)\).

*(Layer continued from the previous page.)*

Staining on joints throughout.

---

**ELEV.**
**GRAPHIC**
**MATERIAL DESCRIPTION**
**COMMENTS - OBSERVATIONS**
**AASHTO / USCS**
**SAMPLE DEPTH**
**SAMPLE No.**
**BLOW COUNTS (Blows/0.5ft)**
**N<sub>60</sub> RQD %**
**REC (ft.)**
**REC (%)**
**Soil/Rock Rec. %**

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>COMMENTS - OBSERVATIONS</th>
<th>AASHTO / USCS</th>
<th>SAMPLE DEPTH</th>
<th>SAMPLE No.</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N&lt;sub&gt;60&lt;/sub&gt; RQD %</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
<th>Soil/Rock Rec. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td></td>
<td>Micaceous <strong>GNEISS</strong>, banded black to white, gneissic foliation, pitted, dull luster, moderately weathered to slightly weathered, laminated bedding with moderate to sheer dip, jointed, close spacing, narrow joint opening, open joints, ((RQD=49%)). <em>(Layer continued from the previous page.)</em></td>
<td>Staining on joints throughout.</td>
<td>15.0</td>
<td>R-3</td>
<td>54%</td>
<td>4.9</td>
<td>98</td>
<td></td>
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<tr>
<td>20.0/El. 77.5</td>
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</tbody>
</table>

Bottom of boring.
Boring SB-10 ECMS

Drilling Start: 01/19/2016 12:00 pm
Drilling Complete: 01/20/2016 11:00 am
Grouting Complete: 01/27/2016 2:00 pm
Rig: Acker XLS Track

Hammer Type: Automatic
SPT Hammer Efficiency:
Assumed 0.8 Measured
Hammer Calibration Date:

Hole Type: Continuous SPT - Rock Core
Casing Type: Hollow Stem Auger
Casing I.D.: 4.25 in
Casing Depth: 12.5 ft.
Rock Core Method: Dble Tube Wire Ln-NQ

Class. on S-4, S-5 (4.5-7.5') SM/A-2-4(0)
N.M.C.=12.4%
LL=NP, PL=NP, PI=NP

Driller: R. Hoffman
Company: Allied Well Drilling

1.5'/El. 111.5

GRAVEL, some Sand, loose, dry, homogeneous, well graded, angular, gray, fill.

1.5'/El. 111.5

SAND, some Silt, trace Gravel, micaceous, loose to medium dense, dry, homogeneous, tan to brown, residual.

Class. on S-4, S-5 (4.5-7.5')
SM/A-2-4(0)
N.M.C.=12.4%
LL=NP, PL=NP, PI=NP

Auger refusal @ 12.5'.

12.1'/El. 100.9

SAND and GRAVEL, micaceous, very dense, dry, homogeneous, well graded, sub-angular, gray, residual.

Auger refusal @ 12.5'.

12.1'/El. 100.9

Micaceous GNEISS, light gray to black, foliated, medium hard to hard, slightly weathered, narrow to medium bedding with steep dip, No apparent jointing, (RQD=45%)
(foliation RD=30-35).

NOTE: N values and all graphical plots are for information only.

Final Log Checked and Approved
By: Michael Giovannitti
Date: 3/30/2016
Micaceous **GNEISS**, light gray to black, foliated, medium hard to hard, slightly weathered, narrow to medium bedding with steep dip, No apparent jointing, *(RQD=45%)* *(foliation RD=30-35)*. *(Layer continued from the previous page.)*

**Unconfined Compression on Rock**

R-3 *(18.8-19.2')*

\[ C_0 = 2,694 \text{ psi} \]

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO / USCS</th>
<th>SAMPLE</th>
<th>DEPTH</th>
<th>N&lt;sub&gt;60&lt;/sub&gt;</th>
<th>RQD %</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
<th>RQD %</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
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<tr>
<td>17.5</td>
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<td></td>
<td>R-2</td>
<td>30%</td>
<td>3.0</td>
<td>100</td>
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<tr>
<td>22.5</td>
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<td></td>
<td></td>
<td>R-3</td>
<td>30%</td>
<td>4.8</td>
<td>96</td>
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<tr>
<td>27.5</td>
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<td></td>
<td></td>
<td>R-4</td>
<td>48%</td>
<td>5.0</td>
<td>100</td>
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<tr>
<td>32.5</td>
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<td></td>
<td>R-5</td>
<td>62%</td>
<td>4.9</td>
<td>98</td>
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<tr>
<td>80</td>
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</tbody>
</table>

Bottom of boring.
**ENGINEER'S LOG**

**Boring**: SB-11  ECMS

**District**: ___  **County**: Delaware  
**SR**:  ___  **Section**: ___  
**Baseline**: SEPTA Victory Avenue  
**Sta.**:  ___  **Offset**:  ___  
**Segment**:  ___  **Offset**:  ___  

**Coordinates:**  
Lat.  ___  Long.  ___  
E  ___  N  ___  
**Ground Elev.**: 112.5 ft.  

**Water Level Elev./Elapsed Time:**  
♀ Initial __107.6 ft.__ Elapsed 0.0 hr.  
♀ Final __100.4 ft.__ Elapsed 22.0 hr.  
**Driller**: R. Hoffman  
**Company**: Allied Well Drilling  

**Drilling Start**: 01/18/2016 10:00 am  
**Drilling Complete**: 01/19/2016 12:00 pm  
**Grouting Complete**: 01/27/2016 2:30 pm  
**Rig**: Acker XLS Track  
**Hammer Type**: Automatic  
**Hammer Calibration Date**:  

**SPT Hammer Efficiency**:  
**Assumed 0.8**  
**Measured ____**  

**Hole Type**: Continuous SPT - Rock Core  
**Casing Type**: Hollow Stem Auger  
**Casing I.D.**: 4.25 in  
**Casing Depth**: 9.5 ft.  
**Rock Core Method**: Dble Tube Wire Ln-NQ  
**Inspector**: Patrick Pendergast  
**Inspector Cert. No.**: 366-15  
**Date**: 3/30/2016  

**NOTE**: N values and all graphical plots are for information only.

### Geological Description

<table>
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<tr>
<td>105</td>
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<tr>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

**CLAY**, some Sand, trace Gravel, medium dense, heterogeneous, well graded, red to brown, fill, *Contained brick*.

- Class. on S-1, S-2 (0.5-3.5)  
- CL/A-4(3)  
- N.M.C. = 19.4%  
- LL = 30, PL = 20, PI = 10  

4.5'/El. 108.0

**SAND** and **GRAVEL**, very dense, dry, homogeneous, well graded, gray to brown, residuum.

**Micaceous GNEISS**, light gray to black, foliated, medium hard, moderately weathered, thin to moderate bedding with moderate dip, No apparent jointing., (RQD=24%).
**ENGINEER’S LOG**

Boring SB-11 ECMS

District: ___ County: Delaware

SR ______ Section ____________
Sta. __________ Offset ________

NOTE: N values and all graphical plots are for information only.

---

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>COMMENTS - OBSERVATIONS</th>
<th>AASHTO / USCS</th>
<th>SAMPLE DEPTH</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N&lt;sub&gt;60&lt;/sub&gt;</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
<th>RQD %</th>
<th>Soil/Rock Rec %</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td></td>
<td>Micaceous GNEISS, light gray to black, foliated, medium hard, moderately weathered, thin to moderate bedding with moderate dip, No apparent jointing., (RQD=24%). (Layer continued from the previous page.)</td>
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<tr>
<td>90</td>
<td></td>
<td>S-8, S-9 - residual sand.</td>
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<tr>
<td>85</td>
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<td>R-5 slightly weathered.</td>
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<tr>
<td>26.1/El. 86.4</td>
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</tbody>
</table>
### PENNDOT ENGINEER’S LOG

**Boring SB-12**

- **District:** ___  
- **County:** Delaware
- **SR:** ___  
- **Section:** __________
- **Baseline:** SEPTA Victory Avenue
- **Sta.** __________  
- **Offset:** ________
- **Segment:** ________  
- **Offset:** ________

#### Coordinates:
- **Lat.** __________  
- **Long.** __________  
- **E** __________  
- **N** __________

- **Ground Elev.** 113.0 ft.

#### Water Level Elev./Elapsed Time:
- **Initial** 107.2 ft.  
- **Elapsed** 0.0 hr.
- **Final** 99.8 ft.  
- **Elapsed** 23.0 hr.

- **Driller:** R. Hoffman
- **Company:** Allied Well Drilling

#### Drilling Start: 01/20/2016 1:00 pm
- **Drilling Complete:** 01/21/2016 10:00 am
- **Grouting Complete:** 01/27/2016 4:00 pm
- **Hammer Type:** Automatic
- **SPT Hammer Efficiency:** Assumed 0.8
- **Hammer Calibration Date:**
- **Hole Type:** Continuous SPT - Rock Core
- **Casing Type:** Hollow Stem Auger
- **Casing I.D.:** 4.25 in
- **Casing Depth:** 12.5 ft.
- **Rock Core Method:** Dble Tube Wire Ln-NQ
- **Inspector:** Patrick Pendergast
- **Inspector Cert. No.:** 366-15

#### Hammer Calibration:

- **SPT (N<sub>60</sub>)**
- **N<sub>60</sub>**
- **REC (%)**
- **REC (%)**

#### Rock Core Method:

- **REC**
- **(ft.)**
- **REC (%)**

#### Soil/Rock Rec.:

- **RIQD %**
- **GRAPHIC**

#### AASHTO/USCS:

- **SAMPLE DEPTH**
- **SAMPLE No.**
- **BLOW COUNTS**
- **REC (%)**

#### Blows/0.5ft:

- **N<sub>60</sub>**
- **REC (%)**

#### Comments - Observations:

- **MATERIAL DESCRIPTION**
- **COMMENTS**

<table>
<thead>
<tr>
<th>ELEV. GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO/USCS</th>
<th>SAMPLE DEPTH</th>
<th>SAMPLE No.</th>
<th>BLOW COUNTS</th>
<th>N&lt;sub&gt;60&lt;/sub&gt;</th>
<th>REC (%)</th>
<th>COMMENTS - OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAVEL, some Sand, dense, dry, homogeneous, well graded, gray, fill. 1.5/El. 111.5</td>
<td></td>
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<tr>
<td>SAND, some Silt, trace Gravel, micaceous, medium dense, dry, homogeneous, well graded, tan to brown, residual.</td>
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<tr>
<td>Class. on S-3, S-4 (3.0-6.0') SM/A-2-4(0) N.M.C.=7.2% LL=NP, PL=NP, PI=NP.</td>
<td></td>
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<tr>
<td>SAND and GRAVEL, very dense, dry, homogeneous, well graded, light gray, residual.</td>
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<tr>
<td>Micaceous GNEISS, light gray, foliated, medium hard to soft, highly weathered to slightly weathered, thin to moderate bedding, jointed, wide spacing, shee dip, tight joints, RD=30-40, (RQD=23%).</td>
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</tbody>
</table>
Micaceous GNEISS, light gray, foliated, medium hard to soft, highly weathered to slightly weathered, thin to moderate bedding, jointed, wide spacing, sheer dip, tight joints, RD=30-40, (RQD=23%).

*(Layer continued from the previous page.)*

*Unconfined Compression on Rock*
*R-3 (16.2-16.9')*
*C_o = 12,703 psi.*

*Highly weathered gneiss from 24.5-33.0'.*
Micaceous GNEISS, light gray, foliated, medium hard to soft, highly weathered to slightly weathered, thin to moderate bedding, jointed, wide spacing, sheer dip, tight joints, $RD=30-40$, $(RQD=23\%)$.

(Layer continued from the previous page.)

Bottom of boring.

**NOTE:** N values and all graphical plots are for information only.
Boring SB-13  ECMS

District:  ___ County:  Delaware
SR  ___________ Section  ______
Baseline:  SEPTA Victory Avenue
Sta.  ___________ Offset  ___________
Segment  ___________ Offset  ___________
Coordinates:
Lat.  _________ Long.  _________
N  E

Ground Elevation:  107.0 ft.

Water Level Elevation/Elapsed Time:
\( \begin{align*}
\n & \text{Initial} & \text{Final} \\
\n & \text{101.8 ft.} & \text{97.2 ft.} \\
\n & \text{Elapsed} & \text{Elapsed} \\
\n & \text{0.0 hr.} & \text{18.0 hr.}
\end{align*}\)

Driller:  R. Hoffman

Company:  Allied Well Drilling

Drilling Start:  01/21/2016 11:00 am
Drilling Complete:  01/21/2016 4:00 pm
Grouting Complete:  01/27/2016 3:30 pm

Hammer Type:  _Automatic

\( \text{SPT Hammer Efficiency:} \frac{\text{Assumed}}{\text{Measured}} 0.8 \)

Hammer Calibration Date:

Hole Type:  _Continuous SPT - Rock Core_

Casing Type:  _Hollow Stem Auger_


Rock Core Method:  Dble Tube Wire Ln-NQ

Class. on S-5, S-6 (6.0-8.4')

SM/A-2-4(0)

N.M.C.=8.2%

LL=NP, PL=NP, PI=NP.

Unconfined Compression on Rock

\( R-2 \) (11.5-12.2')

\( C_0 = 7,436 \text{ psi} \)

**ENGINEER’S LOG**

---

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO / USCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>97.9</td>
<td>TOR</td>
<td>Micaceous GNEISS, gray, medium hard to hard, slightly weathered to fresh, indistinct bedding, foliated, jointed, wide spacing, very steep dip, open joints, ( RD=80-90, ) (RQD=72%).</td>
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<tr>
<td>100</td>
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<td>105</td>
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<tr>
<td>107.0</td>
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<td>GRAVEL, some Sand, medium dense, dry, homogeneous, well graded, gray, fill. 1.5'/El. 105.5</td>
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<tr>
<td>102.0</td>
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<td>SAND, loose to medium dense, dry, homogeneous, poorly graded, brown, residual. 5.0'/El. 102.0</td>
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</tr>
<tr>
<td>100</td>
<td>5.0'/El. 102.0</td>
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</tr>
<tr>
<td>97.2</td>
<td>97.2 ft. Elapsed 18.0 hr.</td>
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</tr>
<tr>
<td>97.9</td>
<td>TOR</td>
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<td>95</td>
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**NOTE:** N values and all graphical plots are for information only.
### ENGINEER'S LOG

**Boring**: SB-13      **ECMS**: __________

**District:** _____ **County:** Delaware

**SR**: _______ **Section**: __________

**Sta.**: __________ **Offset**: _______

*NOTE: N values and all graphical plots are for information only.*

---

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION / COMMENTS - OBSERVATIONS</th>
<th>AASHTO / USCS</th>
<th>SAMPLE DEPTH</th>
<th>SAMPLE No.</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N&lt;sub&gt;60&lt;/sub&gt;</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
<th>RQD %</th>
<th>Soil/Rock Rec. %</th>
<th>SPT (N&lt;sub&gt;s&lt;/sub&gt;)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Micaceous <strong>GNEISS</strong>, gray, medium hard to hard, slightly weathered to fresh, indistinct bedding, foliated, jointed, wide spacing, very steep dip, open joints, <strong>RD=80-90</strong>, (RQD=72%). <em>(Layer continued from the previous page.)</em></td>
<td></td>
<td></td>
<td>R-3</td>
<td>72% 2.4 96</td>
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<td>16.5</td>
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<td>R-4</td>
<td>76% 5.0 100</td>
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<tr>
<td>21.5</td>
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<td></td>
<td>R-5</td>
<td>90% 4.7 94</td>
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<tr>
<td>26.5</td>
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<td>R-6</td>
<td>83% 3.0 100</td>
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</table>

**29.5'/El. 77.5**: Bottom of boring.
**UNSAMPLED, PAVEMENT/SUBBASE.**

1.5'/El. 93.5

**SAND** and **GRAVEL**, medium dense to very dense, dry, lensed, well graded, black to gray, fill.

6.5'/El. 88.5

Cored a piece of concrete and copper wire. Terminate boring, offset 20' towards the existing building in SB-14A. Bottom of boring.

---

<table>
<thead>
<tr>
<th>SAMPLE DEPTH</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO / USCS</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>SPT HAMMER EFFICIENCY</th>
<th>ROCK CORE METHOD</th>
<th>HOLE TYPE</th>
<th>CASING TYPE</th>
<th>Casing Depth</th>
<th>Casing I.D.</th>
<th>HAMMER TYPE</th>
<th>HAMMER CALIBRATION DATE</th>
<th>CASING ID.</th>
<th>CASING TYPE</th>
<th>HAMMER EFFICIENCY</th>
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</thead>
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<tr>
<td>0.0</td>
<td>UNSAMPLED, PAVEMENT/SUBBASE.</td>
<td>UNUNS</td>
<td></td>
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<tr>
<td>1.5</td>
<td>UNSAMPLED, PAVEMENT/SUBBASE.</td>
<td>UNUNS</td>
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<tr>
<td>6.5</td>
<td>UNSAMPLED, PAVEMENT/SUBBASE.</td>
<td>UNUNS</td>
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</tbody>
</table>

24-hr. Water: Boring backfilled upon completion.
**ENGINEER'S LOG**

**Boring SB-14A ECMS**

**District:** ___  **County:** Delaware  
**SR** _______ **Section** _______ 
**Baseline:** SEPTA Victory Avenue  
**Sta.** _______ **Offset** _______ 
**Segment** _______ **Offset** _______ 

**Coordinates:**  
**Lat.** _______ **Long.** _______  
**E** __________ **N** __________  

**Ground Elev.** 95.0 ft. _______ 

**Water Level Elev./Elapsed Time:**  
♀ Initial 86.7 ft.  Elapsed 0.0 hr.  
♀ Final 86.6 ft.  Elapsed 21.0 hr.  

**Driller:** R. Miller  
**Company:** Allied Well Drilling  

**Drilling Start:** 01/28/2016 11:00 am  
**Drilling Complete:** 01/28/2016 2:00 pm  
**Grouting Complete:** 01/29/2016 3:30 pm  
**Rig:** Acker XLS Track  
**Rig Type:** Continuous SPT - Rock Core  
**Casing Type:** Double Tube Wire Ln-NQ  
**Casing I.D.:** 4.25 in  
**Casing Depth:** 10.5 ft.  
**Rock Core Method:** Dble Tube Wire Ln-NQ  
**Inspector:** Patrick Pendergast  
**Inspector Cert. No.:** 366-15  

**Unconfined Compression on Rock**  
**R-2 (12.8-13.4')**  
**C₀ = 23,209 psi.**

---

### MATERIAL DESCRIPTION

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<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>AASHTO / USCS</th>
<th>COMMENTS - OBSERVATIONS</th>
<th>SAMPLE DEPTH</th>
<th>SAMPLE NO.</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N₀</th>
<th>RQD %</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
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<td>90</td>
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</table>
| 85    |         | SAND and SILT, trace Gravel, micaceous, loose, dry, homogeneous, poorly graded, brown, residuum.  
Class. on S-1, S-2 (3.0-6.0')  
SM/A-2-4(0)  
N.M.C.=17.2%  
LL=NP, PL=NP, PI=NP.  
| 3.0'/El. 92.0 | | | S-1 | 2-3-4 | 9 | 1.0 | 67 |
| 85    |         | GRANITE               |               |                         |              |            |                           |    |       |           |         |
| 6.5'/El. 88.5 | | | S-2 | 2-2-5 | 9 | 1.5 | 100 |
| 84.4  | 84.4    | SCHIST, gray, medium hard, slightly weathered to highly weathered, thin to moderate bedding with flat dip.  
| | | | S-3 | 7-25-24 | 65 | 1.5 | 100 |
| 80.0  | 80.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 75.0  | 75.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 70.0  | 70.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 65.0  | 65.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 60.0  | 60.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 55.0  | 55.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 50.0  | 50.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 45.0  | 45.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 40.0  | 40.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 35.0  | 35.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 30.0  | 30.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 25.0  | 25.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 20.0  | 20.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 15.0  | 15.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 10.0  | 10.0    |                 |               |                         |              |            |                           |    |       |           |         |
| 5.0   | 5.0     |                 |               |                         |              |            |                           |    |       |           |         |
| 0.0   | 0.0     |                 |               |                         |              |            |                           |    |       |           |         |

---

**NOTE:** N values and all graphical plots are for information only.
SCHIST, gray, medium hard, slightly weathered to highly weathered, thin to moderate bedding with flat dip.

(Layer continued from the previous page.)

Bottom of boring.
Boring **T-2**  
ECMS

**District:** ___  
**County:** Delaware  
**SR:** _____  
**Section:** _____

**Baseline:** SEPTA Victory Avenue  
**Sta.** _____  
**Offset:** _____  
**Segment:** _____  
**Offset:** _____

**Coordinates:**  
**Lat.** _____  
**Long.** _____  
**E**  
**N**  
**Ground Elev.** 105.2 ft.

**Water Level Elev./Elapsed Time:**  
**Initial** NR  
**Elapsed** NR  
**Final** NR  
**Elapsed** NR

**Driller:** C. Lindhorst  
**Company:** Allied Well Drilling

---

**Soil/Rock Rec.**  
**ELEV.**  
**GRAPHIC**  
**MATERIAL DESCRIPTION**  
**AASHTO / USCS**  
**COMMENTS - OBSERVATIONS**  
**AASHTO / USCS**  
**SAMPLE**  
**DEPTH**  
**SAMPLE No.**  
**BLOW COUNTS**  
**Blows/0.5ft**  
**Nₚₚ**  
**RQD (%)**  
**REC**  
**REC (%)**  
**RQD %**  
**NR**  
**NR**  
**NR**  
**NR**  
**NR**  
**NR**

**SAND** and **GRAVEL**, some Silt, gray to brown, fill.  
5.0'/El. 100.2

**SAND**, some Silt, contains rock fragments, brown to tan, residual.  
Class. on BS-1 (5.0-8.5')  
SM/A-2-4(0)  
N.M.C. = 1.0%  
LL=NP, PL=NP, PI=NP.

8.5'/El. 96.7

**Hit rock at 8.5'. Borehole Infiltration Test performed at 6.0' in offset boring.**  
**Boring was unsampled throughout.**  
**Soil was classified based off of auger cuttings.**  
**Bottom of boring.**
Boring T-4  ECMS

District:  ___ County:  Delaware
SR  __________ Section  ________
Baseline:  SEPTA Victory Avenue
Sta.  __________ Offset  __________
Segment  __________ Offset  __________

Coordinates:
Lat.  __________ Long.  __________
E  N

Ground Elev.  99.1 ft.

Water Level Elev./Elapsed Time:
Initial  95.7 ft.  Elapsed  0.0 hr.
Final  Dry  Elapsed  18.0 hr.

Driller:  R. Hoffman
Company:  Allied Well Drilling

Drilling Start:  01/27/2016 1:00 pm
Drilling Complete:  01/27/2016 2:00 pm
Grouting Complete:  01/28/2016 8:00 am
Rig:  Acker XLS Track
Hammer Type:  Automatic

SPT Hammer Efficiency:
Assumed  0.8  Measured  ______
Hammer Calibration Date:  

Hole Type:  Continuous SPT - Rock Core
Casing Type:  Hollow Stem Auger
Casing I.D.:  4.25 in  Casing Depth:  4.5 ft.

Rock Core Method:  Double Tube Wire Line-NQ

Borehole Infiltration Test performed at 3.5' in offset boring.
Bottom of boring.

SPT Hammer Efficiency:

S-1  4-5-25  40  1.5  100
S-2  31-50/.4'  >67  0.9  100
S-3  50/.1'  >67  0.0  0
R-1  30%  1.4  70

SAND and GRAVEL, very dense, dry, homogeneous, well graded, gray, residuum.

GNEISS, gray, hard, slightly weathered, thin to moderate bedding with steep dip, (RQD=30%).

NOTE: N values and all graphical plots are for information only.
Boring T-5 ECMS

Drilling Start: 01/27/2016 11:00 am
Drilling Complete: 01/27/2016 12:00 pm
Grouting Complete: 01/28/2016 8:00 am

Rig: Acker XLS Track
Hammer Type: Automatic

Hammer Calibration Date:

SPT Hammer Efficiency:

NOTE: N values and all graphical plots are for information only.

<table>
<thead>
<tr>
<th>ELEV.</th>
<th>GRAPHIC</th>
<th>MATERIAL DESCRIPTION</th>
<th>COMMENTS - OBSERVATIONS</th>
<th>AASHTO/USCS</th>
<th>SAMPLE DEPTH</th>
<th>SAMPLE</th>
<th>SAMPLE No.</th>
<th>BLOW COUNTS (Blows/0.5ft)</th>
<th>N/0 RQD</th>
<th>REC (ft.)</th>
<th>REC (%)</th>
<th>SPT (N60)</th>
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</tbody>
</table>

**UNSAMPLED.**
0.0-1.2' Pavement
1.2-1.5' Subbase.

1.5'/El. 98.0

**SAND and GRAVEL,** very dense, dry, homogeneous, gray, fill.

2.5'/El. 97.0

**SAND and GRAVEL,** very dense, dry, homogeneous, gray, residuum.

4.0'/El. 95.5

GNEISS, gray, medium hard, slightly weathered, thin to moderate bedding with steep dip, (RQD=35%).

6.0'/El. 93.5

Borehole Infiltration Test performed at 3.0' in offset boring.

Auger refusal at 4.0'.

Bottom of boring.

Final Log Checked and Approved
By: Michael Giovannitti
Date: 3/30/2016

PENNDOT ENGINEER'S LOG - PENNDOT_GINT_VERSION_1.2.2.1_2-26-2016.GDT - 3/30/16 15:20 - L:\_GINT\PROJECTS\2015\15046.GPJ
APPENDIX D

PREVIOUSLY DRILLED BORINGS

(OCTOBER 2014 - FIDELIS ENGINEERING)
## Log of Boring B-3

**Project:** SEPTA- 103 Victory Avenue Project  
**Project Location:** 103 Victory Avenue, Upper Darby, PA  
**Project Number:** 14121

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Checked By</th>
<th>Drilling Method</th>
<th>Size/Type</th>
<th>Total Depth of Borehole</th>
<th>Drill Rig Type</th>
<th>Drilling Contractor</th>
<th>Approximate Surface Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/21/2014</td>
<td>J. Hartz</td>
<td>R. Crossan</td>
<td>6&quot; HSA</td>
<td>2&quot; o.d. SBS</td>
<td>13 feet bgs</td>
<td>Truck Rig</td>
<td>Allied Drilling</td>
<td>98.28</td>
</tr>
</tbody>
</table>

**Groundwater Level and Date Measured:** Not encountered ATD  
**Sampling Method(s):** SPT  
**Hammer Data:** 140 lb. -30" drop  
**Backfill:** cuttings  

**Borehole:**  
**Logged By:** J. Hartz  
**Drill Bit Size/Type:** 2" o.d. SBS  
**Total Depth of Borehole:** 13 feet bgs  
**Drilling Contractor:** Allied Drilling  
**Approximate Surface Elevation:** 98.28

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Elevation (feet)</th>
<th>Depth (feet)</th>
<th>Sample Number</th>
<th>Sample Type</th>
<th>Sampling Resistance, blows/ft</th>
<th>Recovery (ft)</th>
<th>Recovery %</th>
<th>q, ksf</th>
<th>Water Content, %</th>
<th>LL, %</th>
<th>PI, %</th>
<th>q, ksf</th>
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<tr>
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<td></td>
<td></td>
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<td>S2</td>
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<td>Fill</td>
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</table>

**Remarks and Other Tests:**  
Boring terminated at 13' below ground surface due to auger refusal.

**USCS Symbol:** Asphalt, SM

**Fill:**  
- 6" of Asphalt  
- Silty sand (sm), brown to black, dry, medium dense

**SM:**  
- Silty sand, white and gray, dry, very dense, completely weathered rock

---

Fidelis Engineering, Inc.  
1691 Horseshoe Pike, Suite One  
Glenmoore, PA 19343  
(p) 484-228-8241 (f) 484-228-8175
Date(s) Drilled: 10/22/2014
Logged By: J. Hartz
Checked By: R. Crossan

Drilling Method: 6" HSA
Drill Bit Size/Type: 2" o.d. SBS
Total Depth of Borehole: 10 feet bgs

Drill Rig Type: Truck Rig
Drilling Contractor: Allied Drilling
Approximate Surface Elevation: 103.91

Groundwater Level and Date Measured: Not encountered ATD
Sampling Method(s): SPT
Hammer Data: 140 lb. -30" drop

Backfill: cuttings
Location: Checked By: R. Crossan

Total Depth of Borehole: 10 feet bgs
Approximate Surface Elevation: 103.91

MATERIAL DESCRIPTION

- Silty sand (sm), brown, dry, dense
- Silty sand (sm), brown with white and black bands, dry, medium dense to very dense. Completely weathered rock.
- Boring terminated at 10' below ground surface due to auger refusal.

Graphic Log

USCS Symbol: SM

REMARKS AND OTHER TESTS

- Elevation (feet):
  - 103.91
  - 98.91
  - 93.91
  - 88.91
  - 83.91
  - 78.91
  - 73.91

- Depth (feet):
  - 0
  - 5
  - 10
  - 15
  - 20
  - 25
  - 30

- Sample Number:
  - S1
  - S2
  - S3
  - S4

- Sample Type:
  - Sampling Resistance, blows/ft
  - Recovery %
  - q, ksf
  - Water Content, %
  - LL, %
  - PI, %
  - Recovery (ft)

- Elevation (feet):
  - 103.91
  - 98.91
  - 93.91
  - 88.91
  - 83.91
  - 78.91
  - 73.91

- USCS Symbol:
  - SM

- Sample Type:
  - Sampling Resistance, blows/ft
  - Recovery%
  - q, ksf
  - Water Content, %
  - LL, %
  - PI, %
  - Recovery (ft)

- Elevation (feet):
  - 103.91
  - 98.91
  - 93.91
  - 88.91
  - 83.91
  - 78.91
  - 73.91

- Sample Type:
  - Sampling Resistance, blows/ft
  - Recovery%
  - q, ksf
  - Water Content, %
  - LL, %
  - PI, %
  - Recovery (ft)

- Elevation (feet):
  - 103.91
  - 98.91
  - 93.91
  - 88.91
  - 83.91
  - 78.91
  - 73.91

- Sample Type:
  - Sampling Resistance, blows/ft
  - Recovery%
  - q, ksf
  - Water Content, %
  - LL, %
  - PI, %
  - Recovery (ft)

- Elevation (feet):
  - 103.91
  - 98.91
  - 93.91
  - 88.91
  - 83.91
  - 78.91
  - 73.91

- Sample Type:
  - Sampling Resistance, blows/ft
  - Recovery%
  - q, ksf
  - Water Content, %
  - LL, %
  - PI, %
  - Recovery (ft)

- Elevation (feet):
  - 103.91
  - 98.91
  - 93.91
  - 88.91
  - 83.91
  - 78.91
  - 73.91

- Sample Type:
  - Sampling Resistance, blows/ft
  - Recovery%
  - q, ksf
  - Water Content, %
  - LL, %
  - PI, %
  - Recovery (ft)

- Elevation (feet):
  - 103.91
  - 98.91
  - 93.91
  - 88.91
  - 83.91
  - 78.91
  - 73.91

- Sample Type:
  - Sampling Resistance, blows/ft
  - Recovery%
  - q, ksf
  - Water Content, %
  - LL, %
  - PI, %
  - Recovery (ft)
**Project:** SEPTA- 103 Victory Avenue Project  
**Project Location:** 103 Victory Avenue, Upper Darby, PA  
**Project Number:** 14121

### Log of Boring B-5

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/23/2014</td>
<td>J. Hartz</td>
<td>R. Crossan</td>
</tr>
</tbody>
</table>

**Drilling Method:** 6” HSA  
**Drill Bit Size/Type:** 2” o.d. SBS  
**Drill Rig Type:** Truck Rig  
**Drilling Contractor:** Allied Drilling  
**Groundwater Level and Date Measured:** Not encountered ATD  
**Sampling Method(s):** SPT  
**Total Depth of Borehole:** 14 feet bgs  
**Approximate Surface Elevation:** 105.52  
**Hammer Data:** 140 lb. -30” drop  
**Backfill:** cuttings

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Number</th>
<th>Sample Type</th>
<th>Sampling Resistance, blows/ft</th>
<th>Recovery (%)</th>
<th>Recovery (ft)</th>
<th>LL, %</th>
<th>PI, %</th>
<th>q, ksf</th>
<th>Water Content, %</th>
<th>USCS Symbol</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>S1</td>
<td>7-4-10-11</td>
<td></td>
<td>1.5</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fill</td>
<td>silty sand (sm), brown and black, dry, medium dense</td>
</tr>
<tr>
<td>10</td>
<td>S2</td>
<td>5-5-7-10</td>
<td></td>
<td>1.33</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>silty sand (sm), brown, dry, medium dense</td>
</tr>
<tr>
<td>20</td>
<td>S3</td>
<td>7-12-24-47</td>
<td></td>
<td>1.66</td>
<td>87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>silty sand (sm), tan and white with black streaks, dry, dense to very dense, completely weathered rock.</td>
</tr>
<tr>
<td>30</td>
<td>S4</td>
<td>27-50/4</td>
<td>.83</td>
<td>100</td>
<td>6.1</td>
<td>NV</td>
<td>NP</td>
<td>100</td>
<td></td>
<td></td>
<td>Boring terminated at 14’ below ground surface due to auger refusal.</td>
</tr>
<tr>
<td>40</td>
<td>S5</td>
<td>50/5</td>
<td>.25</td>
<td>60</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Graphic Log:**

- Fill
- SM

---

**Fidelis Engineering, Inc.**

1691 Horseshoe Pike, Suite One  
Glenmoore, PA 19343  
(p) 484-228-8241 (f) 484-228-8175
### Log of Boring B-6

**Project:** SEPTA- 103 Victory Avenue Project  
**Project Location:** 103 Victory Avenue, Upper Darby, PA  
**Project Number:** 14121

<table>
<thead>
<tr>
<th>Date(s) Drilled</th>
<th>Logged By</th>
<th>Checked By</th>
<th>Drilling Method</th>
<th>Drilling Rig Type</th>
<th>Groundwater Level and Date Measured</th>
<th>Total Depth of Borehole</th>
<th>Approximate Surface Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/22/2014</td>
<td>J. Hartz</td>
<td>R. Crossan</td>
<td>6” HSA</td>
<td>Truck Rig</td>
<td>Not Encountered ATD</td>
<td>11 feet bgs</td>
<td>113.55</td>
</tr>
</tbody>
</table>

#### Drilling Parameters
- **Drill Bit Size/Type:** 2” o.d. SBS  
- **Drill Rig Contractor:** Allied Drilling  
- **Sampling Method(s):** SPT  
- **Hammer Data:** 140 lb. -30” drop

<table>
<thead>
<tr>
<th>Drilling Contractor</th>
<th>Approximate Surface Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allied Drilling</td>
<td>113.55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cutting</th>
<th>Backfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logged By J. Hartz</td>
<td>Location</td>
</tr>
<tr>
<td>Drill Bit Size/Type</td>
<td>2” o.d. SBS</td>
</tr>
<tr>
<td>Drilling Contractor</td>
<td>Allied Drilling</td>
</tr>
<tr>
<td>Groundwater Level and Date Measured</td>
<td>Not Encountered ATD</td>
</tr>
<tr>
<td>Drilling Rig Type</td>
<td>Truck Rig</td>
</tr>
</tbody>
</table>

#### Material Description
- **Approximately 3” of gravel silty sand (sm), brown, dry, medium dense**
- **Silty sand, tan and brown with orange and white spec, dry, very dense. completely weathered rock**
- **Boring Terminated at 11’ below ground surface due to auger refusal.**

### Graphical Log

- **USCS Symbol:** SM
- **Graphic Log:** Material description graphics

### Test Results
- **Elevation (feet):** 113.55  
- **Depth (feet):** 0
- **Sample Number:** S1  
- **Sample Type:** Silty Sand
- **Sampling Resistance, Blow Count:** 9-7-5-6
- **Recovery:** .66  
- **Recovery %:** 33  
- **q, ksf:** 11.4
- **Water Content, %:** 11.4
- **USCS Symbol:** SM

- **Elevation (feet):** 108.55  
- **Depth (feet):** 5
- **Sample Number:** S2  
- **Sample Type:** Silty Sand
- **Sampling Resistance, Blow Count:** 3-4-5-14
- **Recovery:** 1  
- **Recovery %:** 50

- **Elevation (feet):** 103.55  
- **Depth (feet):** 10
- **Sample Number:** S3  
- **Sample Type:** Silty Sand
- **Sampling Resistance, Blow Count:** 8-22-43-50/5
- **Recovery:** 1.75  
- **Recovery %:** 88

- **Elevation (feet):** 98.55  
- **Depth (feet):** 15
- **Sample Number:** S4  
- **Sample Type:** Silty Sand
- **Sampling Resistance, Blow Count:** 34-50/5
- **Recovery:** .75  
- **Recovery %:** 82

---

**Fidelis Engineering, Inc.**  
1691 Horseshoe Pike, Suite One  
Glenmoore, PA 19343  
(p) 484-228-8241 (f) 484-228-8175
**Log of Boring B-7**

**Sheet 1 of 1**

**Project:** SEPTA- 103 Victory Avenue Project  
**Project Location:** 103 Victory Avenue, Upper Darby, PA  
**Project Number:** 14121

---

**Date(s) Drilled:** 10/21/2014  
**Logged By:** J. Hartz  
**Checked By:** R. Crossan

**Drilling Method:** 6" HSA  
**Drill Bit Size/Type:** 2" o.d. SBS

**Drill Rig Type:** Truck Rig  
**Drilling Contractor:** Allied Drilling

**Groundwater Level and Date Measured:** Not encountered ATD  
**Sampling Method(s):** SPT

**Borehole Backfill:** cuttings

---

**Total Depth of Borehole:** 13 feet bgs  
**Approximate Surface Elevation:** 113.2  
**Hammer Data:** 140 lb. -30" drop

---

<table>
<thead>
<tr>
<th>Elevation (feet)</th>
<th>Depth (feet)</th>
<th>Sample Number</th>
<th>Sample Type</th>
<th>Sampling Resistance, blows/ft</th>
<th>Recovery (ft)</th>
<th>Recovery %</th>
<th>q, ksf</th>
<th>Water Content, %</th>
<th>LL, %</th>
<th>PI, %</th>
<th>Sample Type</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>113.2</td>
<td>0</td>
<td>S1</td>
<td>9-9-5-4</td>
<td>1.33</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>S2</td>
<td>4-3-2-3</td>
<td>1</td>
<td>50</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>108.2</td>
<td>5</td>
<td>S3</td>
<td>5-5-6-8</td>
<td>1.2</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
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<td>SM</td>
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<td></td>
<td></td>
<td>S4</td>
<td>9-8-8-13</td>
<td>2</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td>12-48-50/3</td>
<td>1</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

- Approximately 3" of gravel. Silty sand (sm), brown, dry, loose to medium dense
- Silty sand (sm), brown with orange and white streaks and specs, dry, medium dense to very dense
- Boring terminated at 13' below ground surface due to auger refusal.
**Project:** SEPTA- 103 Victory Avenue Project  
**Project Location:** 103 Victory Avenue, Upper Darby, PA  
**Project Number:** 14121

**Log of Boring B-8**

**Date(s) Drilled:** 8/21/2014  
**Logged By:** J. Hartz  
**Checked By:** R. Crossan

**Drilling Method:** 6" HSA  
**Drill Bit Size/Type:** 2" o.d. SBS

**Drill Rig Type:** Truck Rig  
**Drilling Contractor:** Allied Drilling

**Groundwater Level and Date Measured:** Not encountered ATD  
**Sampling Method(s):** SPT  
**Hammer Data:** 140 lb. -30" drop

**Total Depth of Borehole:** 19 feet bgs  
**Approximate Surface Elevation:** 112.75

**Backfill:** cuttings  

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Number</th>
<th>Sample Type</th>
<th>Sampling Resistance, Blows/ft</th>
<th>Recovery (%)</th>
<th>q, ksf</th>
<th>Water Content, %</th>
<th>USCS Symbol</th>
<th>Material Description</th>
<th>Remarks and Other Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>S1</td>
<td>5-8-5-4</td>
<td>1.2</td>
<td>60</td>
<td></td>
<td></td>
<td>SM</td>
<td>2&quot; of gravel</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S2</td>
<td>6-5-4-3</td>
<td>1</td>
<td>50</td>
<td></td>
<td></td>
<td>SM</td>
<td>silty sand with gravel (sm), brown and tan, loose to medium dense, dry</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S3</td>
<td>6-3-5-6</td>
<td>1.5</td>
<td>75</td>
<td></td>
<td></td>
<td>SM</td>
<td>silty sand (sm), brown with orange and white specs and streaks, dry, loose</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>S4</td>
<td>5-7-8-10</td>
<td>1.5</td>
<td>75</td>
<td></td>
<td></td>
<td>SM</td>
<td>silty sand (sm), tan and white with black streaks, dry, dense to very dense. completely weathered rock.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>S5</td>
<td>3-10-20-19</td>
<td>1.33</td>
<td>67</td>
<td>9.0</td>
<td>NV, NP</td>
<td>SM</td>
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<td>Boring terminated at 19' below ground surface due to auger refusal.</td>
</tr>
<tr>
<td>20</td>
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<td>1-19-33-50/5</td>
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<td>67</td>
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</tr>
<tr>
<td>25</td>
<td>S7</td>
<td>50/2</td>
<td>.17</td>
<td>100</td>
<td></td>
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<td>SM</td>
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</tr>
</tbody>
</table>

**Graph Log:**

**USCS Symbols:** SM, NV, NP

**Designation:**

1691 Horseshoe Pike, Suite One  
Glenmoore, PA 19343  
(p) 484-228-8241 (f) 484-228-8175

Fidelis Engineering, Inc.
APPENDIX E

CORE BOX PHOTOGRAPHS
Boring SB-1
Box 1 of 1; Depth 1.5 ft. to 15.0 ft.
District: SEPTA Victory Avenue
County: Delaware
Station: Boring SB-2
Offset: Box 1 of 1; Depth 1.5 ft. to 16.0 ft.

<table>
<thead>
<tr>
<th>Run</th>
<th>Depth</th>
<th>Tec.</th>
<th>Jam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0-15.0</td>
<td>3.0</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>15.0-16.0</td>
<td>3.0</td>
<td>12</td>
</tr>
</tbody>
</table>

Boring SB-2
Box 1 of 1; Depth 1.5 ft. to 16.0 ft.

Prepared by: American Geotechnical and Environmental Services, Inc.
Boring SB-3
Box 1 of 1; Depth 1.5 ft. to 26.1 ft.
Boring SB-4
Box 1 of 1; Depth 0.0 ft. to 20.7 ft.
<table>
<thead>
<tr>
<th>Run</th>
<th>Depth</th>
<th>PVC</th>
<th>Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15.0 - 17.6</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>17.0 - 20.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3</td>
<td>20.0 - 25.6</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Boring SB-5
Box 1 of 1; Depth 0.0 ft. to 25.6 ft.

Prepared by: American Geotechnical and Environmental Services, Inc.
Boring SB-6
Box 1 of 1; Depth 1.5 ft. to 11.5 ft.
CORE BOX PHOTO LOG

District: Delaware
County: Delaware
Station: Boring SB-7
Offset:

SEPTA Victory Avenue

ECMS No.:

Page 1 of 1
Date Printed: 3/18/2016

Boring SB-7
Box 1 of 2; Depth 0.0 ft. to 26.7 ft.

Boring SB-7
Box 2 of 2; Depth 26.7 ft. to 35.2 ft.

Prepared by: American Geotechnical and Environmental Services, Inc.
Boring SB-8
Box 1 of 1; Depth 0.0 ft. to 24.3 ft.
<table>
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<th>RUN</th>
<th>DEPTH</th>
<th>RECOVERY</th>
<th>RQD</th>
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<tbody>
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<td>1</td>
<td>11.0 - 13.0</td>
<td>1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>2</td>
<td>13.0 - 15.0</td>
<td>1.5</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>15.0 - 20.0</td>
<td>4.9</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Boring SB-9
Box 1 of 1; Depth 0.0 ft. to 20.0 ft.
Boring SB-10
Box 1 of 2; Depth 0.0 ft. to 23.5 ft.

Boring SB-10
Box 2 of 2; Depth 23.5 ft. to 32.5 ft.

Prepared by: American Geotechnical and Environmental Services, Inc.
<table>
<thead>
<tr>
<th>Station</th>
<th>Offset</th>
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</thead>
</table>

Boring SB-11
Box 1 of 1; Depth 0.5 ft. to 26.1 ft.
CORE BOX PHOTO LOG

SEPTA Victory Avenue

District:  
County: Delaware

Station:  
Offset:

ECMS No.:  
Page 1 of 1

Date Printed: 3/18/2016

Boring SB-12  
Box 1 of 2; Depth 0.0 ft. to 34.5 ft.

Boring SB-12  
Box 2 of 2; Depth 24.5 ft. to 37.0 ft.

Prepared by: American Geotechnical and Environmental Services, Inc.
District: SEPTA Victory Avenue
County: Delaware
Station: Box 1 of 2; Depth 0.0 ft. to 21.5 ft.
Offset:
ECMS No.:
Page 1 of 1
Date Printed: 3/18/2016

Boring SB-13
Box 1 of 2; Depth 0.0 ft. to 21.5 ft.

Boring SB-13
Box 2 of 2; Depth 21.5 ft. to 29.5 ft.

Prepared by: American Geotechnical and Environmental Services, Inc.
<table>
<thead>
<tr>
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<tbody>
<tr>
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<tr>
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</tr>
<tr>
<td>and Boring SB-14A</td>
<td></td>
</tr>
<tr>
<td>Box 1 of 1; Depth 3.0 ft. to 21.1 ft.</td>
<td></td>
</tr>
</tbody>
</table>
SEPTA Victory Avenue

District: Delaware
Station: Boring T-4
Box 1 of 1; Depth 1.5 ft. to 6.6 ft.
and Boring T-5
Box 1 of 1; Depth: 1.5 ft. to 6.0 ft.

Prepared by: American Geotechnical and Environmental Services, Inc.
APPENDIX F
LABORATORY TESTING RESULTS
## SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>Boring and Sample Number</th>
<th>Depth (feet)</th>
<th>Classification</th>
<th>USCS and AASHTO Symbols</th>
<th>Water Content (%)</th>
<th>Dry Unit Weight (pcf)</th>
<th>Atterberg Limits</th>
<th>Specific Gravity</th>
<th>Organic Content (%)</th>
<th>Grain Size</th>
<th>Compaction</th>
<th>Consolidation</th>
<th>Unconfined Compression</th>
<th>Chloride (ppm)</th>
<th>Sulfate (ppm)</th>
<th>Sulfide (ppm)</th>
<th>Resistivity (Ohm-cm)</th>
<th>pH</th>
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<tbody>
<tr>
<td>SB-01 R-2</td>
<td>7.5-7.9</td>
<td>Rock Core</td>
<td>SP-SM A-1-b(0)</td>
<td>4.5</td>
<td>NP</td>
<td>NP</td>
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<td>6,530</td>
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★ Refer to Laboratory Test Curves

Sheet 1 of 2
### SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>Boring and Sample Number</th>
<th>Depth (feet)</th>
<th>Classification</th>
<th>USCS and AASHTO Symbols</th>
<th>Water Content (%)</th>
<th>Dry Unit Weight (pcf)</th>
<th>Atterberg Limits</th>
<th>Organic Content (%)</th>
<th>Grain Size</th>
<th>Compaction</th>
<th>Consolidation</th>
<th>Direct Shear</th>
<th>Analytical Results (ppm)</th>
<th>Unconfined Compression</th>
<th>Resistivity (Ohm-m)</th>
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★ Refer to Laboratory Test Curves
COBBLES

GRAVEL

SAND

SILT OR CLAY

course fine course medium fine

U.S. STANDARD SIEVE OPENING IN INCHES

U.S. STANDARD SIEVE NUMBERS

6 4 3 2 1.5 1 3/8 4 10 20 40 60 100 200

HYDROMETER

% +3
% Gravel
% Sand
% Fines
% -2μ
Cc
Cu
LL
PL
PI
AASHTO
USCS
w (%)

Particle Size

(Sieve #)

PERCENT PASSING

PERCENT FINER

100 90 80 70 60 50 40 30 20 10 0

100 100.0
90 68.9
80 68.9
70 58.8
60 54.5
50 49.3
40 46.0
30 42.0
20 32.6
10 24.8
5 19.6
2 15.6

SYMBOL

DESCRIPTION AND REMARKS

Brown SILTY GRAVEL with SAND (GM)

PARTICLE SIZE DISTRIBUTION

SEPTA 103 Victory Avenue

Project Number: 60414225

March 2016

Figure 6

AECOM
### Specimen Information

<table>
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<th>Water Content (%)</th>
<th>Wet Unit Weight (pcf)</th>
<th>Dry Unit Weight (pcf)</th>
<th>Length (in)</th>
<th>Diameter (in)</th>
<th>q₀ (psi)</th>
<th>Strain to Peak (%)</th>
<th>Strain Rate (%/min)</th>
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**Tested by:** BS  
**Test Date:** 3/2/2016  
**Reviewed by:** MHD

---

### Test Summary

**Project No.:** 60414225  
**SEPTA 103 Victory Avenue**  
**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**  

**Boring:** SB-1  
**Sample:** R-2  
**Depth:** 7.5-7.9  
**March 2016**
Specimen Information Test Summary

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Tested by: BS  Test Date: 3/2/2016  Reviewed by: MHD

Project No. 60414225  SEPTA 103 Victory Avenue

UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN

Boring: SB-3
Sample: R-3  Depth: 18.2-18.7  March 2016
**Specimen Information**

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**Test Summary**

- **Project No.** 60414225
- **SEPTA 103 Victory Avenue**
- **UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**
- **Boring:** SB-4
- **Sample:** R-3
- **Depth:** 15.9-16.3
- **March 2016**

**Analysis File:** UCDAPV1.XLS  
**RC-3 SB-4 R-3 15.9-16.3**  
**3/3/2016**
# Specimen Information and Test Summary

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Tested by: BS  
Test Date: 3/2/2016  
Reviewed by: MHD

### Project No.

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### SEPTA 103 Victory Avenue

## UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN

- Boring: SB-6
- Sample: R-2  
  - Depth: 8.5-8.9  
  - March 2016

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**Analysis File:** UCDAPV1.XLS  
**RC-4 SB-6 R-2 8.5-8.9**  
**3/3/2016**
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Tested by: BS  
Test Date: 3/2/2016  
Reviewed by: MHD

### UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN

**Project No.**  
60414225  
**SEPTA 103 Victory Avenue**

**Boring:** SB-7  
Sample: R-3  Depth: 22.0-22.8  
March 2016
UNCONFINED COMPRESSION TEST
ON ROCK CORE SPECIMEN

Project No. 60414225
SEPTA 103 Victory Avenue

Tested by: BS  Test Date: 3/3/2016  Reviewed by: MHD

Sample: R-1  Depth: 13.0-13.6  March 2016

Specimen Information

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Analysis File: UCDAPV1.XLS
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Tested by: BS  
Test Date: 3/3/2016  
Reviewed by: MHD

## Test Summary

**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**

- **Project No.:** 60414225  
- **SEPTA:** 103 Victory Avenue
- **Boring:** SB-10
- **Sample:** R-2  
- **Depth:** 18.8-19.2  
- **March 2016**

Analysis File: UCDAPV1.XLS  
RC-7 SB-10 R-2 18.8-19.2  
3/4/2016
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<tbody>
<tr>
<td>0.1</td>
<td>166.4</td>
<td>166.1</td>
<td>4.02</td>
<td>1.98</td>
<td>12,703</td>
<td>0.33</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Tested by: BS  
Test Date: 3/3/2016  
Reviewed by: MHD

### Project Information

**Project No.** 60414225  
**SEPTA** 103 Victory Avenue  
**Boring:** SB-12  
**Sample:** R-3  
**Depth:** 16.2-16.9  
**March 2016**

### Graph

- **Compressive Stress, psi** vs **Axial Strain, %**
- Analysis File: UCDAPV1.XLS RC-8 SB-12 R-3 16.2-16.9

**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**
UNCONFINED COMPRESSION TEST
ON ROCK CORE SPECIMEN

Tested by: MHD  Test Date: 3/3/2016  Reviewed by: MHD

Project No. 60414225  
SEPTA  103 Victory Avenue  

Analysis File: UCDAPV1.XLS  
RC-9 SB-13 R-2  11.5-12.2  
March 2016
### Specimen Information

<table>
<thead>
<tr>
<th>Water Content (%)</th>
<th>Wet Unit Weight (pcf)</th>
<th>Dry Unit Weight (pcf)</th>
<th>Length (in)</th>
<th>Diameter (in)</th>
<th>(q_u) (psi)</th>
<th>Strain to Peak (%)</th>
<th>Strain Rate (%/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>167.9</td>
<td>167.8</td>
<td>4.04</td>
<td>1.98</td>
<td>23,209</td>
<td>0.27</td>
<td>0.28</td>
</tr>
</tbody>
</table>

**Test Summary**

- **Project No.**: 60414225
- **SEPTA 103 Victory Avenue**
- **UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**
- **Boring**: SB-14A
- **Sample**: R-2  Depth: 12.8-13.4
- **Test Date**: 3/3/2016
- **Reviewed by**: MHD

**Analysis File**: UCDAPV1.XLS

**RC-10 SB-14A R-2 12.8-13.4**

**March 2016**
APPENDIX G

CALCULATIONS
### SEPTA Victory Avenue

#### Shop Building

<table>
<thead>
<tr>
<th>N&lt;sub&gt;60&lt;/sub&gt;</th>
<th>Spoons</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-1: 8</td>
<td>8 (1)</td>
</tr>
<tr>
<td>SB-2: 29+12 = 41</td>
<td>12</td>
</tr>
<tr>
<td>SB-3: 21-27-44 = 92</td>
<td>3</td>
</tr>
<tr>
<td>SB-5: 15+25+8+5 = 55</td>
<td>5</td>
</tr>
<tr>
<td>SB-6: 100 = 100</td>
<td>(1)</td>
</tr>
<tr>
<td>SB-8: 15+8 = 23</td>
<td>2</td>
</tr>
<tr>
<td>SB-9: 17-6-3 = 26</td>
<td>3</td>
</tr>
<tr>
<td>B-3: 12+100 = 112</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N&lt;sub&gt;60&lt;/sub&gt;'s</th>
<th>Spoons</th>
<th>Average N&lt;sub&gt;60&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>457</td>
<td>19</td>
<td>24.1 = USE 24</td>
</tr>
</tbody>
</table>

For a N<sub>60</sub> value of 24, in fill material, a friction angle of 28° is used. (DM-4/2015, Table 10.8.3.5.2a-1P), attached.

Dry unit weight of 115 psf

\[ \phi_f = 28° \]
\[ \gamma \text{(pcf)} = 115 \]

- For Residual, assume \( N_{an} = 450 \), \( v.s. \)

\[ \phi = 28° \]
\[ \gamma = 140 \text{pcf} \]
SPECIFICATIONS

COMMENTARY

placement.

An enlarged base may be used at the tip of a shaft to increase the tip bearing area, or to provide additional resistance to uplift loads. Due to the difficulty of excavation and support of enlarged bases, consideration should be given instead to extending the shaft to a greater depth to provide additional resistance. This avoids the construction difficulties and high additional cost of shafts with enlarged bases relative to straight-sided shafts.

10.8.3.5.2 Estimation of Drilled Shaft Resistance in Cohesionless Soils

10.8.3.5.2b Side Resistance

The following shall supplement A10.8.3.5.2b.

A correlation between \( N_{60} \) blow count, friction angle and unit weight of material is provided in Table 10.8.3.5.2b-1P.

Table 10.8.3.5.2b-1P – Friction Angles and Unit Weights of Sands

<table>
<thead>
<tr>
<th>CONSISTENCY</th>
<th>( \phi )</th>
<th>( N_{60} )</th>
<th>( \gamma ) (kcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Loose</td>
<td>25°-30°</td>
<td>0-4</td>
<td>0.070-0.100</td>
</tr>
<tr>
<td>Loose</td>
<td>27°-32°</td>
<td>4-10</td>
<td>0.090-0.115</td>
</tr>
<tr>
<td>Medium</td>
<td>30°-35°</td>
<td>10-30</td>
<td>0.110-0.130</td>
</tr>
<tr>
<td>Dense</td>
<td>35°-40°</td>
<td>30-50</td>
<td>0.110-0.130</td>
</tr>
<tr>
<td>Very Dense</td>
<td>38°-43°</td>
<td>&gt; 50</td>
<td>0.130-0.150</td>
</tr>
</tbody>
</table>

10.8.3.5.3 Shafts in Strong Soil Overlying Weaker Compressible Soil

The following shall supplement A10.8.3.5.3.

Where the tip of a shaft could bear on a thin firm soil layer underlain by a softer soil unit, the shaft shall be extended through the softer soil unit to eliminate the potential for a punching shear failure into the softer soil deposit.

10.8.3.5.4 Estimation of Drilled Shaft Resistance in Rock

10.8.3.5.4a General

The following shall supplement A10.8.3.5.4a.

The side resistance from overlying soil deposits and weak rock shall be ignored.

C10.8.3.5.3

The following shall supplement AC10.8.3.5.3.

Punching shear failure is a failure mode typically associated with drilled shafts bearing on soils which behave plastically, but it is also of concern where shafts bear on a thin firm soil layer underlain by a softer deposit. In such cases, the influence of the bearing load at the surface of the soft layer shall be analyzed.

10.8.3.5.4a

The following shall supplement AC10.8.3.5.4a.

Rock stratification should be considered in the design of rock sockets as follows:

- Sockets embedded in alternating layers of weak and strong rock should be designed using the strength of the weaker rock.
Shop Building

- Assume FF = 101.0 ft, BFE = ± 97.0 ft, use 4.0' Frost Depth.

Recommandation

- Maximum allowable Foundation Pressure = 2.5 ksf
- Foundation pressures are to reduce concerns for settlement of Fill and differential settlement.
- Loose existing Fill encountered during construction should be removed and replaced.

Admin. Building

- Assume FF = 102.0 ft, BFE = ± 98.0 ft [4.0' Frost Protected]

Recommandations

- Maximum allowable Foundation Pressure = 5.0 ksf
- Some rock may need to be excavated to get building floor area to grade and install footings.

Retaining Wall - Western portion along Victory Ave.

- Based on proximity of Victory Ave - Most feasible wall is an unanchored Soldier Beam and Lagging.
- Soldier beams will be pre-drilled into bedrock; bearing resistance is not a design issue. Lateral deflection at the tops of the drilled shanks to be limited to 0.5 ft or less.
- For lateral capacity and deflection analysis, use the following:

**Soil**

\[ \phi = 32^\circ \]  
Conservative for residual, but represents retained soil as well.

\[ C = 0 \text{ pcf} \]

\[ \gamma = 120 \text{ pcf} \]

\[ \gamma_s = 125 \text{ pcf} \]

- Assume groundwater El. 98 ft based on SB-4, SB-7, SB-10

\[ k_a = \frac{\sin^2(\theta + \phi')}{\pi \left[ \sin^2 \theta \sin(\theta - \phi) \right]} \]

Where, \( \phi = 0^\circ \) - Conservative

\[ \beta = 0^\circ \] - Assume level backfill along Victory Ave.

\[ \theta = 90^\circ \] - Slope of Backfill

\[ \theta = 90^\circ \] - From horizontal

\[ k_a = 0.34 \]

\[ \phi' = 32^\circ \]

- Add traffic surcharge to loading:

\[ T = \left[ 1 + \frac{\sin(\phi')}{\sin(\phi) \sin(\phi') \sin(\phi - \phi')} \right]^2 = 2.341 \]

- For lateral pile capacity/deflection analyses, assume:

- Sand P-Y curve, \( k = 60 \text{ pcf} \) (subgrade mod-ks), cyclic loading.

**Rock** - Top of rock varies along Wally: see boring logs.

\[ \phi = 38^\circ \]

\[ C = 0 \]

\[ \sigma = 140 \text{ pcf} \]

- Assume no active earth pressure contribution from intact rock.
<table>
<thead>
<tr>
<th>Retaining Wall - Southern portion along existing driveway</th>
</tr>
</thead>
<tbody>
<tr>
<td>- To remain consistent with western wall, Soldier Beam and Lagging</td>
</tr>
<tr>
<td>is reasonable. However, available site plan suggests adequate room</td>
</tr>
<tr>
<td>is available to provide a temporary cut and build a wall from</td>
</tr>
<tr>
<td>bottom-up. Therefore, a conventional cast-in-place concrete</td>
</tr>
<tr>
<td>cantilevered wall, MSE, T-wall, or similar are feasible.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>- Based on finished grade of about FL 100 ft in front of wall</td>
</tr>
<tr>
<td>retaining wall foundations will be drilled (soldier beam and</td>
</tr>
<tr>
<td>lagging) or bearing (cantilever, MSE, T-wall, etc.) on rocks. Use the</td>
</tr>
<tr>
<td>following parameters:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Soil</strong> - Assume medium to very dense residual, use same parameters</td>
</tr>
<tr>
<td>as western side.</td>
</tr>
<tr>
<td>$\phi = 32^\circ$</td>
</tr>
<tr>
<td>$c = 0$ psf</td>
</tr>
<tr>
<td>$\gamma = 125$ psf</td>
</tr>
<tr>
<td>$k_v = 0.31$</td>
</tr>
<tr>
<td>Groundwater elevation 98.0 ft.</td>
</tr>
<tr>
<td>- Maximum allowable foundation pressure = 5 ksf</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Rock</strong> - Use same as western side.</td>
</tr>
<tr>
<td>$\phi = 30^\circ$</td>
</tr>
<tr>
<td>$c = 0$ psf</td>
</tr>
<tr>
<td>$\gamma = 140$ psf</td>
</tr>
<tr>
<td>- Maximum allowable foundation pressure = 5 ksf</td>
</tr>
<tr>
<td>- Assume no active soil pressure contribution from intact rock.</td>
</tr>
</tbody>
</table>