PRELIMINARY GEOTECHNICAL SUMMARY REPORT

SCHUYLKILL RIVER TRAIL EXTENSION
PROPOSED RETAINING WALL
SOUTH STREET TO CHRISTIAN STREET
PHILADELPHIA COUNTY, PENNSYLVANIA

Prepared for

Schuylkill River Development Corporation
Philadelphia, Pennsylvania

and

Urban Engineers, Inc.
Philadelphia, Pennsylvania

Prepared by

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

APRIL 2015

A.G.E.S., INC. PROJECT NO. 13004

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April 20, 2015

Mr. John E. Federico, P.E., P.P., A.I.C.P.
Urban Engineers, Inc.
530 Walnut Street, 14th Floor
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Re: Preliminary Geotechnical Summary Report
Schuylkill River Trail Extension – Proposed Retaining Wall
South Street to Christian Street
City of Philadelphia, Philadelphia County, Pennsylvania
A.G.E.S. Project No. 13004

Gentlemen:

American Geotechnical & Environmental Services (A.G.E.S.), Inc. is pleased to present the Preliminary Geotechnical Summary Report for the above referenced structure site. Included in this report are results of the subsurface investigations, laboratory testing results, along with recommendations concerning the design and construction of the proposed retaining wall.

We wish to extend our appreciation 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.

Yojiro Yoshida, P.E.
Project Engineer

Solveig Sahlin, P.E.
Project Engineer

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1.0 INTRODUCTION

1.1 Project Description and Proposed Construction

This project involves an approximately 1,400 foot long extension to the Schuylkill River Trail. The north end of the proposed extension will tie into the proposed Schuylkill Banks Boardwalk and Plaza area (currently under construction) and the existing stair tower to the South Street Bridge. The proposed trail will continue south to a proposed terminus near Christian Street. The Schuylkill River Trail within the area of the wall is located on the east bank of the Schuylkill River; between the river and the CSX railroad tracks. Refer to Figure 1 for the Project Location Map.

Proposed construction consists of a 12 foot wide paved trail, which widens to 14' in the vicinity of the plaza area. Protective steel fences will be provided between the trail and the CSX railroad tracks and also between the trail and the Schuylkill River. In order to construct the proposed trail extension, an approximately 90 foot long retaining wall will be constructed just south of the Schuylkill Banks Boardwalk and Plaza to span a fairly large washout area. Based on preliminary drawings, the maximum exposed height of the retaining wall is approximately 8'-0".

1.2 Purpose and Scope

This submission represents a preliminary geotechnical summary for the proposed retaining wall for the Schuylkill River Development Corporation. The objective of this report is to present the information determined from the preliminary site investigation, office research, subsurface investigation, laboratory testing, and analysis for the above referenced project. Accordingly, our tasks for this submission include:

- Review published geology, and complete a site visit to identify features that may impact our interpretation of the subsurface conditions;

- Perform a subsurface exploration program behind the proposed retaining wall at location determined by Urban Engineers, Inc.

- Conduct laboratory testing on select soil samples and rock cores;

- Interpret the subsurface data and prepared a generalized geologic profile at the proposed structure location;

- Prepare this report, documenting the data collected and analyses performed and provide recommendations concerning the type and depth of foundation support for the wall, relevant design parameters, and site preparation criteria.

2.0 BACKGROUND INFORMATION

2.1 Existing Plans

The proposed wall will be constructed at the existing washout area to accommodate a proposed 14 foot wide paved trail path. Refer to site photos included in Appendix H for the existing condition of the proposed wall location.

2.2 Previous Subsurface Information

Subsurface information from three (3) nearby projects was reviewed (Appendix J).

URS Corporation provided Structure Boring Sheets for the Schuylkill River Boardwalk and Plaza project. The Schuylkill River Boardwalk and Plaza project involves extension to the Schuylkill River Trail. The proposed retaining wall is a part of the construction of the trail extension. Applicable borings (Borings A-1 and A-2) were drilled for the Plaza directly north of the proposed retaining wall. Soil in the borings indicated various granular and fine-grained fill (SM, CL, sc, sp) over granular residual soil (sm, gm) to the top of bedrock. Top of rock was encountered at depths varying from 20.4 feet (Boring A-1) to 23.6 feet (Boring A-2). Bedrock consists of medium hard to very hard, slightly weathered to fresh mica schist, amphibolite, and schist.

Structure plans from the reconstruction of the South Street Bridge were also reviewed. The South Street Bridge is located approximately 200 feet north of the proposed retaining wall. Two (2) borings (Borings S11-19 and S11-20) were drilled for the proposed Pier 11, adjacent to the existing stairway north of the retaining wall. Soils reported in the boring logs are various granular and fine-grained soil layers (SM, GP-SP, ML, SP) to the top of bedrock. Top of rock in the borings were encountered at depths varying from 36.7 feet (S11-19) to 28.1 feet (S11-20). Bedrock consists of medium hard to hard, slightly weathered to fresh mica schist.

Structure plans for the proposed access ramp from the South Street Bridge to the Schuylkill River Trail (north of the South Street Bridge) were reviewed. The proposed access ramp is located immediately north of the South Street Bridge. Three (3) borings (Borings TB-01, TB-02, and TB-03) were drilled for the proposed access ramp north of the retaining wall. Soil in the borings indicated various granular and fine-grained fill and residual soil layers. Bedrock was not cored in the borings. Top of saprolite/top of highly weathered bedrock in the borings were encountered at approximate depths 33.0 feet (TB-01), 42.5 feet (TB-02) to 38.5 feet (TB-03). The saprolite/highly weathered bedrock consists of weathered schist.

2.3 Site Reconnaissance

A preliminary site reconnaissance was performed on February 6, 2013 to view the site and to verify site features and access routes for the drill equipment. Refer to Site Photographs included in Attachment H. The proposed retaining wall will be located between the Schuylkill River and CSX railroad tracks to the south of the South Street Bridge. Surface material in the area generally consists of random fill material including brick and asphalt fragments. The area between the South Street Bridge and Boring B-1 is generally flat with little vegetation. In the general vicinity of proposed Borings B-2 and B-3, there are some smaller trees, brush and vines.

There are existing wood tie bulkheads adjacent to the Schuylkill River on either side of the wash-out area. The bulkheads appear to be in fair condition and were likely added to protect the adjacent railroad from being undercut by scour. The existing slope where the proposed retaining wall will be located varies from approximately 1:1 (H:V) to approximately 4:1 (H:V). There were no obvious indications of slope instability noted during the site reconnaissance. Erosion and scour were noted within the wash-out area exposing the tree roots. Visible streambed material at the base of the wash-out area generally consists of gravel and cobbles with some sand, silt and clay.

There were no overhead utility lines (electric, cable and phone) observed within the limits of the proposed retaining wall. A locked, white PVC pipe was noted between the proposed wall and South Street Bridge. The owner or purpose of this pipe is not known at this time. Additionally,

there is an underground cable trench between the CSX rails and the proposed retaining wall. There are also underground drainage pipes, discharging into the Schuylkill River directly north of the proposed retaining wall location.

3.0 GEOLOGIC CONDITIONS

The geologic literature indicates that the proposed wall is within the Lowland and Intermediate Upland Section of the Atlantic Coast Plain Province. The dominant topographic form of the Lowland and Intermediate Upland Section is characterized by flat upper terrace surfaces cut by shallow valleys. The underlying material generally consists of unconsolidated to poorly consolidated sand and gravel underlain by schist, gneiss and other metamorphic rocks.

Based on the published literature the material below the proposed wall location is expected to consist of the Trenton Gravel (refer to Figure 2 – Geology Map). However, the geologic contact with the Pensauken and Bridgeton Formations, undifferentiated and Wissahickon formation are mapped to be in close proximity to the proposed wall location. The Trenton Gravel Formation consists of unconsolidated sands and gravels and may be hundreds of feet in thickness. The Trenton Gravel was deposited by fluvial erosion. In general, the Trenton Gravel consists of gray or pale-reddish-brown very gravelly sand with layers of cross-bedded sand. It also includes clay and silt layers. The Pensauken and Bridgeton Formations, undifferentiated consist of cross-stratified, unconsolidated material. Specifically, the material is reported to be dark-reddish-brown sand with some thin beds of fine gravel and rare layers of clay or silt. The Wissahickon formation generally consists of mica schist or gneiss bedrock. Depth to bedrock within the Wissahickon formation is generally shallow however it can be highly variable with zones of highly weathered rock interbedded with less weathered material.

Although the project is underlain by unconsolidated (soil) material, bedrock was not expected to be excessively deep because of the close proximity to the geologic contact of the Wissahickon formation. Bedrock was encountered between depths of 19.5 and 30.0 feet below ground surface.

From a review of the United States Department of Agriculture (USDA) Web Soil Survey, the proposed project is noted as being associated with Urban Land (Ub) which indicates that the surface is covered with pavement, buildings and other artificially covered areas. Therefore,

specific soil information is not available and is expected that the soils near the proposed wall will be highly variable.

4.0 PRELIMINARY GEOTECHNICAL INVESTIGATION

A subsurface exploration program was completed between August 6 and August 8, 2013. Stations, offsets, and elevations for the borings were provided by Urban Engineers, Inc. Drilling was completed by TRC Engineers, Inc. with boring inspection performed by A.G.E.S., Inc. personnel. A total of four (4) borings, three (3) structure borings and one (1) offset boring, were drilled for the proposed retaining wall structure. Engineer's Boring Logs are included in Appendix A. Refer to TS&L Plan included in Appendix E. Plotted Structure Borings Sheets are included in Appendix C. Photographs of the core boxes are provided in Appendix D. The Summary of Subsurface Explorations is detailed in Table 1.

Soil sampling was conducted using a Split Spoon Sampler in accordance with ASTM Design Method D1586-84. The samples were collected continuously by a 2-inch outside diameter Split Spoon Sampler that was driven 18 inches into the soil with blows from a 140 pound hammer falling a distance of 30 inches. The number of blows required to drive the sampler for each 6-inch interval was recorded; with the cumulative number of blows for the last two (2) 6-inch intervals designated as the "Standard Penetration Resistance" or N-value. This value generally gives an indication of the in-situ relative density of granular soils or consistency of fine-grained soils and, in turn, their shear strength and compressibility. The N-values along with a visual identification of the materials are recorded. The soil sampling was advanced using a hollow-stem auger until bedrock was encountered.

Once bedrock was encountered, continuous core samples were obtained. Bedrock samples with a minimum 2-inch diameter were obtained and visually identified with core recoveries and Rock Quality Designation (RQD) values measured by the boring inspector. The rock core description, core recovery for each core interval, and the RQD values (expressed in percent) for each lithologic unit are recorded.

4.1 Test Boring Results

Boring B-1 was drilled near the beginning of the proposed retaining wall and approximately 20 feet behind the front face of the wall. Soils encountered consisted of fill material, alluvial and

residual soils. Fill material consisted of fine and coarse grained material. Coarse grained fill material consisted of wet to moist, very loose to medium dense, silty sand to silty gravel (sm,gm). Fine grained fill material consisted of moist, stiff sandy silt (ml). Thickness of the fill material was 7.5 feet. Alluvial soil was encountered under the fill material. Alluvial soil consisted of coarse and fine grained material. Coarse grained alluvial soil consisted of wet, very loose to loose silty sand (SM). Fine grained fill material consisted of wet, medium stiff elastic silt (mh). Thickness of the alluvial soil was 9.0 feet. Residual soil encountered below the alluvial soil and above top of rock consisted of wet, medium dense to very dense silty sand with gravel (sm). Thickness of the residual soil was 3.0 feet. Bedrock consisted of schist. Schist was described as soft to medium hard, moderately to slightly weathered with a stratum RQD of 10 percent. The boring was terminated at a depth of 25.5 feet within schist. The 0-hour and 24-hour groundwater level readings were 5.7 and 7.0 feet below the ground surface, respectively. Petroleum odor was noted in soil samples between depths of 4.5 and 16.5 feet.

Boring B-2 was drilled near the middle of the proposed retaining wall approximately 19 feet behind the front face of the wall. Soils encountered consisted of fill material, alluvial and residual soils. Fill material consisted of wet to moist, very loose to medium dense silty sand with gravel (sm). Thickness of the fill material was 10.2 feet. Alluvial soil was encountered under the fill material. Alluvial soil consisted of coarse and fine grained material. Coarse grained alluvial soil consisted of wet, very loose to loose clayey sand with gravel (sc). Fine grained fill material consisted of wet, soft to stiff elastic silt (mh). Thickness of the alluvial soil was 8.3 feet. Residual soil encountered below the alluvial soil and above top of rock consisted of wet to moist, medium dense to very dense silty sand with gravel (sm). Thickness of the residual soil was 8.3 feet. Bedrock consisted of amphibolite. Amphibolite was described as soft to medium hard, highly to moderately weathered with a stratum RQD of 18 percent. The boring was terminated at a depth of 31.8 feet. The 0-hour and 24-hour groundwater level readings were 7.3 feet below the ground surface.

Boring B-3 was drilled near the end of the proposed retaining wall approximately 13 feet behind the front face of the wall. Soils encountered consisted of fill material, alluvial and residual soils. Fill material consisted of moist, loose to dense silty sand with gravel (sm). Thickness of the fill material was 4.5 feet. Alluvial soil was encountered under the fill material. Alluvial soil consisted of coarse and fine grained material. Coarse grained alluvial soil consisted of wet, very

loose to loose silty sand with gravel (sm). Fine grained fill material consisted of moist, soft to hard elastic silt and sandy silt with gravel (mh, ml). Thickness of the alluvial soil was 18.5 feet. Residual soil encountered below the alluvial soil and above top of rock consisted of moist, dense to very dense silty sand with gravel (sm). Thickness of the residual soil was 7.0 feet. Bedrock consisted of schist. Schist was described as medium hard to hard, highly to slightly weathered with a stratum RQD of 35 percent. The boring was terminated at a depth of 32.0 feet. The 0-hour groundwater reading was 9.0 feet below the ground surface. The boring was grouted upon completion and 24-hour reading was not obtained.

4.2 Laboratory Testing Results

Laboratory testing for this project consisted of two (2) soil classification tests, one (1) direct shear test, and one (1) corrosion test on soil. The Summary of Laboratory Testing is shown in Table 2 and the Laboratory Test Result sheets are included in Appendix B.

Soil classification testing of the alluvial soil indicated that the soil was non-plastic silty sand (SM) and elastic silt with sand (MH). Natural moisture content of the soil varied from 44.8 to 71.8 percent.

A direct shear test was performed on the material that was classified as MH. The direct shear test yielded an ultimate friction angle of 20.9 degrees and an ultimate cohesion of 0.065 tsf.

Corrosion test was performed on a composite jar sample from the existing fill material and alluvial soil. Based on the corrosion test result, the soil had a pH of 6.4, chlorides of 30.0 ppm, sulfate of 16.0 ppm, and minimum resistivity of 7,400 ohm-cm. Based on these results, in-situ soil at the project site is not potentially corrosive.

5.0 ANALYSIS AND CONCLUSIONS

A total of three (3) structure borings were drilled for the proposed retaining wall. In general borings encountered the existing fill material near the surface underlain by alluvial and residual soils. The existing fill material generally consisted of very loose to dense coarse grained silty sand and gravel. Alluvial soil consisted of silty sand and elastic silt. Elastic silt exhibited relatively low blow counts. Direct shear test was performed on an undisturbed soil sample from the elastic silt layer. The direct shear test yielded internal friction angle of 20.9 degrees. Residual soil was generally described as medium dense to very dense silty sand with gravel. Bedrock was encountered 19.5 to 30.0 feet below the ground surface and consisted of soft to hard schist and soft to medium amphibolite.

Prior to the subsurface exploration, wall alternatives considered for the proposed retaining wall included: pre-cast concrete modular wall (T-Wall), stone gabion basket wall, soldier pile and lagging wall, cast-in-place reinforced concrete gravity wall, and sheet pile wall. Based on the preliminary cost and construction analyses, a T-Wall alternate appeared to be the preferred wall alternative. However, the subsurface exploration program revealed the presence of weak elastic silt layer below the streambed elevation. Based on analyses performed, overexcavation of this weak material was required for a T-Wall alternate to satisfy bearing capacity, external stability requirements and to not encroach on the underground fiber optics. Therefore, additional cost estimates and additional designs were performed incorporating the information from the subsurface exploration program. Wall alternatives considered for the revised cost estimate included: pre-cast concrete modular wall (T-Wall) with overexcavation of weak material, soldier pile and lagging wall, cast-in-place reinforced concrete wall supported on piles and without piles, stone gabion basket wall, unreinforced concrete gravity wall, and sheet pile wall. **The soldier pile and lagging wall alternate was determined to be the most cost effective alternate.** Based on the analyses, a sheet pile wall is not a feasible alternate due to the shallow depth to bedrock.

The proposed top of wall elevation ranges from elevation 10.89 feet at the beginning of the wall to 11.26 feet at the end of the wall. The proposed streambed elevation in front of the wall is

approximately at elevation 3.0 feet. Bottom of lagging and/or top of caisson is proposed at 6.0 feet below the proposed grade in front of the wall at elevation -3.0 feet. As a result, the design height of the wall is 14.0 feet. Caissons are to be 2.5 feet in diameter and will be spaced at a center to center spacing of 8.0 feet. In order to achieve fixity at the tip, caissons are to be advanced 5.0 feet into bedrock. Lateral deflection at the top of the caisson was calculated to be 0.45 inches which is less than the allowable limit of 0.5 inches. Lateral deflection at the top of the wall was calculated to be 1.18 inches. Sliding and overturning were also evaluated. Performance ratios of both sliding and overturning were greater than 1.0. Calculations for the soldier pile and lagging wall alternate are included in Appendix G.

Other Findings

- The proposed retaining wall is located in an washout area along Schuylkill River and signs of scour and erosion were observed during field reconnaissance. Scour protection will be provided per PennDOT DM-4.

- Based on the corrosion test performed on a soil sample from boring, soil at the project site is not potentially corrosive. However, due to the presence of the Schuylkill River, which has numerous sources of potentially corrosive material flowing into the river in front of the proposed retaining wall, the project site is treated as potentially corrosive.

- Since the wall system is supported by bedrock, settlement is not expected to be a concern.

- Global stability of the proposed retaining wall was also evaluated. Shear resistance from caissons were considered in the analysis. Based on the analysis, global stability is not expected to be a concern.

- If temporary shoring is required, utilize parameters included in the Recommendation Section.

- Petroleum odor was noted for soil samples from Boring B-1 between depth 4.6 and 16.5 feet. Any material excavated shall be handled in accordance with **Specification Section 026113 – Excavation of Contaminated Materials Handling**.

6.0 RECOMMENDATIONS

The following is a list of recommendations for this project:

6.1 General

- The construction, including any temporary construction, is to be performed in accordance with PennDOT Publication 408. The Contractor is responsible for the stability of all excavated slopes. Perform all excavation in accordance with OSHA requirements.

- Recommended wall type for the proposed retaining wall is a **soldier pile and lagging wall**. Allowable alternate wall type is a **cast-in-place reinforced concrete wall supported on piles.**

- Design retaining wall so that none of the wall elements will encroach within 5.0 feet of existing underground fiber optic cable and do not extend into CSX Railroad right-of-way.

- Utilize frost depth of 3.0 feet in design.

- Consider extreme event condition (i.e., rapid drawdown) in design.

- Backfill behind the retaining wall in accordance with PennDOT Standard RC-12M. Structure backfill may consist of material meeting AASHTO No. 57 or PennDOT Open Graded Subbase (OGS) criterion.

- Temporary shoring and/or stream diversion barriers along with dewatering techniques may be required for construction of substructure units.

- Treat project location as potentially corrosive environment and corrosion protection measures are required.

- All excavated material shall be handled in accordance with Special Provision ‘Off-Site Disposal of Contaminated Material’.

- Provide riprap rock scour protection as per DM-4, Section PP.7.2.5 and as shown on the plans. Bottom of riprap shall extend to bottom of lagging elevation.

6.2 Soldier Pile and Lagging Wall

- The soldier pile wall must be designed in accordance with all requirements listed in the AASHTO 2010 LRFD Bridge Design Specifications and PennDOT Design Manual -4, 2012, including all revisions. The design must include complete analyses of the proposed retaining wall including external stability.

- Temporary casing may be required to maintain an open borehole. If temporary casing is utilized, maintain concrete levels above the bottom of casing at all times during extraction to prevent caved material from contaminating the concrete.

- Backfill caisson borehole within 24 hours after drilling to limit the deterioration of the bearing material.

- The minimum required pile size is W12 x 190.

- The caisson diameter is 2.5 feet.

- Place bottom of lagging at elevation -3.0 feet.

- Extend caissons a minimum of 5.0 feet into bedrock.

- If subsurface condition encountered during construction varies from what was encountered during subsurface exploration program, perform global stability analysis of the retaining wall as directed by the Engineer.

- Design soldier pile and lagging wall based on the following parameters:

	Moist Unit Weight, pcf	Saturated Unit Weight, pcf	Internal Friction Angle, ϕ, degrees	Cohesion, c, psf	Modulus of Subgrade Reaction, k, pci (above water /below water)	Axial Strain at 50% of Strength, $\varepsilon 50$	p-y curve
Soil Retained Behind the Wall	110	115	25	0	25/20	-	Sand
Alluvial Soil Below Bottom of Lagging	105	110	21	0	25/20	-	Sand
Residual Soil	130	135	35	0	225/125	-	Sand
Bedrock	150	150	0	200,000[(1)]	-	-	Vuggy Limestone

(1) Unconfined compressive strength of bedrock.

- Perform lateral load analysis of caisson with LPILE or COM 624P program using parameters presented above. The maximum allowable deflection at the top of caisson is 0.5 inches.

- Design the soldier pile and lagging wall utilizing the following Load and Resistance Factors:
  - Load Factor:
    - Earth Horizontal = 1.5
    - Live Surcharge = 1.75
    - Hydrostatic Pressure = 1.0
  - Resistance Factor:
    - Passive Resistance = 0.75
    - Hydrostatic Pressure = 1.0

- Fill the gap between permanent lagging and temporary timber lagging with AASHTO No. 57 coarse aggregate.

- Provide galvanized steel pile and utilize Type II Cement for corrosion protection

- Blasting is not permitted as a method of excavation.

- Design the Soldier Pile and Lagging Wall for the models provided in Appendix M of the Preliminary Geotechnical Summary Report.

- No live load surcharge is required for design of the wall.

6.3 Cast-in-Place Reinforced Concrete Wall

- Support cast-in-place reinforced concrete wall on piles.

- A minimum pile length of 10.0 feet is required.

- Use a resistance factor of 0.35 to determine the axial structural pile resistance at the strength limit state.

- Use a resistance factor of 0.25 to determine the axial structural pil resistance at the service limit state.

- Drive piles to Case 2 Absolute End Bearing Refusal in bedrock in accordance with Pub. 408/2011, Section 1005.3(b)4. Use driving method A as per DM-4, Part A, Section 1.7.5.

- Design cast-in-place reinforced wall based on the following parameters:

	Moist Unit Weight, pcf	Saturated Unit Weight, pcf	Internal Friction Angle, ϕ, degrees	Cohesion, c, psf	Modulus of Subgrade Reaction, k, pci (above water /below water)	Axial Strain at 50% of Strength, ε50	p-y curve
Soil Retained Behind the Wall	110	115	25	0	25/20	-	Sand
Alluvial Soil Below Bottom of Lagging	105	110	21	0	25/20	-	Sand
Residual Soil	130	135	35	0	225/125	-	Sand
Bedrock	150	150	0	200,000(1)	-	-	Vuggy Limestone

(1) Unconfined compressive strength of bedrock.

- Utilize 1/16" reduction in the pile section for design.

- Backfill behind the proposed wall in accordance with PennDOT Standard RC-12M.

6.4 Temporary Shoring

- Design temporary shoring utilizing the following soil and rock parameters:

Effective Friction Angle	21 degrees
Cohesion	0 psf
Moist Unit Weight	110 pcf
Saturated Unit Weight	115 pcf
Static Groundwater Level	Elevation 3.0 feet or stream level of Schuylkill River, whichever is higher.
Rock Undrained Shear Strength	10 ksf

6.5 Notes for Drawings

The following notes are developed for the soldier pile and lagging wall alternate:

- The construction, including any temporary construction, is to be performed in accordance with PennDOT Publication 408. The Contractor is responsible for the stability of all excavated slopes. Perform all excavation in accordance with OSHA requirements.

- Temporary shoring and/or stream diversion barriers along with dewatering techniques may be required for construction of substructure units.

- All excavated material shall be handled in accordance with **Specification Section 026113 – Excavation of Contaminated Materials Handling**.

- Provide galvanized pile for corrosion protection.

- Temporary casing may be required to maintain an open borehole. If temporary casing is utilized, maintain concrete levels above the bottom of casing at all times during extraction to prevent caved material from contaminating the concrete.

- Backfill caisson borehole within 24-hours after drilling to limit the deterioration of the bearing material.

- Backfill behind the retaining wall in accordance with PennDOT Standard RC-12M. Structure backfill may consist of material meeting ASSHEO No. 57 or PennDOT Open Graded Subbase (OGS) criterion.

- Fill the gap between permanent lagging in and temporary timber lagging with AASHTO No. 57 coarse aggregate.

- Blasting is not permitted as a method of excavation.

REFERENCES

1. Berg, T. M., Edmunds, W. E., Geyer, A. R., and others, compilers, 1980, Geologic Map of Pennsylvania: Pennsylvania Geological Survey, 4th ser., Map 1, 2nd ed., 3 sheets, scale 1:250,000.

2. Bureau of Topographic and Geologic Survey, 1990, Map 7 Geologic Map of Pennsylvania, Commonwealth of Pennsylvania Department of Conservation and Natural Resources.

3. Geyer, Alan, and Wilshusen, J. Peter, Engineering Characteristics of the Rocks of Pennsylvania, Department of Environmental Resources, Office of Resources Management, Bureau of Topographic and Geologic Survey, Environmental Geology Report 1, 1982.

4. Pennsylvania Department of Transportation, Type 10 Map, Philadelphia County, Pennsylvania.

5. Sevon, W.D., 2000, Map 13, Physiographic Provinces of Pennsylvania, Commonwealth of Pennsylvania Department of Conservation and Natural Resources.

6. U.S. Department of Agriculture, Soil Data Mart, Soil Survey for Montgomery County, Pennsylvania.

7. U.S. Department of the Interior, Geologic and Topographic Survey, Philadelphia Topographic Quadrangle Map.

8. Concise Reconnaissance Soils and Geological Engineering Report, March 2013, prepared by A.G.E.S., Inc.

TABLES

TABLE 1
SUMMARY OF SUBSURFACE EXPLORATION
SCHUYLKILL RIVER TRAIL EXTENSION - SOUTH STREET TO CHRISTIAN STREET
CITY OF PHILADELPHIA, PHILADELPHIA COUNTY, PENNSYLVANIA

Boring Designation	Station	Offset from Centerline	Ground Surface Elevation (ft)	SOIL							Top of Gravel/ Boulder/ Cobble Layer (ft)	Bottom of Boring Elevation (ft)	0 Hour Water Elevation (ft)	24 Hour Water Elevation (ft)
				Unsampled (ft)	Bituminous Concrete (ft)	Subbase (ft)	Fill (ft)	Alluvial (ft)	Residual (ft)	Total (ft)				
B-1	113+34	10 RT	9.3	-	-	-	7.5	9.0	3.0	19.5	-10.2	-16.2	5.7	7.0
B-2	112+89	9 RT	10.5	-	-	-	10.2	8.3	8.3	26.8	-16.3	-21.3	7.3	7.3
B-2A (1)	112+89	7 RT	10.5	15.0	-	-	-	2.0	-	17.0	-	-6.5	Dry	*
B-3	112+50	3 RT	13.0	-	-	-	4.5	18.5	7.0	30.0	-17.0	-19.0	9.0	*
Total				**15.0**	**0.0**	**0.0**	**22.2**	**37.8**	**18.3**	**93.3**				

Notes: * - Boring grouted upon completion of drilling.

1. Unsampled drilling, 0.0 to 15.0 feet (elevation 10.5 to -4.5 feet).
   Shelby tube, ST-1, obtained from 15.0 to 17.0 feet (elevation -4.5 to -6.5 feet).

By: YZ 09-04-13
Chk: SCS 09-04-13

TABLE 2
SUMMARY OF LABORATORY TESTING

Schuylkill River Trail Extension – South Street to Christian Street
City of Philadelphia, Philadelphia County, Pennsylvania

Summary of Soil Classification Testing

Sample ID	Moisture Content (%)	Atterberg Limits		USCS Gradation			Classification	
		LL (%)	PI (%)	% Rock Frags	% Sand	% Fines	AASHTO	USCS
Boring B-1 S-6,7,8,9 7.5 – 13.5 ft Alluvial	71.8	NP	NP	8.1	45.1	46.8	A-4(0)	SM
Boring B-2A ST-1 15.0 – 17.0 ft Alluvial	44.8	56	32	3.2	15.8	81	A-7-5(22)	MH

Summary of Moisture Content Testing

Boring Number	Sample Number	Depth	Origin	Moisture Content (%)
B-1	S-6,7,8,9	7.5 – 13.5 ft	Alluvial	71.8
B-2A	ST-1	15.0 – 17.0 ft	Alluvial	44.8

Summary of Direct Shear Testing

Boring	Average Initial/Test Dry Density (pcf)	Friction Angle at Failure (degrees)	Cohesion at Failure (tsf)	Ultimate Friction Angle (degrees)	Ultimate Cohesion (tsf)
Boring B-2A ST-1 15.0 – 17.0 ft Alluvial	73.0	21.0	0.190	20.9	0.065

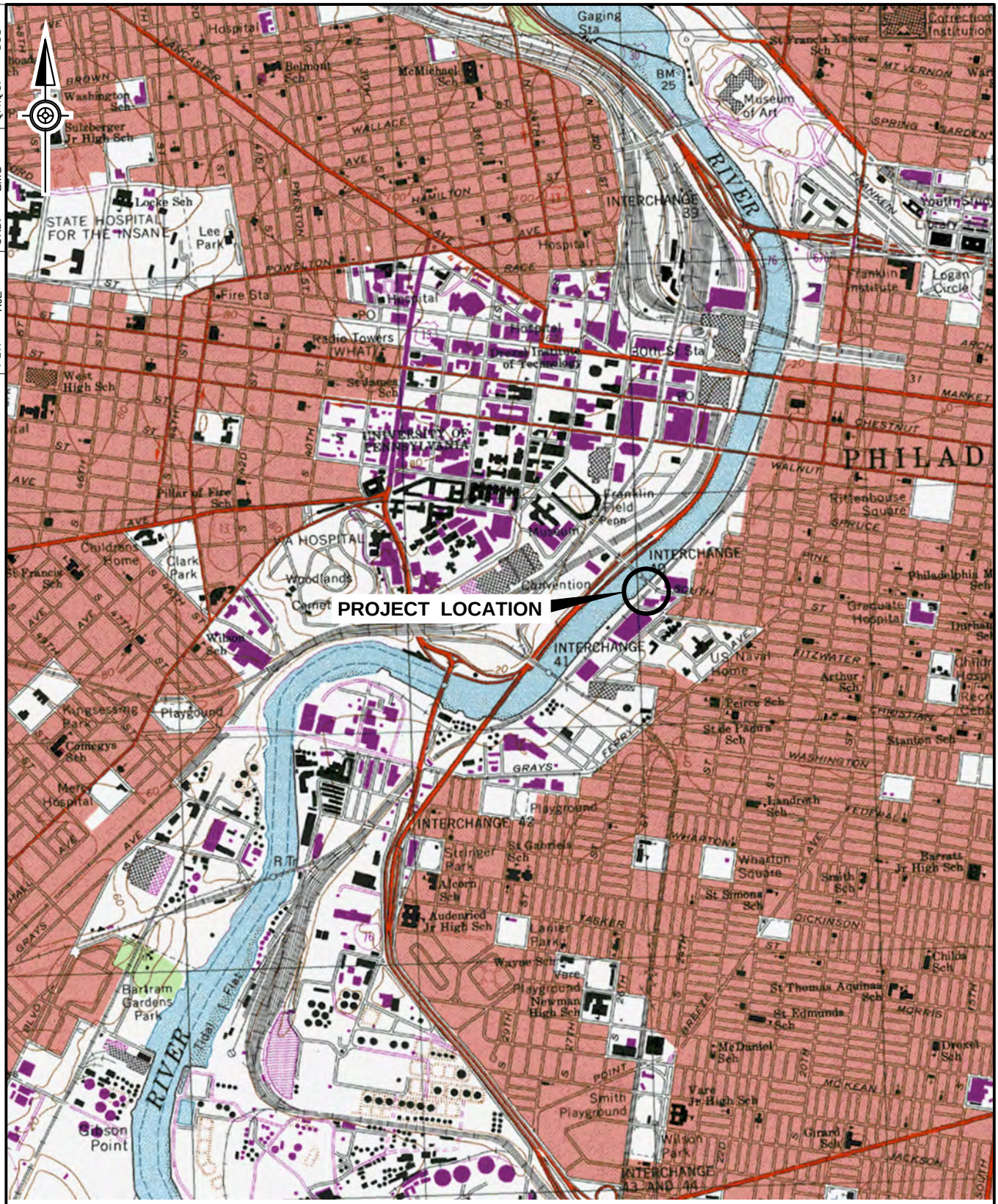
Summary of Soil Corrosion Testing

Sample ID	Chlorides (ppm)	Sulfates (ppm)	pH	Resistivity (ohm-cm)
Boring B-3 S-1 to 7 0.0 – 15.0 ft Fill and Alluvial	30.0	16.0	6.4	7,400

By: YZ 09-04-13Ckd: SCS 09-04-13

FIGURES

PLT: RJE CKD: EMG QA\QC: SCS



SOURCE: US Geological Survey, Quadrangle Map (7 ½' Series);Philadelphia, PA

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Corporate Office:	Canonsburg, PA	(724) 916-0300
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SCHUYLKILL RIVER TRAIL EXTENSION

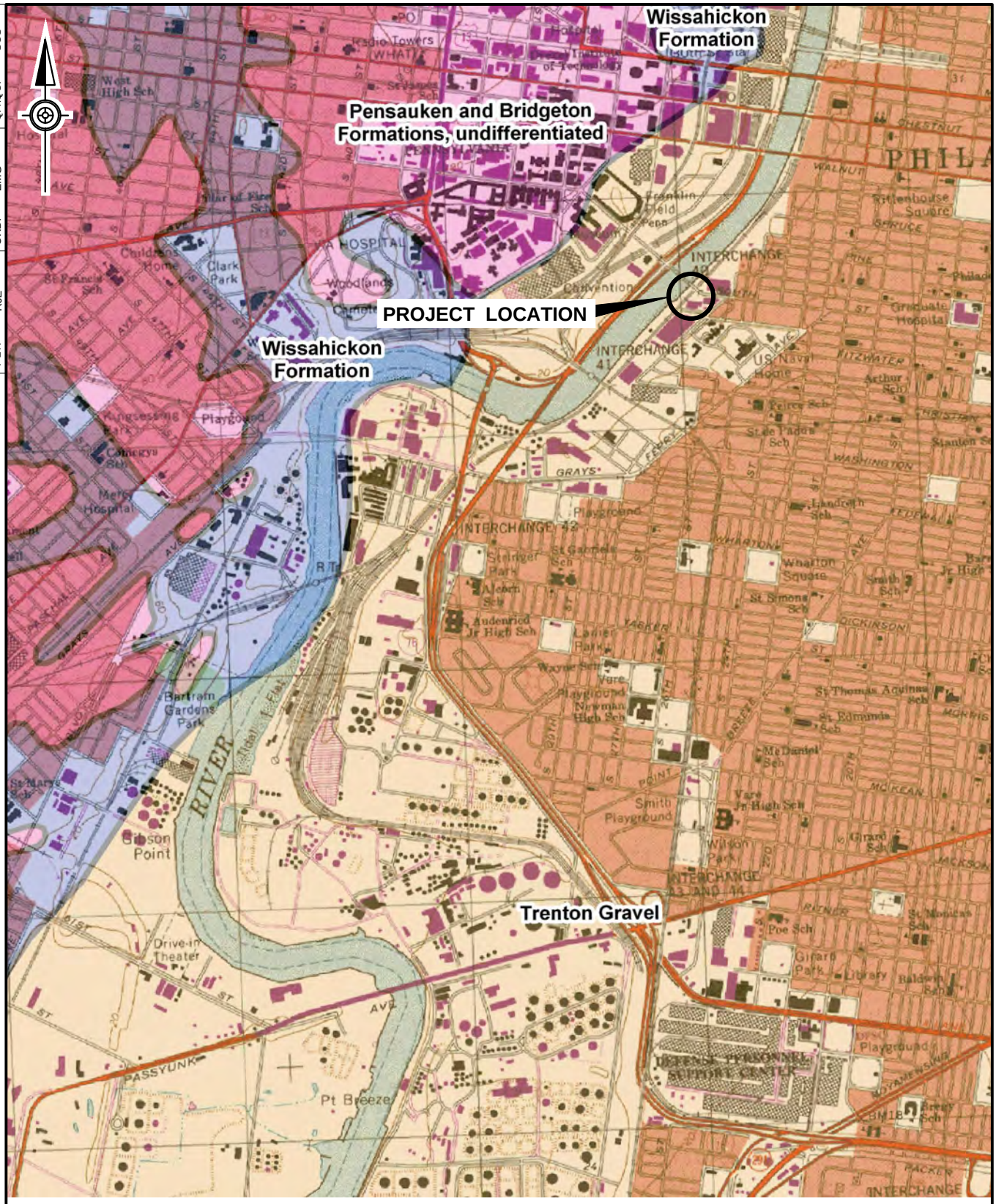
PHILADELPHIA COUNTY, PENNSYLVANIA

PROJECT LOCATION MAP

PROJECT:	13004
DRAWN:	RJE
DATE:	MARCH 2013
SCALE:	1" = 2000'
FIGURE:	1

File: M:_2013\004\exhibits\misc\13004_prjl.dwg
Date: 3/08/13

PLT: RJE CKD: EMG QA\QC: SCS



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

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SCHUYLKILL RIVER TRAIL EXTENSION

PHILADELPHIA COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT:	13004
DRAWN:	RJE
DATE:	MARCH 2013
SCALE:	1" = 2000'
FIGURE:	2

File: M:_2013\004\exhibits\misc\13004_geol.dwg
Date: 3/08/13

APPENDIX A

ENGINEER'S FIELD BORING LOGS

Schuylkill River Trail Extension – Proposed Retaining Wall
South Street to Christian Street
City of Philadelphia, Philadelphia County, Pennsylvania

Project No. 13004
October 2014

ENGINEER'S CERTIFICATION

I, the undersigned, hereby certify that I have observed the soil samples and rock cores for this project and that the classification of materials and depths presented on the following Engineer's Field Boring Logs are, to the best of my knowledge, correct as submitted.

American Geotechnical & Environmental Services, Inc.

Solveig Salin, P.E.
Project Engineer

ENGINEERS FIELD BORING LOG

BORING NO. B-1
SHEET 1 OF 2
DATE: START 8-6-13
END 8-6-13
O.G. ELEV. 9.3 ft.

PROJECT NAME Schuylkill River Trail Extension COUNTY Philadelphia
STATE RT. NO. - SECT. - SEGMENT - OFFSET -
STATION 113+34 OFFSET FROM CENTERLINE 10 ft RT
INSPECTOR (SIGNED) S. Yuan DRILLERS NAME/COMPANY A. Scafidi / TRC Engineers, Inc.
EQUIPMENT USED Acker Soil X Track Mount Rig with Safety Hammer
DRILLING METHODS Flush Joint Casing with Water, Split Inner Core Barrel, NX Wireline with Water
CASING: SIZE: 3.0 in I.D. DEPTH: 19.5 ft WATER: DEPTH: 5.7 ft TIME: 1300 DATE: 8-6-13
CHECKED BY: SCS DATE: 9-8-13 DEPTH: 7.0 ft TIME: 0900 DATE: 8-8-13
NOT ENCOUNTERED ☐

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	Recovery (%) / RQD (%)	POCKET PENET or TORVANE (TSF)	USCS / AASHTO	H_2O CONTENT	DESCRIPTION	REMARKS
1.5	S-1	4 6 4	0.5	33	-	ml a-4	M	0.0 to 1.5 SANDY SILT with gravel (ml), brown to black, moist, stiff, homogeneous (FILL) El. 7.8	
3.0	S-2	4 6 13	0.4	27	-	sm	M	1.5 to 4.5 SILTY SAND with gravel (sm), black, moist, medium dense, homogenous (FILL)	
4.5	S-3	13 8 18	0.5	33	-	a-2-4	M	El. 4.8	
6.0	S-4	13 7 3	0.2	13	-	gm	W	4.5 to 7.5 SILTY GRAVEL with sand (gm), black, wet, loose, homogeneous (FILL)	Persistent petroleum odor from 4.5-16.5 ft
7.5	S-5	2 2 3	0.0	0	-	a-2-4	-	El. 1.8	
9.0	S-6	2 4 1	0.6	40	-	SM	W	7.5 to 13.5 SILTY SAND (SM), black, wet, very loose to loose, homogeneous, (ALLUVIAL) Decomposed organics present, S-6	
10.5	S-7	4 5 3	0.3	20	-		W		
12.0	S-8	5 2 2	0.3	20	-		W		Class. on S-6 to S-9 N.M.C.=71.8%
13.5	S-9	1 2 1	0.3	20	-	A-4(0)	W	El. -4.2	
15.0	S-10	2 2 4	1.0	67	0.75	mh	W	13.5 to 16.5 ELASTIC SILT (mh), dark brown to black, wet, medium stiff, homogeneous (ALLUVIAL)	
16.5	S-11	3 3 2	1.4	93	1.0	a-7-5	W	El. -7.2	
18.0	S-12	5 8 14	1.3	87	-	sm	W	16.5 to 19.5 SILTY SAND with gravel (sm), dark brown to black, wet, medium dense to very dense, homogeneous, (RESIDUAL)	
19.2 19.5	S-13	30 31 50/0.2	0.4	33	-	a-2-4	W	El. -10.2	
	S-14	50/0.0	0.0	0	-		-	19.5 to 25.5 SCHIST, dark gray to orange/brown, soft to medium	TOP OF ROCK

ENGINEERS FIELD BORING LOG

BORING NO.	B-1
SHEET	2 OF 2
DATE: START	8-6-13
END	8-6-13
O.G. ELEV.	9.3 ft.

PROJECT NAME Schuylkill River Trail Extension COUNTY Philadelphia
STATE RT. NO. - SECT. - SEGMENT - OFFSET -
STATION 113+34 OFFSET FROM CENTERLINE 10 ft RT
INSPECTOR (SIGNED) S. Yuan DRILLERS NAME/COMPANY A. Scafidi / TRC Engineers, Inc.
EQUIPMENT USED Acker Soil X Track Mount Rig with Safety Hammer
DRILLING METHODS Flush Joint Casing with Water, Split Inner Core Barrel, NX Wireline with Water
CASING: SIZE: 3.0 in I.D. DEPTH: 19.5 ft WATER: DEPTH: 5.7 ft TIME: 1300 DATE: 8-6-13
CHECKED BY: SCS DATE: 9-8-13 DEPTH: 7.0 ft TIME: 0900 DATE: 8-8-13
NOT ENCOUNTERED ☐

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	Recovery (%) / RQD (%)	POCKET PENET or TORVANE (TSF)	USCS / AASHTO	H_2O CONTENT	DESCRIPTION	REMARKS
20.5	R-1		1.0	100 / 0 96				hard, moderately to slightly weathered, very intensely to intensely foliated (RD=60-65), extremely to very closely jointed (RD=5-10, 60-65, 85-90), very broken to slightly broken (RQD=10%) (RMR: D=3, S=1, R=3, I=2, W=3-5) Moderately weathered, 21.4-24.4'	@ 19.5 ft
25.5	R-2		4.8	12				El. -16.2 END OF BORING @ 25.5 ft	

ENGINEERS FIELD BORING LOG

BORING NO.	B-2
SHEET	1 OF 2
DATE: START	8-7-13
END	8-7-13
O.G. ELEV.	10.5 ft.

PROJECT NAME Schuylkill River Trail Extension COUNTY Philadelphia
STATE RT. NO. - SECT. - SEGMENT - OFFSET -
STATION 112+89 OFFSET FROM CENTERLINE 9 ft RT
INSPECTOR (SIGNED) S. Yuan DRILLERS NAME/COMPANY A. Scafidi / TRC Engineers, Inc.
EQUIPMENT USED Acker Soil X Track Mount Rig with Safety Hammer
DRILLING METHODS Flush Joint Casing with Water, Split Inner Core Barrel, NX Wireline with Water
CASING: SIZE: 3.0 in I.D. DEPTH: 26.8 ft WATER: DEPTH: 7.3 ft TIME: 1130 DATE: 8-7-13
CHECKED BY: SCS DATE: 9-8-13 DEPTH: 7.3 ft TIME: 0700 DATE: 8-8-13
NOT ENCOUNTERED ☐

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	Recovery (%) / RQD (%)	POCKET PENET or TORVANE (TSF)	USCS / AASHTO	H_2O CONTENT	DESCRIPTION	REMARKS
		4				sm		0.0 to 10.2 SILTY SAND with gravel (sm), black, wet to moist, very loose to medium dense, homogeneous (FILL)	
		5							
1.5	S-1	5	0.1	7	-		M	Coal fragments, coal dust and slag present, 0.0-9.0'	
		6							
		6							
3.0	S-2	7	0.4	27	-		M		
		4							
		3						Wood fragments present, S-3	
4.5	S-3	2	0.3	20	-		M		
		2							
		1							
6.0	S-4	2	0.2	13	-		M		
		3							
		2							
7.5	S-5	2	0.3	20	-		M		
		4							
		2							
9.0	S-6	1	0.4	27	-		W		
		3							
		3							
10.5	S-7	1	0.1	7	-	a-2-4	W	El. 0.3	
		1				sc		10.2 to 13.5 CLAYEY SAND with gravel (sc), dark brown, wet, very loose to loose, homogeneous (ALLUVIAL)	
		3							
12.0	S-8	2	0.4	27	-		W		
		5							
		3							
13.5	S-9	2	0.0	0	-	a-2-6	-	El. -3.0	
		5				MH		13.5 to 18.5 ELASTIC SILT with sand (MH), brown, wet, soft to stiff, homogeneous (ALLUVIAL)	Shelby Tube, ST-1, collected in offset Boring B-2A, 15.0 to 17.0 ft.
		7							
15.0	S-10	2	0.1	7	0.1		W		Class on ST-1 N.M.C.=44.8%
		2							
		1							
16.5	S-11	3	1.5	100	0.1		W		
		2							
		1							
18.0	S-12	2	1.4	93	0.1		W		
		3				A-7-5(22)		El. -8.0	
		10				sm		18.5 to 26.8 SILTY SAND with gravel (sm), dark gray to brown, wet to moist, medium dense to very dense, homogeneous (RESIDUAL-completely weathered amphibolite)	
19.5	S-13	10	0.3	20	-		W		
		6							

ENGINEERS FIELD BORING LOG

BORING NO.	B-2
SHEET	2 OF 2
DATE: START	8-7-13
END	8-7-13
O.G. ELEV.	10.5 ft.

PROJECT NAME Schuylkill River Trail Extension COUNTY Philadelphia
STATE RT. NO. - SECT. - SEGMENT - OFFSET -
STATION 112+89 OFFSET FROM CENTERLINE 9 ft RT
INSPECTOR (SIGNED) S. Yuan DRILLERS NAME/COMPANY A. Scafidi / TRC Engineers, Inc.
EQUIPMENT USED Acker Soil X Track Mount Rig with Safety Hammer
DRILLING METHODS Flush Joint Casing with Water, Split Inner Core Barrel, NX Wireline with Water
CASING: SIZE: 3.0 in I.D. DEPTH: 26.8 ft WATER: DEPTH: 7.3 ft TIME: 1130 DATE: 8-7-13
CHECKED BY: SCS DATE: 9-8-13 DEPTH: 7.3 ft TIME: 0700 DATE: 8-8-13
NOT ENCOUNTERED ☐

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	Recovery (%) / RQD (%)	POCKET PENET or TORVANE (TSF)	USCS / AASHTO	H_2O CONTENT	DESCRIPTION	REMARKS
21.0	S-14	8 21	0.0	0	-		-		
21.8	S-15	11 50/0.3	0.6	75	-		M		
23.8	R-1		0	0					
24.1	S-16	50/0.3	0.2	67	-		M		BX sized (1.0" O.D.) spoon used for S-16, S-17
25.5	R-2		0	0					
25.8	S-17	50/0.3	0.2	67	-		M		
26.8						a-2-4		El. -16.3	
28.8	R-3		1.2	60 / 20				26.8 to 31.8 AMPHIBOLITE, black to dark gray, soft to medium hard, highly to moderately weathered, intensely to very thinly foliated (RD=65-70), very closely to closely jointed (RD=25-30, 65-70), very broken to slightly broken, (RQD=18%) (RMR: D=3, S=1, R=3, I=2, W=1-3)	TOP OF ROCK @ 26.8 ft
31.8	R-4		2.5	83 / 17				El. -21.3	
								END OF BORING @ 31.8 ft	

ENGINEERS FIELD BORING LOG

BORING NO.	B-2A
SHEET	1 OF 1
DATE: START	8-8-13
END	8-8-13
O.G. ELEV.	10.5 ft.

PROJECT NAME Schuylkill River Trail Extension COUNTY Philadelphia
STATE RT. NO. - SECT. - SEGMENT - OFFSET -
STATION 112+89 OFFSET FROM CENTERLINE 7 ft RT
INSPECTOR (SIGNED) S. Yuan DRILLERS NAME/COMPANY A. Scafidi / TRC Engineers, Inc.
EQUIPMENT USED Acker Soil X Track Mount Rig with Safety Hammer
DRILLING METHODS HSA
CASING: SIZE: - DEPTH: - WATER: DEPTH: 7.5 ft TIME: 1100 DATE: 8-8-13
CHECKED BY: SCS DATE: 9-8-13 DEPTH: * TIME: - DATE: -
NOT ENCOUNTERED ☐

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	Recovery (%) / RQD (%)	POCKET PENET or TORVANE (TSF)	USCS / AASHTO	H_2O CONTENT	DESCRIPTION	REMARKS
								0.0 to 15.0 UNSAMPLED	*Boring grouted upon completion
15.0								El. -4.5	
						MH		15.0 to 17.0 ELASTIC SILT with sand (MH), brown, wet, homogeneous, (ALLUVIAL)	Class. onST-1
17.0	ST-1		1.5	75	0.1	A-7-5(22)	44.8	El. -6.5	
								END OF BORING @ 17.0 ft	

ENGINEERS FIELD BORING LOG

BORING NO.	B-3
SHEET	1 OF 2
DATE: START	8-7-13
END	8-8-13
O.G. ELEV.	13.0 ft.

PROJECT NAME Schuylkill River Trail Extension COUNTY Philadelphia
STATE RT. NO. - SECT. - SEGMENT - OFFSET -
STATION 112+50 OFFSET FROM CENTERLINE 3 ft RT
INSPECTOR (SIGNED) S. Yuan DRILLERS NAME/COMPANY A. Scafidi / TRC Engineers, Inc.
EQUIPMENT USED Acker Soil X Track Mount Rig with Safety Hammer
DRILLING METHODS Flush Joint Casing with Water, Split Inner Core Barrel, NX Wireline with Water
CASING: SIZE: 3.0 in I.D. DEPTH: 30.0 ft WATER: DEPTH: 9.0 ft TIME: 0920 DATE: 8-8-13
CHECKED BY: SCS DATE: 9-8-13 DEPTH: * TIME: - DATE: -
NOT ENCOUNTERED ☐

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	Recovery (%) / RQD (%)	POCKET PENET or TORVANE (TSF)	USCS / AASHTO	H_2O CONTENT	DESCRIPTION	REMARKS
		2				sm		0.0 to 4.5 SILTY SAND with gravel (sm), black to dark brown, moist, loose to dense, homogeneous (FILL)	*Boring grouted upon completion
		4							
1.5	S-1	5	0.2	13	-		M	Coal and concrete fragments, 0.0-4.5'	
		12							
		10							
3.0	S-2	12	1.1	73	-		M		
		15							
		20							
4.5	S-3	20	1.0	67	-	a-2-4	M	El. 8.5	
		12				ml		4.5 to 10.5 SANDY SILT with gravel (ml), brown, moist, stiff to hard, homogeneous (ALLUVIAL)	
		19							
6.0	S-4	14	0.8	53	-		M		
		6							
		5						Trace organics, S-5	
7.5	S-5	5	1.0	67	1.0		M		
		12							
		14						Wood fragments present, S-6	
9.0	S-6	12	1.0	67	0.75		M		
		5							
		10							
10.5	S-7	8	0.4	27	-	a-4	M	El. 2.5	
		5				sm		10.5 to 19.5 SILTY SAND with gravel (sm), light brown, wet, very loose to loose, homogeneous (ALLUVIAL)	
		3							
12.0	S-8	2	0.0	0	-		-		
		2							
		2							
13.5	S-9	2	0.1	7	-		W		
		2							
		2							
15.0	S-10	2	0.5	33	-		W		
		3							
		2							
16.5	S-11	1	0.1	7	-		W		
		2							
		1							
18.0	S-12	2	1.1	73	-		W		
		1							
		1							
19.5	S-13	2	0.1	7	-	a-2-4	W	El. -6.5	
		2				mh		19.5 to 23.0 ELASTIC SILT (mh), light brown, wet to moist, soft to	

ENGINEERS FIELD BORING LOG

BORING NO.	B-3
SHEET	2 OF 2
DATE: START	8-7-13
END	8-8-13
O.G. ELEV.	13.0 ft.

PROJECT NAME Schuylkill River Trail Extension COUNTY Philadelphia
STATE RT. NO. - SECT. - SEGMENT - OFFSET -
STATION 112+50 OFFSET FROM CENTERLINE 3 ft RT
INSPECTOR (SIGNED) S. Yuan DRILLERS NAME/COMPANY A. Scafidi / TRC Engineers, Inc.
EQUIPMENT USED Acker Soil X Track Mount Rig with Safety Hammer
DRILLING METHODS Flush Joint Casing with Water, Split Inner Core Barrel, NX Wireline with Water
CASING: SIZE: 3.0 in I.D. DEPTH: 30.0 ft WATER: DEPTH: 9.0 ft TIME: 0920 DATE: 8-8-13
CHECKED BY: SCS DATE: 9-8-13 DEPTH: * TIME: - DATE: -
NOT ENCOUNTERED ☐

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	Recovery (%) / RQD (%)	POCKET PENET or TORVANE (TSF)	USCS / AASHTO	H_2O CONTENT	DESCRIPTION	REMARKS
		2						stiff, homogeneous, (ALLUVIAL)	
21.0	S-14	1	0.7	47	1.0		W		
		2							
		7							
22.5	S-15	4	0.0	0	-		-		
		21				a-7-5		El. -10.0	
		28				sm		23.0 to 30.0 SILTY SAND with gravel (sm), light gray, moist, dense to very dense, homogeneous, (RESIDUAL-completely weathered schist)	
24.0	S-16	17	1.5	100	-		M		
		18							
		30							
25.5	S-17	34	1.0	67	-		M		
		21							
		29							
27.0	S-18	44	0.6	40	-		M		
		18							
		18							
28.5	S-19	26	1.0	67	-		M		
28.7	S-20	50/0.2	0.2	100	-		M		
30.0						a-2-4		El. -17.0	
				100				30.0 to 32.0 SCHIST, dark gray to light brown/ orange, medium hard to hard, highly to slightly weathered, very intensely foliated, (RD=55-60), very closely to closely jointed (RD=5-10, 30-35, 55-60), very broken to slightly broken, (RDQ=35%)	TOP OF ROCK @ 30.0 ft
32.0	R-1		2.0	35				(RMR: D=3, S=1, R=3, I=2, W=1-3)	
								Foliations are wavy throughout El. -19.0	
								END OF BORING @ 32.0 ft	

APPENDIX B

LABORATORY TESTING RESULTS

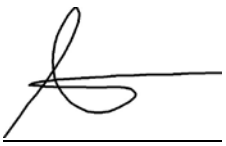
Schuylkill River Trail Extension – Proposed Retaining Wall
South Street to Christian Street
City of Philadelphia, Philadelphia County, Pennsylvania

Project No. 13004
October 2014

ENGINEER'S CERTIFICATION

I, the undersigned, hereby certify that the laboratory testing was performed in accordance with the identified test methods, and the results have been checked to verify that to the best of my knowledge they represent the materials provided.

American Geotechnical & Environmental Services, Inc.



Solveig Salin, P.E.
Project Engineer

Corrosivity Test Report
Schuylkill River Trail Extension
Job #13004

Test Procedure

Soil
pH – D4972
Chloride content – CalDOT 422
Sulfate content – CalDOT 417
Resistivity – PTM 133

Water
pH – D1067
Chloride content – D512
Sulfate content – D516
Conductivity – D1125

Results

Sample ID	pH	Chlorides, ppm	Sulfates, ppm	Resistivity, ohm-cm Conductivity, µS/cm
B-3, S-1 to 7, 0.0 – 10.5 ft	6.4	30.0	16.0	7.4×10^3

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	8.1	45.1	38.5	8.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	2.65	0.504	0.117	0.0112	0.0070	0.0057	0.04	88.92

MATERIAL DESCRIPTION	USCS	AASHTO
○ Silty Sand	SM	A-4(0)

Project No. 13004 **Client:** Urban Engineers, Inc.

Project: Schuylkill River Trail Extension

○ **Location:** B-1, S-6,7,8,9, 7.5 - 13.5 ft

Remarks:

○ Lab Sample #13474

N.M.C. = 71.8%

Composite Jar Sample

August 2013

PARTICLE SIZE DISTRIBUTION TEST REPORT

American Geotechnical & Environmental Services, Inc.

PARTICLE SIZE DISTRIBUTION TEST REPORT

	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	3.2	15.8	65.4	15.6

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	56	32	0.108	0.0360	0.0182	0.0078	0.0049	0.0038	0.45	9.57

MATERIAL DESCRIPTION	USCS	AASHTO
○ Elastic Silt with Sand	MH	A-7-5(22)

Project No. 13004 **Client:** Urban Engineers, Inc.

Project: Schuylkill River Trail Extension

○ **Location:** B-2A, ST-1, 15.0 - 17.0 ft

Remarks:

○ Lab Sample #13475

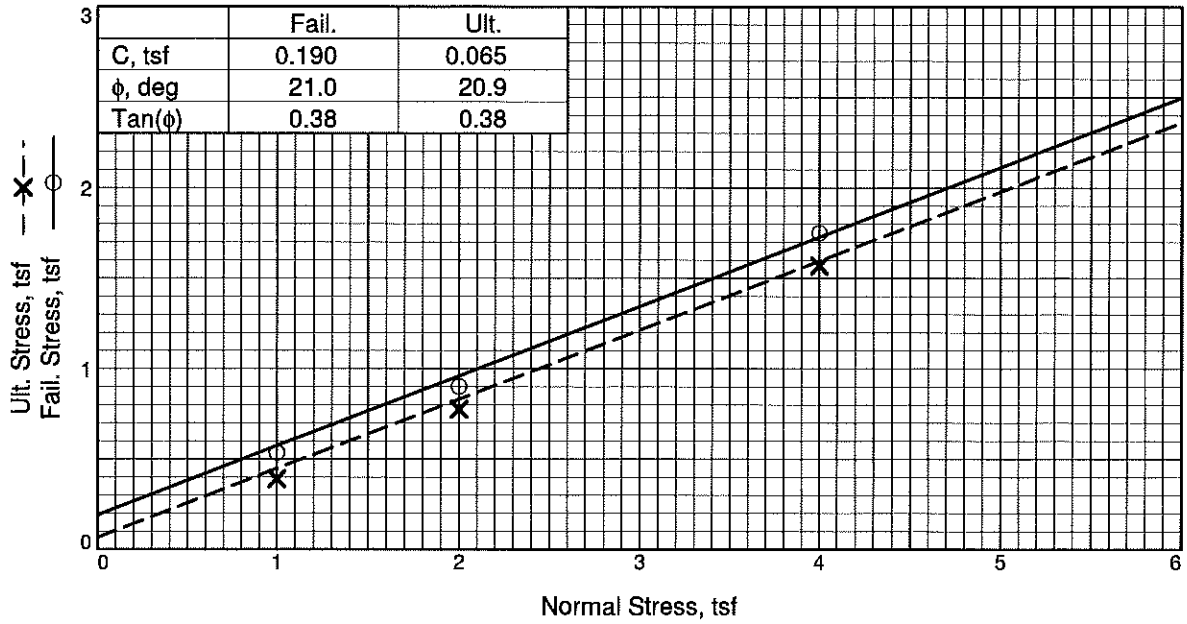
N.M.C. = 44.8%

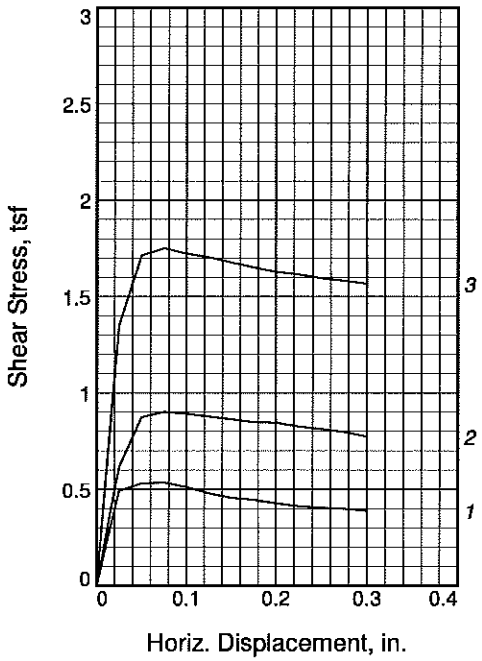
Shelby Tube

August 2013

PARTICLE SIZE DISTRIBUTION TEST REPORT

American Geotechnical & Environmental Services, Inc.





Sample No.		1	2	3
Initial	Water Content, %	44.4	41.7	43.0
	Dry Density, pcf	72.3	73.6	73.1
	Saturation, %	91.2	88.5	90.2
	Void Ratio	1.2881	1.2485	1.2642
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.25	1.25	1.25
At Test	Water Content, %	47.6	46.3	46.7
	Dry Density, pcf	72.3	73.6	73.1
	Saturation, %	97.9	98.3	97.9
	Void Ratio	1.2881	1.2485	1.2642
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.25	1.25	1.25
Normal Stress, tsf		1.000	2.000	4.000
Fail. Stress, tsf		0.535	0.901	1.751
Displacement, in.		0.08	0.08	0.08
Ult. Stress, tsf		0.390	0.774	1.568
Displacement, in.		0.30	0.30	0.30
Strain rate, in./min.		0.00	0.00	0.00

Sample Type:
Description: Elastic Silt with Sand

LL= 56 **PL=** 32 **PI=** 24
Specific Gravity= 2.65
Remarks: Lab Sample #13475
N.M.C. = 44.8%
Shelby Tube
August 2013
Figure _____

Client: Urban Engineers, Inc.

Project: Schuylkill River Trail Extension

Location: B-2A, ST-1, 15.0 - 17.0 ft
Sample Number: #13475
Proj. No.: 13004 **Date Sampled:**

DIRECT SHEAR TEST REPORT

American Geotechnical & Environmental Services, Inc.

APPENDIX C

STRUCTURE BORING SHEETS

RETAINING WALL
(BORING B- I)

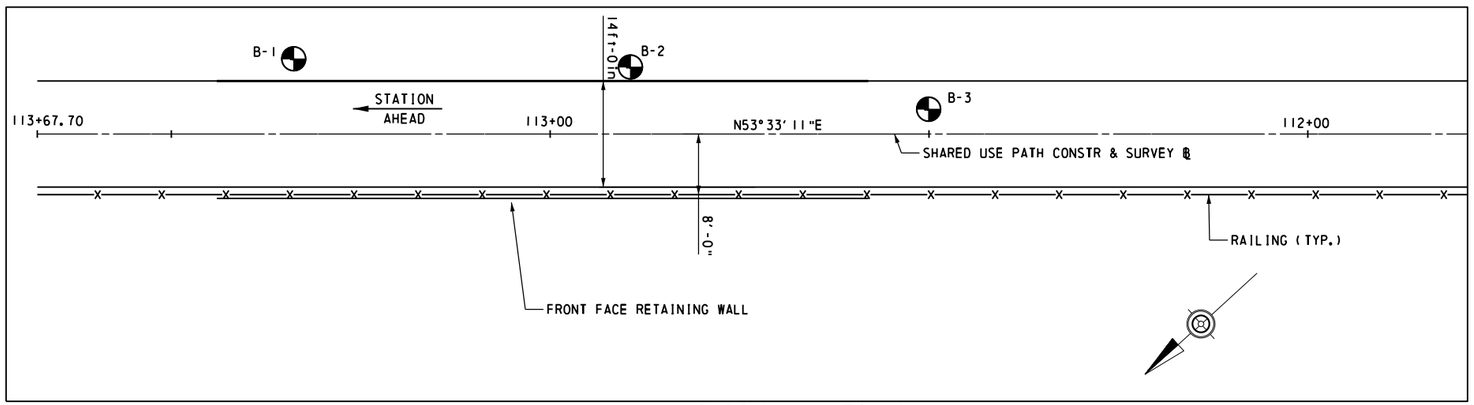
BORING NO. B-1
STA. 113+34, 10 FT RT
ELEV. 9.3'

		A	B	C	D	E	F	G	H	DESCRIPTION		REMARKS
EL. 9.3	SE											
		1.5	S-1	4-6-4	0.5	33	-	ml / a-4	M	0.0 TO 1.5 SANDY SILT WITH GRAVEL (ml), BROWN TO BLACK, MOIST, STIFF, HOMOGENEOUS (FILL)	EL. 7.8	
		3.0	S-2	4-6-13	0.4	27	-	sm / a-2-4	M	1.5 TO 4.5 SILTY SAND WITH GRAVEL (sm), BLACK, MOIST, MEDIUM DENSE, HOMOGENOUS (FILL)	EL. 4.8	
		4.5	S-3	13-8-18	0.5	33	-		M			
▽	EL. 3.6 0 HR 8-6-13	6.0	S-4	13-7-3	0.2	13	-	gm / a-2-4	W	4.5 TO 7.5 SILTY GRAVEL WITH SAND (gm), BLACK, WET, LOOSE, HOMOGENEOUS (FILL)	EL. 1.8	PERSISTENT PETROLEUM ODOR FROM 4.5-16.5 FT
		7.5	S-5	2-2-3	0.0	0	-		-			
▽	EL. 2.3 24 HR 8-8-13	9.0	S-6	2-4-1	0.6	40	-	SM / A-4(0)	W	7.5 TO 13.5 SILTY SAND (SM), BLACK, WET, VERY LOOSE TO LOOSE, HOMOGENEOUS, (ALLUVIAL)		CLASS. ON S-6 TO S-9 N.M.C.=71.8%
		10.5	S-7	4-5-3	0.3	20	-		W			
		12.0	S-8	5-2-2	0.3	20	-		W			
EL. -3.0	TOC									DECOMPOSED ORGANICS PRESENT, S-6		
		13.5	S-9	1-2-1	0.3	20	-		W		EL. -4.2	
		15.0	S-10	2-2-4	1.0	67	0.75	mh / a-7-5	W	13.5 TO 16.5 ELASTIC SILT (mh), DARK BROWN TO BLACK, WET, MEDIUM STIFF, HOMOGENEOUS (ALLUVIAL)	EL. -7.2	
		16.5	S-11	3-3-2	1.4	93	1.0		W			
		18.0	S-12	5-8-14	1.3	87	-	sm / a-2-4	W	16.5 TO 19.5 SILTY SAND WITH GRAVEL (sm), DARK BROWN TO BLACK, WET, MEDIUM DENSE TO VERY DENSE, HOMOGENEOUS, (RESIDUAL)	EL. -10.2	
		19.2	S-13	30-31-50/0.2	0.4	33	-		W			
EL. -10.2	TRE	19.5	S-14	50/0.0	0.0	0	-		-			
		20.5	R-1		1.0	100 / 96	0			19.5 TO 25.5 SCHIST, DARK GRAY TO ORANGE/ BROWN, SOFT TO MEDIUM HARD, MODERATELY TO SLIGHTLY WEATHERED, VERY INTENSELY TO INTENSELY FOLIATED (RD=60-65), EXTREMELY TO VERY CLOSELY JOINTED (RD=5-10, 60-65, 85-90), VERY BROKEN TO SLIGHTLY BROKEN (RQD=10%) (RMR: D=3, S=1, R=3, I=2, W=3-5)		TOP OF ROCK @ 19.5 FT
EL. -15.2	BOC	25.5	R-2		4.8	12				MODERATELY WEATHERED, 21.4-24.4' BOTTOM OF BORING 25.5 FT.	EL. -16.2	

WATER LEVEL: 0-HRS: 5.7 FT
24-HRS: 7.0 FT

DRILLING DATES: START: 8-6-13
FINISH: 8-6-13

DRILLER: A. SCAFIDI / TRC ENGINEERS, INC.
EQUIPMENT USED: ACKER SOIL X TRACK RIG WITH SAFETY HAMMER
DRILLING METHODS: FLUSH JOINT CASING WITH WATER, SPLIT INNER CORE BARREL, NX WIRELINE WITH WATER
INSPECTOR: S. YUAN



BORING LOCATIONS
SCALE
10 FEET 0 10 FEET

GENERAL NOTES

COLUMN A - PROFILE DEPTH IN FEET
COLUMN B - SAMPLE NUMBER AND TYPE OR RUN NUMBER
COLUMN C - NUMBER OF BLOWS FOR EVERY 0.5' (EXCEPT AS NOTED) ON SPOON SAMPLER FOR SPT
COLUMN D - AMOUNT OF RECOVERY IN FEET FOR ROCK AND SOIL
COLUMN E - % OF SPT RECOVERY OR % OF NX CORE RECOVERY AND ROCK QLTY. DESIGNATION (RQD) PERCENTAGES SHOWN AS % RECOVERY / % RQD
COLUMN F - POCKET PENETROMETER OR TORVANE PRESSURE IN TSF
COLUMN G - USCS AND AASHTO CLASSIFICATION
COLUMN H - MOISTURE CONTENT

FOR ADDITIONAL GENERAL NOTES AND LEGEND, AND SOIL AND ROCK DESCRIPTION REFER TO BC-795M

▽ ELEV. GROUND WATER ELEVATION IN FEET
HR. HOUR OF READING
DATE DATE OF READING

SE - SURFACE ELEVATION IN FEET
TRE - TOP OF ROCK ELEVATION IN FEET
TOC - TOP OF CAISSON ELEVATION IN FEET
BOC - BOTTOM OF CAISSON ELEVATION IN FEET

⊕ - TEST BORING LOCATION

THE CLASSIFICATIONS OF THE MATERIAL ENCOUNTERED HAVE BEEN VERIFIED.

SCS
INITIAL

THE INFORMATION, AS SUBMITTED, ACCURATELY REPRESENTS THE CONDITIONS ENCOUNTERED BY THE TEST BORING PROGRAM, INCLUDING BORING LOGS, EARTH SAMPLES, ROCK CORES, CLASSIFICATION OF MATERIALS, AND DEPTH OF BORINGS.

10/11/13
GEOTECHNICAL ENGINEER/ENGINEERING GEOLOGIST

THIS SHEET IS INCLUDED FOR THE CONVENIENCE OF THE DEPARTMENT. REFER TO PUBLICATION 408 SECTION 102.05 FOR FURTHER INFORMATION.

Prepared By:

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL SOLVEIG C. SAHLIN ENGINEER PROGRAM

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

PHILADELPHIA COUNTY

SCHUYKILL RIVER TRAIL EXTENSION
SOUTH STREET TO CHRISTIAN STREET

TEST BORINGS (SHEET 1 OF 2)

SHEET __ OF __

S- _____

PLT: RJE | CKD: SCS | QA/QC: YY

M:_2013\004\exhibits\structure\13004_strb.dgn

D-9012 CADD 02/90 REVISED (10-04)

RETAINING WALL
(BORING B-2)

BORING NO. B-2
STA. 112+89, 9 FT RT
ELEV. 10.5'

EL. 10.5	A	B	C	D	E	F	G	H	DESCRIPTION	EL. 10.5	REMARKS
SE	1.5	S-1	4-5-5	0.1	7	-	sm	M	0.0 TO 10.2 SILTY SAND WITH GRAVEL (sm), BLACK, WET TO MOIST, VERY LOOSE TO MEDIUM DENSE, HOMOGENEOUS (FILL)		
	3.0	S-2	6-6-7	0.4	27	-		M			
	4.5	S-3	4-3-2	0.3	20	-		M	COAL FRAGMENTS, COAL DUST AND SLAG PRESENT, 0.0-9.0'		
	6.0	S-4	2-1-2	0.2	13	-		M			
▽ EL. 3.2 0 HR 8-7-13	7.5	S-5	3-2-2	0.3	20	-		M	WOOD FRAGMENTS PRESENT, S-3		
	9.0	S-6	4-2-1	0.4	27	-		W			
▽ EL. 3.2 24 HR 8-8-13	10.5	S-7	3-3-1	0.1	7	-	a-2-4	W		EL. 0.3	
	12.0	S-8	1-3-2	0.4	27	-	sc	W	10.2 TO 13.5 CLAYEY SAND WITH GRAVEL (sc), DARK BROWN, WET, VERY LOOSE TO LOOSE, HOMOGENEOUS (ALLUVIAL)		
EL. -3.0	13.5	S-9	5-3-2	0.0	0	-	a-2-6	-		EL. -3.0	
TOC	15.0	S-10	5-7-2	0.1	7	0.1	MH	W	13.5 TO 18.5 ELASTIC SILT WITH SAND (MH), BROWN, WET, SOFT TO STIFF, HOMOGENEOUS (ALLUVIAL)		SHELBY TUBE, ST-1, COLLECTED IN OFFSET BORING B-2A, 15.0 TO 17.0 FT
	16.5	S-11	2-1-3	1.5	100	0.1		W			
	18.0	S-12	2-1-2	1.4	93	0.1	A-7-5(22)	W			CLASS. ON ST-1 N.M.C.=44.8%
	19.5	S-13	3-10-10	0.3	20	-		W		EL. -8.0	
	21.0	S-14	6-8-21	0.0	0	-	sm	-	18.5 TO 26.8 SILTY SAND WITH GRAVEL (sm), DARK GRAY TO BROWN, WET TO MOIST, MEDIUM DENSE TO VERY DENSE, HOMOGENEOUS (RESIDUAL-COMPLETELY WEATHERED AMPHIBOLITE)		
	21.8	S-15	11-50/0.3	0.6	75	-		M			BX SIZED (1.0" O.D.) SPOON USED FOR S-16, S-17
	23.8	R-1		0	0						
	24.1	S-16	50/0.3	0.2	67	-		M			
	25.5	R-2		0	0						
	25.8	S-17	50/0.3	0.2	67	-		M			
EL. -16.3							a-2-4			EL. -16.3	
TRE					60/83				26.8 TO 31.8 AMPHIBOLITE, BLACK TO DARK GRAY, SOFT TO MEDIUM HARD, HIGHLY TO MODERATELY WEATHERED, INTENSELY TO VERY THINLY FOLIATED (RD=65-70), VERY CLOSELY TO CLOSELY JOINTED (RD=25-30, 65-70), VERY BROKEN TO SLIGHTLY BROKEN, (RQD=18%) (RMR: D=3, S=1, R=3, I=2, W=1-3) BOTTOM OF BORING 31.8 FT.		TOP OF ROCK @ 26.8 FT
	28.8	R-3		1.2	20						
					83						
EL. -21.3 BOC	31.8	R-4		2.5	17					EL. -21.3	

WATER LEVEL: 0-HRS: 7.3 FT
24-HRS: 7.3 FT

DRILLING DATES: START: 8-7-13
FINISH: 8-7-13

DRILLER: A. SCAFIDI / TRC ENGINEERS, INC.
EQUIPMENT USED: ACKER SOIL X TRACK RIG WITH SAFETY HAMMER
DRILLING METHODS: FLUSH JOINT CASING WITH WATER, SPLIT INNER CORE BARREL, NX WIRELINE WITH WATER
INSPECTOR: S. YUAN

RETAINING WALL
(BORING B-3)

BORING NO. B-3
STA. 112+50, 3 FT RT
ELEV. 13.0'

EL. 13.0	A	B	C	D	E	F	G	H	DESCRIPTION	EL. 13.0	REMARKS
SE	1.5	S-1	2-4-5	0.2	13	-	sm	M	0.0 TO 4.5 SILTY SAND WITH GRAVEL (sm), BLACK TO DARK BROWN, MOIST, LOOSE TO DENSE, HOMOGENEOUS (FILL)		* BORING GROUTED UPON COMPLETION
	3.0	S-2	12-10-12	1.1	73	-		M			
	4.5	S-3	15-20-20	1.0	67	-	a-2-4	M	COAL AND CONCRETE FRAGMENTS, 0.0-4.5'	EL. 8.5	
	6.0	S-4	12-19-14	0.8	53	-	ml	M	4.5 TO 10.5 SANDY SILT WITH GRAVEL (ml), BROWN, MOIST, STIFF TO HARD, HOMOGENEOUS (ALLUVIAL)		
	7.5	S-5	6-5-5	1.0	67	1.0		M			
▽ EL. 4.0 0 HR 8-8-13	9.0	S-6	12-14-12	1.0	67	0.75		M	TRACE ORGANICS, S-5 WOOD FRAGMENTS PRESENT, S-6	EL. 2.5	
	10.5	S-7	5-10-8	0.4	27	-	a-4	M			
	12.0	S-8	5-3-2	0.0	0	-	sm	-	10.5 TO 19.5 SILTY SAND WITH GRAVEL (sm), LIGHT BROWN, WET, VERY LOOSE TO LOOSE, HOMOGENEOUS (ALLUVIAL)		
	13.5	S-9	2-2-2	0.1	7	-		W			
	15.0	S-10	2-2-2	0.5	33	-		W			
EL. -3.0 TOC	16.5	S-11	3-2-1	0.1	7	-		W			
	18.0	S-12	2-1-2	1.1	73	-		W			
	19.5	S-13	1-1-2	0.1	7	-	a-2-4	W		EL. -6.5	
	21.0	S-14	2-2-1	0.7	47	1.0	mh	W	19.5 TO 23.0 ELASTIC SILT (mh), LIGHT BROWN, WET TO MOIST, SOFT TO STIFF, HOMOGENEOUS, (ALLUVIAL)		
	22.5	S-15	2-7-4	0.0	0	-		-		EL. -10.0	
	24.0	S-16	21-28-17	1.5	100	-	a-7-5	M	23.0 TO 30.0 SILTY SAND WITH GRAVEL (sm), LIGHT GRAY, MOIST, DENSE TO VERY DENSE, HOMOGENEOUS, (RESIDUAL-COMPLETELY WEATHERED SCHIST)		
	25.5	S-17	18-30-34	1.0	67	-	sm	M			
	27.0	S-18	21-29-44	0.6	40	-		M			
	28.5	S-19	18-18-26	1.0	67						
	28.7	S-20	50/0.2	0.2	100	-		M			
EL. -17.0							a-2-4			EL. -17.0	
TRE					100/35				30.0 TO 32.0 SCHIST, DARK GRAY TO LIGHT BROWN/ ORANGE, MEDIUM HARD TO HARD, HIGHLY TO SLIGHTLY WEATHERED, VERY INTENSELY FOLIATED, (RD=55-60), VERY CLOSELY TO CLOSELY JOINTED (RD=5-10, 30-35, 55-60), VERY BROKEN TO SLIGHTLY BROKEN, (RDQ=35%) (RMR: D=3, S=1, R=3, I=2, W=1-3) FOLIATIONS ARE WAVY THROUGHOUT BOTTOM OF BORING 32.0 FT.		TOP OF ROCK @ 30.0 FT
	32.0	R-1		2.0						EL. -19.0	
EL. -22.0 BOC											

WATER LEVEL: 0-HRS: 9.0 FT
24-HRS: *BORING GROUTED UPON COMPLETION

DRILLING DATES: START: 8-7-13
FINISH: 8-8-13

DRILLER: A. SCAFIDI / TRC ENGINEERS, INC.
EQUIPMENT USED: ACKER SOIL X TRACK RIG WITH SAFETY HAMMER
DRILLING METHODS: FLUSH JOINT CASING WITH WATER, SPLIT INNER CORE BARREL, NX WIRELINE WITH WATER
INSPECTOR: S. YUAN

SEE SHEET 1 OF 2 FOR BORING LOCATION LAYOUT

THE CLASSIFICATIONS OF THE MATERIAL ENCOUNTERED HAVE BEEN VERIFIED.

SCS
INITIAL

THIS SHEET IS INCLUDED FOR THE CONVENIENCE OF THE DEPARTMENT. REFER TO PUBLICATION 408 SECTION 102.05 FOR FURTHER INFORMATION.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

PHILADELPHIA COUNTY

SCHUYKILL RIVER TRAIL EXTENSION
SOUTH STREET TO CHRISTIAN STREET

TEST BORINGS (SHEET 2 OF 2)

SHEET __ OF __

S- _____

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PLT: RJE | CKD: SCS | QA/QC: YY

APPENDIX D

CORE BOX PHOTOS

Photo 1: **B-1, Box 1 of 1.**

Photo 2: **B-2, Box 1 of 1.**

Photo 3: B-3, Box 1 of 1.

APPENDIX E

CONCEPTUAL STRUCTURE PLAN

(Provided by Urban Engineers, Inc.)

	DISTRICT	COUNTY	TOWNSHIP	BOROUGH	ROUTE	SECTION	TOTAL SHEETS
	6-0	PHILADELPHIA	PHILADELPHIA		–	–	3

WBS ELEMENT								
T/P	SYS	WO	SPUR	PHA	SECTION	ORG	PRG	P_C

SCHUYLKILL RIVER DEVELOPMENT CORPORATION

STRUCTURAL DRAWINGS

FOR

CONSTRUCTION

OF

THE SCHUYLKILL RIVER TRAIL EXTENSION – SOUTH STREET TO CHRISTIAN STREET IN PHILADELPHIA COUNTY, PENNSYLVANIA

FROM STA. 99+56.00 TO STA. 113+68.00 LENGTH 1412.00 FT, 0.27 MI.

DESIGN DESIGNATION

HIGHWAY CLASSIFICATION	– SHARED USE PATH
DESIGN SPEED	– 20 MPH
PAVEMENT WIDTH	– 12'–0"
SHOULDER WIDTH	– 2'–0" (NON–PAVED)

PREPARED BY:
URBAN ENGINEERS, INC.
530 WALNUT STREET, 7TH FL.
PHILADELPHIA, PA 19106
215–922–8080

DATE: APRIL 2015

APPROVED DATE: _____

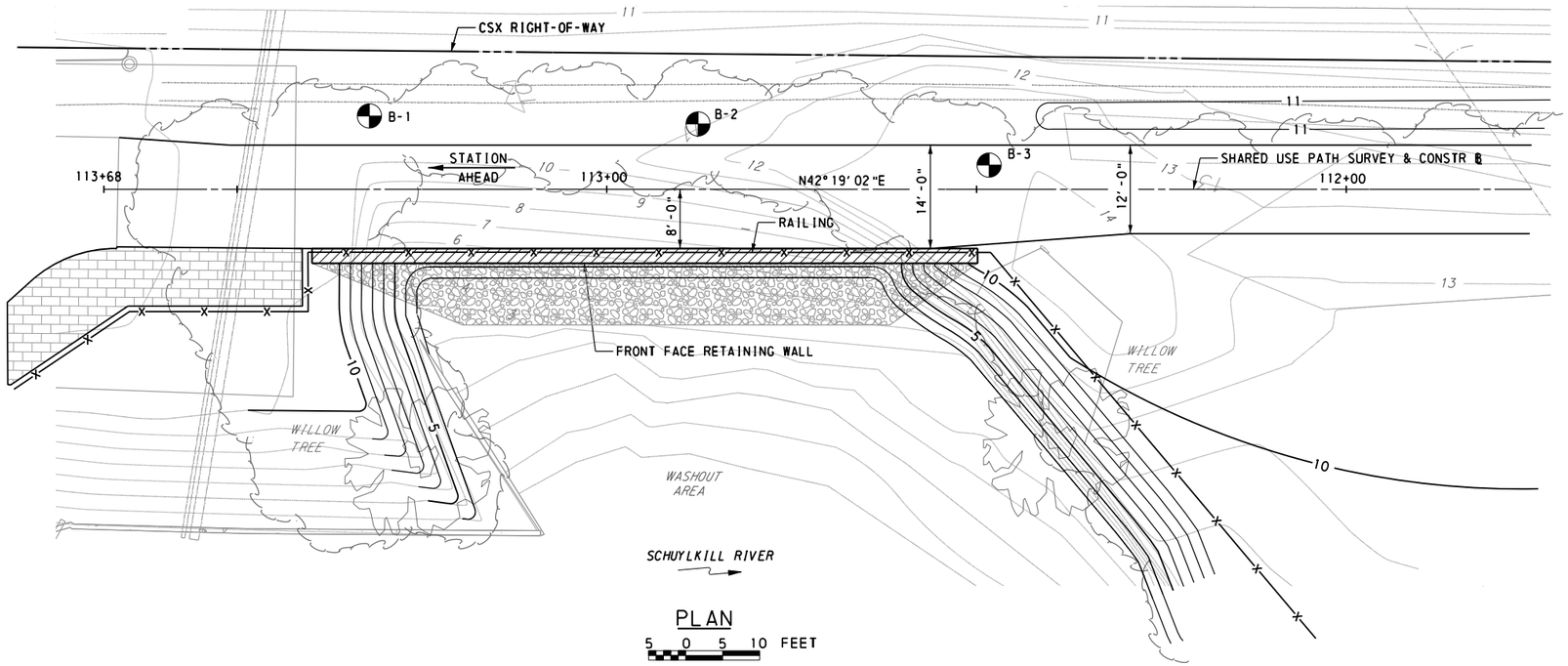
PRESIDENT
SCHUYLKILL RIVER DEVELOPMENT CORPORATION

PLOTTED: 4/10/2015 8:45:12 AM
D-9012 CADD (02-90) REVISED (10-04)
OPERATOR:
FILE NAME: T:\Projects\SRDC - Schuylkill Trail at South Street\Drawings\Structures\SRT_Wall_TS&L.dgn

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
6-0	PHILADELPHIA			2 OF 3
CITY OF PHILADELPHIA				

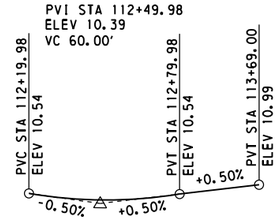
REVISION NUMBER	REVISIONS	DATE	BY

SCHUYLKILL RIVER TRAIL EXTENSION
CONCEPTUAL STRUCTURE PLAN



PLAN

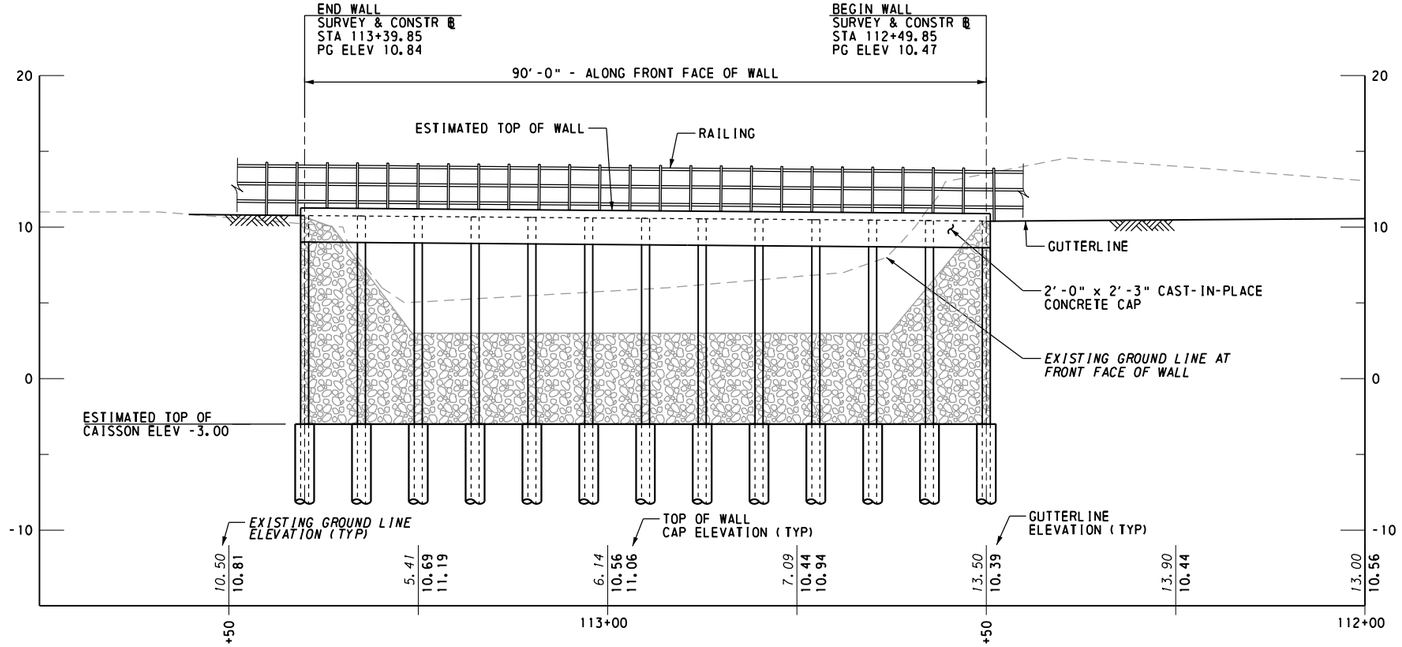
5 0 5 10 FEET



SHARED USE PATH VERTICAL ALIGNMENT

TANGENT

SHARED USE PATH HORIZONTAL ALIGNMENT



ELEVATION

HORIZONTAL SCALE: 5 0 5 10 FEET

VERTICAL SCALE: 2.5 0 5 FEET

BORING LOCATIONS

SHARED USE PATH SURVEY & CONSTR ℄

BORING NUMBER	STATION	OFFSET
B-1	113+32.25	9.93' RT
B-2	112+87.81	8.85' RT
B-3	112+48.45	3.28' RT

NOTES

1. FOR GENERAL NOTES AND TYPICAL SECTION, SEE SHEET 2.
2. RAILING WILL BE CHOSEN IN FINAL DESIGN.

LEGEND

- AS DRILLED TEST BORING LOCATION
- RETAINING WALL
- R-8 ROCK SCOUR PROTECTION
- RAILING

TABULATION OF STRUCTURE ITEMS

ITEM NO	ITEM	UNIT	TOTAL
8212-0001	DESIGN OF RETAINING WALL (AS-DESIGNED FOUNDATION PROVIDED)	LS	LUMP SUM
8255-0001	CONSTRUCTION OF SOLDIER PILE RETAINING WALL	LS	LUMP SUM

DESCRIPTION	DWG NO	APP DATE
PROTECTIVE FENCE	BC-701M	5-18-12
ANCHOR SYSTEMS	BC-734M	10-26-10
REINFORCEMENT BAR FABRICATION DETAILS	BC-736M	5-18-12
BRIDGE DRAINAGE	BC-751M	5-18-12
CLASSIFICATION OF EARTHWORK FOR STRUCTURES	RC-11M	6-1-10
BACKFILL AT STRUCTURES	RC-12M	6-1-10

SUPPLEMENTAL DRAWINGS

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
6-0	PHILADELPHIA			3 OF 3
CITY OF PHILADELPHIA				

REVISION NUMBER	REVISIONS	DATE	BY

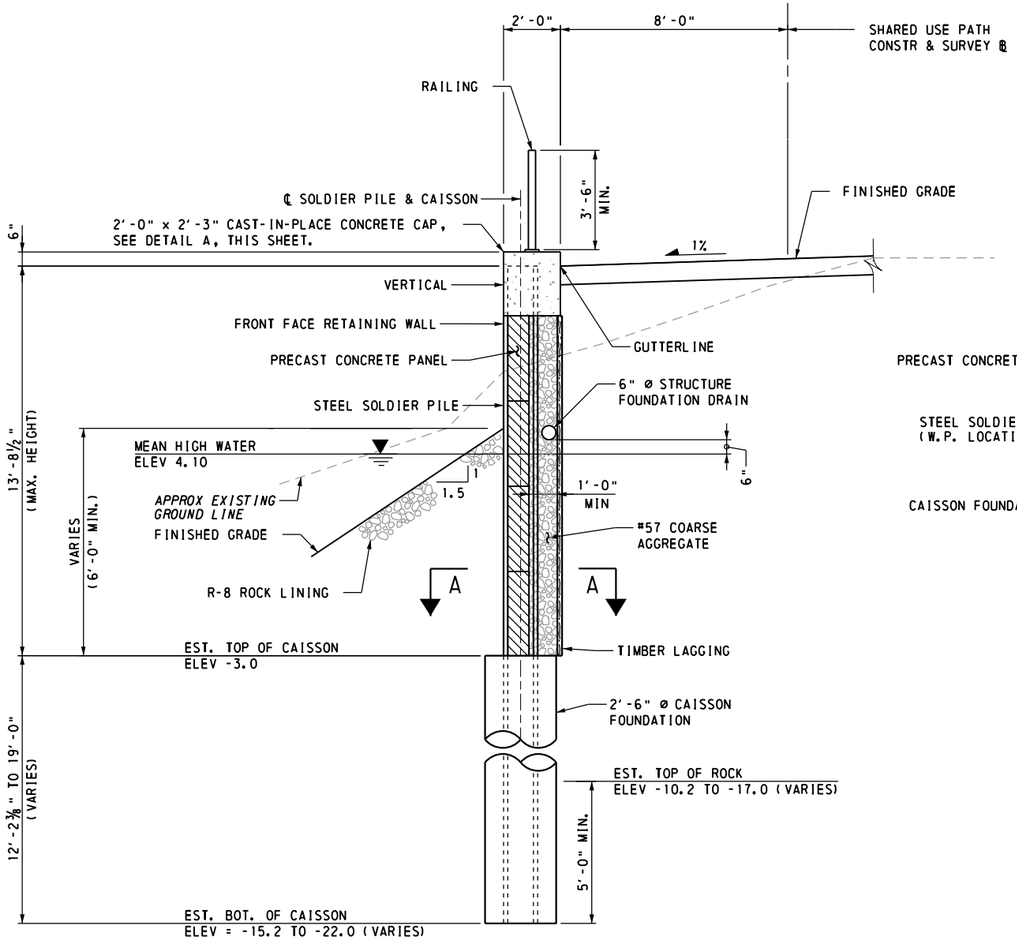
GENERAL NOTES & TYPICAL SECTION

GENERAL NOTES

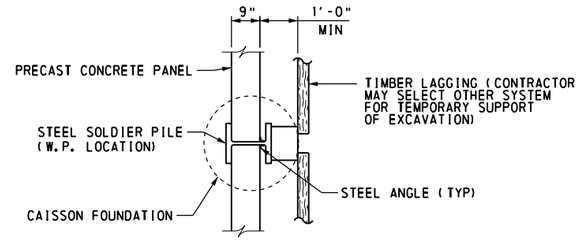
1. PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS, PUBLICATION 408/2011-5, AASHTO/AWS D1.5/D1.5M BRIDGE WELDING CODE (2008) AND CONTRACT SPECIAL PROVISIONS. USE AWS D1.1/D1.1M-2008 FOR WELDING NOT COVERED IN AASHTO/AWS D1.5/D1.5M-2008.
2. PROVIDE STRUCTURAL STEEL (GALVANIZED AND COLOR COATED) CONFORMING TO AASHTO M270/M270M GRADE 50 (ASTM A709/A709M GRADE 50) EXCEPT WHEN NOTED OTHERWISE.
3. DESIGN SPECIFICATIONS: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (2010) AND AS SUPPLEMENTED BY THE PENNDOT DESIGN MANUAL, PART 4, MAY 2012 EDITION. DESIGN IS IN ACCORDANCE WITH THE LRFD METHOD DESIGN LOAD: LIVE LOAD SURCHARGE PER DESIGN MANUAL, PART 4.
4. PROVIDE 2 IN. CONCRETE COVER ON REINFORCEMENT BARS, EXCEPT AS NOTED.
5. CHAMFER EXPOSED CONCRETE EDGES 1"x1", EXCEPT AS NOTED OTHERWISE.
6. USE CLASS AA CEMENT CONCRETE IN PRECAST CONCRETE PANELS.
7. USE CLASS A CEMENT CONCRETE FOR DRILLED CAISSON FOUNDATIONS.
8. UTILIZE TYPE II CEMENT FOR ALL CONCRETE STRUCTURES.
9. A HIGHER CLASS CONCRETE MAY BE SUBSTITUTED FOR A LOWER CLASS CONCRETE AT NO ADDITIONAL COST TO THE OWNER.
10. PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF A615/A615M-A996/A996M OR A706/A706M. DO NOT WELD GRADE 60 REINFORCING STEEL BARS UNLESS SPECIFIED. GRADE 40 REINFORCING STEEL BARS MAY BE SUBSTITUTED WITH A PROPORTIONAL INCREASE IN CROSS SECTIONAL AREA, IF APPROVED BY THE OWNER REPRESENTATIVE. DO NOT USE RAIL STEEL A996/A996M REINFORCEMENT BARS WHERE BENDING OR WELDING OF THE REINFORCEMENT BARS IS INDICATED.
11. USE EPOXY COATED REINFORCEMENT BARS IN PRECAST CONCRETE PANELS.
12. GALVANIZED REINFORCING STEEL BARS MAY BE SUBSTITUTED FOR EPOXY COATED REINFORCING STEEL BARS AT NO ADDITIONAL COST TO THE DEPARTMENT.
13. PROVIDE NO. 57 AGGREGATE DRAINAGE DETAILS AS INDICATED.
14. PROVIDE SHOP DRAWINGS IN ACCORDANCE WITH SECTION 105.02. SUBMIT DETAILED LAYOUT OF RETAINING WALL INCLUDING POST LOCATIONS WITH SHOP DRAWINGS FOR APPROVAL. SUBMIT ERECTION PROCEDURES, INCLUDING BRACING AND NECESSARY DETAILS FOR APPROVAL PRIOR TO CONSTRUCTION.
15. ALL DIMENSIONS ARE HORIZONTAL UNLESS NOTED OTHERWISE.
16. PROVIDE MINIMUM EMBEDMENT AND SPLICE LENGTHS IN ACCORDANCE WITH STANDARD DRAWING BC-736M, UNLESS OTHERWISE INDICATED.
17. WELDING OF REINFORCEMENT BARS DURING FABRICATION AND CONSTRUCTION IS NOT PERMITTED UNLESS SPECIFIED.
18. COORDINATE, LOCATE, AND CONDUCT ALL WORK RELATED TO PUBLIC AND PRIVATE UTILITES IN ACCORDANCE WITH SECTIONS 105.06 AND 107.12. PA ONE CALL SERIAL NUMBER 20130491115, 20130491116, & 20130491117. (1-800-242-1776)

FOUNDATIONS

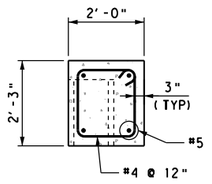
1. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF ALL EXCAVATED SLOPES. PERFORM ALL EXCAVATIONS IN ACCORDANCE WITH OSHA REQUIREMENTS.
2. TEMPORARY SHORING AND/OR STREAM DIVERSION BARRIERS ALONG WITH DEWATERING TECHNIQUES MAY BE REQUIRED FOR CONSTRUCTION OF SUBSTRUCTURE UNITS.
3. ALL EXCAVATED MATERIAL SHALL BE HANDLED IN ACCORDANCE WITH SPECIFICATION "026113 - EXCAVATION OF CONTAMINATED MATERIAL HANDLING."
4. PROVIDE GALVANIZED PILE FOR CORROSION PROTECTION.
5. TEMPORARY CASING MAY BE REQUIRED TO MAINTAIN AN OPEN BOREHOLE. IF TEMPORARY CASING IS UTILIZED, MAINTAIN CONCRETE LEVELS ABOVE THE BOTTOM OF CASING AT ALL TIMES DURING EXTRACTION TO PREVENT CAVED MATERIAL FROM CONTAMINATING THE CONCRETE.
6. BACKFILL CAISSON BOREHOLE WITHIN 24-HOURS AFTER DRILLING TO LIMIT THE DETERIORATION OF THE BEARING MATERIAL.
7. STRUCTURE BACKFILL MAY CONSIST OF MATERIAL MEETING ASSHTO NO. 57 OR PENNDOT OPEN GRADED SUBBASE (OGS) CRITERION.
8. FILL THE GAP BETWEEN PERMANENT LAGGING AND TEMPORARY TIMBER LAGGING WITH AASHTO NO. 57 COARSE AGGREGATE.
9. BLASTING IS NOT PERMITTED AS A METHOD OF EXCAVATION.



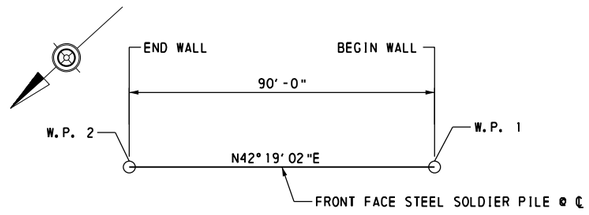
TYPICAL SECTION
1 0 1 2 3 FEET



SECTION A-A
1 0 1 2 FEET



DETAIL A
1 0 1 2 FEET



STAKE-OUT PLAN
NOT TO SCALE

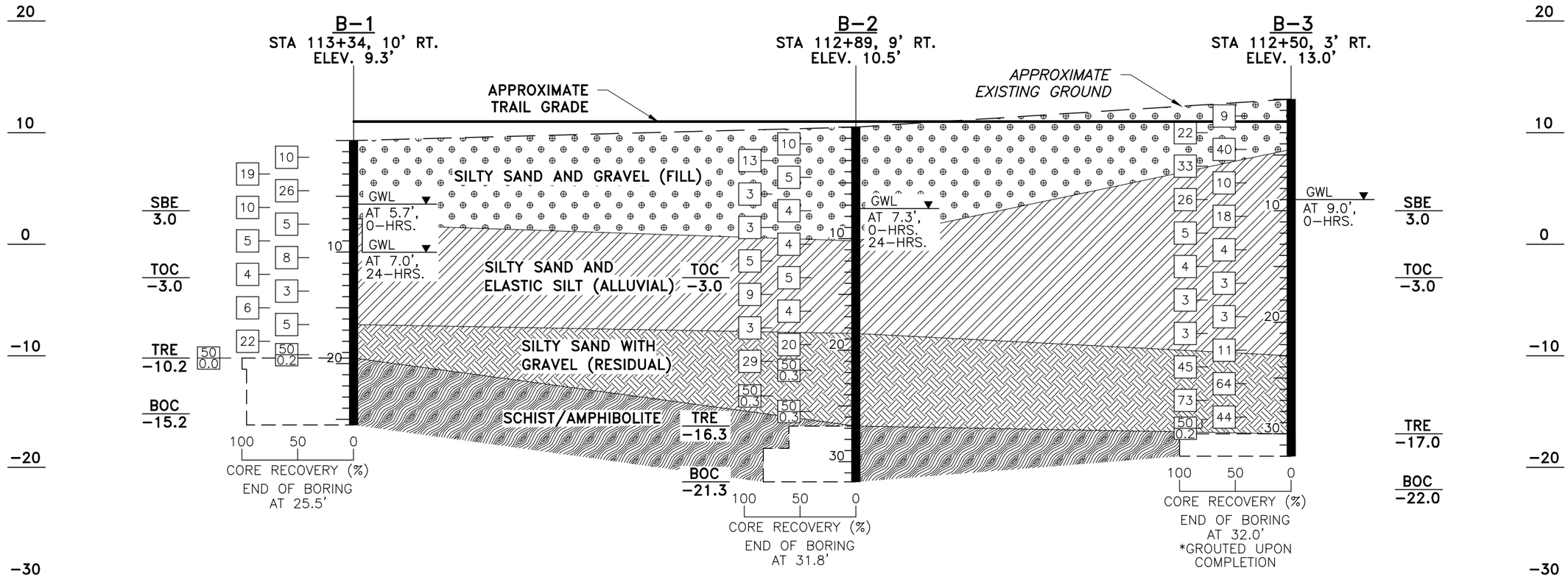
WORK POINT DATA

LOCATION / W.P.	SHARED USE PATH SURVEY & CONSTR. ℄		COORDINATES	
	STATION	OFFSET	NORTHING	EASTING
1	112+49.85	10.00' LT	233577.6293	2686987.9173
2	113+39.85	10.00' LT	233644.1780	2687048.5083

APPENDIX F

GENERALIZED GEOLOGIC PROFILE

PLT: RJE | CKD: SCS | QA/QC: YY



LEGEND

- FILL
- ALLUVIAL
- RESIDUAL
- BEDROCK
- X — STANDARD PENETRATION RESISTANCE
- GWL ▼ AT (DEPTH), HOURS — GROUND WATER LEVEL
- TRE — TOP OF ROCK ELEVATION (FT)
- SBE — STREAM BED ELEVATION (FT)
- TOC — TOP OF CAISSON ELEVATION (FT)
- BOC — BOTTOM OF CAISSON ELEVATION (FT)

NOTE:
GEOLOGIC PROFILES ARE INTERPRETED FROM THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS AND MAY NOT REFLECT ACTUAL CONDITIONS BETWEEN BORINGS.

10 0 10
SCALE (FT)

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
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Baltimore, MD (410) 814-7552
www.agesinc.com

SCHUYKILL RIVER TRAIL EXTENSION
SOUTH STREET TO CHRISTIAN STREET

PHILADELPHIA COUNTY, PENNSYLVANIA
GENERALIZED GEOLOGIC PROFILE A-A

PROJECT:	13004
DRAWN:	RJE
DATE:	SEP. 2013
SCALE:	AS SHOWN
FIGURE:	

File: M:_2013\13004\exhibits\profile\13004_gpro.dwg
Date: 4/10/15

APPENDIX G

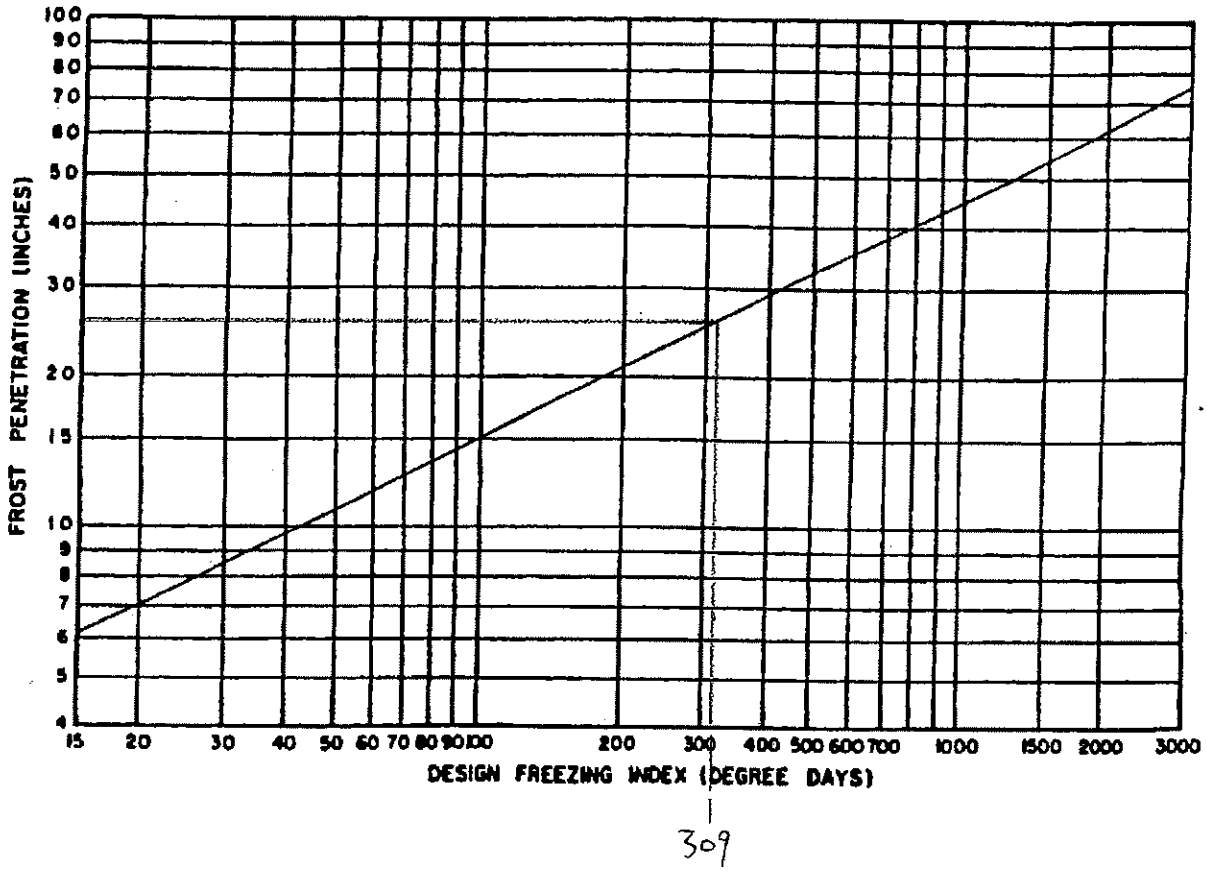
GEOTECHNICAL ANALYSIS

By: YZ 09-04-13
Chk: SCS 09-08-13

PENNDOT PUB 242 – PAVEMENT POLICY MANUAL, 2010

1/2

Figure 9.1
Design Chart for Determination of Frost Penetration



~25"

FOR DREXEL UNIVERSITY, PHILADELPHIA COUNTY, INDEX 309

INDEX OF 309 ⇒ FROST DEPTH ≃ 25"

FOR DESIGN USE: FROST DEPTH = 3'-0" (36")

1

By: YZ 09-04-13
Chk: SCS 09-08-13
2/2

DISTRICT 5

Location	Elevation	Index	Winter
Berks County			
Reading WB	266	436	62-63
Morgantown	595	664	62-63
Carbon County			
Palmerton	435	749*	62-63
Lehigh County			
Allentown WB	376	752	62-63
Allentown Gas	254	621	62-63
Monroe County			
Mt. Pocono 2 mi. N	1915	1194	62-63
Stroudsburg	480	987	62-63
Tobyhanna	1950	1216	62-63
Schuylkill County			
Port Clinton	450	971*	62-63
Northhampton County			
Bethlehem (Lehigh U)	411	752	62-63

DISTRICT 6

Location	Elevation	Index	Winter
Bucks County			
George School	135	685*	60-61
Quakertown	490	669*	60-61
Chester County			
Coatsville 1 mi. SW	342	592*	60-61
Devalut 1 mi. W	360	629	60-61
Phoenixville	105	473	60-61
Delaware County			
Marcus Hook	12	228	60-61
Montgomery County			
Graterford 1 mi. E	240	718	60-61
Norristown	75	355	62-63
Philadelphia County			
Phila. Airport WB	7	506	60-61
→ Drexel University	30	309	62-63
Pt. Breeze	32	184	62-63

2

Chk: SCS 09-08-13

Group	Frost Susceptibility or Danger	Soils
I	None	Gravel, sand, gravelly tills
II	Moderate	Fine clay (≥ 40% clay [1] content); sandy tills, clayey tills with 16% fines[2]
III	Strong	Silt, course clay (clay [1] content 15-25%); silty tills

After Hansbo (1975)
[1]Defined as -2 μm.
[2]Defined as - 0.06 mm.

FOR DESIGN USE: FROST GROUP III (STRONG)

Figure 2.7.3.3.5(D) Frost susceptibility soil groups

2.7.3.4 COMPACTED SOILS

Information regarding the engineering behavior of compacted soils is required when subgrade soils cannot support structures and fills or when engineered fills for embankments or backfills are needed. Compaction is accomplished by mechanical compactors of a mass and type consistent with soil conditions and foundation requirements. Compaction requirements are developed considering the engineering properties needed for a particular situation (e.g., strength, compressibility, and/or permeability). Laboratory compaction tests to establish moisture content-dry unit weight relationships are used in combination with field measurements to determine whether field compaction efforts meet the compaction control criteria.[54, 55]

2.7.3.4.1 Compaction Criteria

In general, a Standard Proctor effort is specified as the reference compaction criterion for subgrade soils, and a Modified Proctor effort is specified as the reference compaction criterion for subbase and base soils. Usually the compaction specification is defined as a percentage (e.g., 90 to 100 percent) of the reference compaction level. Examples of moisture content-dry unit weight relationships (compaction curves) are presented in Figure 2.7.3.4.1 (A) for a range of soil types compacted to a Standard Proctor effort. Moisture-Density, curves have a distinctive shape typified by a peak defined by the maximum dry unit weight, γ_{dmax} and optimum moisture content, w_{opt}, and the right side of the curve is parallel to the zero air voids curve. Moisture contents to the left of w_{opt} are referred to as dry of optimum, and to the right of w_{opt} as wet of optimum. As shown in Figure 2.7.3.4.1(B), higher compactive efforts result in compaction curves shifted upward and to the left such that the resulting compaction curve has higher values of γ_{dmax} and lower values of w_{opt} than at lower compactive efforts.

American Geotechnical & Environmental Services, Inc.
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4 Grandview Circle
Canonsburg, PA 15317-6507

Project SCHUYLKILL RIVER TRAIL EXTENSION Project No. 13004

Sheet 1 of 6

WALL #1 Dwg. By Y.Y Date 9/11/13

PARAMETER DEVELOPMENT Chk. By SCS Date 9/27/13

- BORINGS; B-1 ~ B-3

LAYER ① - G.S.E. - EL. -3.0 (SOILS BEHIND PROPOSED RETAINING WALL)

SOILS BEHIND THE PROPOSED WALL PREDOMINATELY CONSISTS OF COARSE GRAINED MATERIAL (SAND & GRAVEL) WITH RELATIVE DENSITY OF VERY LOOSE TO DENSE, WITH SOME SILT. DUE TO THE PRESENCE OF LOWER BLOWCOUNT (WEAKER) SOILS, USE FOLLOWING PARAMETERS

$\gamma_m = 110$ PCF
$\gamma_{sat} = 115$ PCF
$\phi = 25°$
$C = 0$ PSF
} DM-4, 2012 TABLE 10.8.3.5.26-1P

LAYER ② - EL. -3.0 ~ EL. -10.0 (SOILS IMMEDIATELY BELOW PROPOSED BLPE)

SOILS IMMEDIATELY BELOW PROPOSED BLPE CONSISTS OF ELASTIC SILTY SAND AND SILT. DIRECT SHEAR TEST WAS PERFORMED ON A SAMPLE FROM THIS LAYER FROM BORING B-2A AND YIELDED FOLLOWING RESULTS. $\gamma_d = 72.3 \sim 73.6$, $C_{ULT.} = 0.065$ TSF, $\phi_{ULT} = 20.9°$ N.M.C. = 44.8%

FOR ANALYSIS USE; $\gamma_m = 105$ PCF
$\gamma_{sat} = 110$ PCF
$\phi = 21°$
$C = 0$ PSF, CONSERVATIVELY ASSUMED LONG TERM DRAINED CONDITION.

LAYER ③ - EL. 10.0 ~ T.O.R. (EL. -17.0) (RESIDUAL SOIL)

SOILS CONSISTS OF COARSE GRAINED, SM, RESIDUAL SOIL WITH RELATIVE DENSITY OF MEDIUM DENSE TO VERY DENSE, USE FOLLOWING PARAMETERS FOR ANALYSIS.

$\gamma_m = 130$ PCF
$\gamma_{sat} = 135$ PCF
$\phi = 35°$
$C = 0$ PSF
} DM-4, 2012 TABLE 10.8.3.5.26-1P

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Canonsburg, PA 15317-6507

Project SCHUYLKILL RIVER TRAIL EXTENSION Project No. 13004

Sheet 2 of 6

WALL#1 Dwg. By Y.Y Date 9/11/13

PARAMETER DEVELOPMENT Chk. By SL Date 10-15-13

LAYER ④ - COARSE AGGREGATE BACKFILL:

WHEN BEARING MATERIAL IS REMOVED, BACKFILL EXCAVATION WITH COARSE GRAINED MATERIAL TO THE BLPE. USE FOLLOWING PARAMETERS FOR PROPERLY COMPACTED BACKFILL

$\gamma_m = 120$ PCF
$\gamma_{sat} = 125$ PCF
$\phi = 34°$
$c = 0$ PSF
} TYPICAL PROPERTIES FOR SPECIFIED BACKFILL (BC-799M)

LAYER ⑤ - BEDROCK;

USE EXAGGERATED PARAMETERS TO KEEP FAILURE PLANE WITHIN SOIL.

$\gamma_{sat} = 150$ PCF
$\phi = 45°$
$c = 1000$ PSF
} FOR GLOBAL STABILITY ANALYSIS ONLY. FOR OTHER ANALYSIS UTILIZE SHEAR STRENGTH OF BEDROCK IN PAGE 11 OF THIS APPENDIX

LAYER ⑥ - SPECIFIED BACKFILL;

ASSUME SIMILAR PROPERTY AS MSE WALL BACKFILL; (BC-799M)

$\gamma_m / \gamma_{sat} = 120/125$ PCF FOR STRENGTH I MAX AND SERVICE CASES
90/95 PCF FOR STRENGTH I MIN CASES
$\phi = 34°$, $c = 0$ PSF

GROUNDWATER;

24-HR WATER ELEVATION RANGED BETWEEN 2.3 FT IN BOR. B-1 TO 3.2 FT IN BORING B-2. ASSUME GROUNDWATER AT EL. 3.0

LAYER ⑦ - RIP-RAP INFRONT OF WALL, R-ROCK

$\gamma_m = 130$ PCF
$\gamma_{sat} = 135$ PCF
$\phi = 36°$
$c = 0$ PSF

Project: Schuylkill River Trail Extension, South Street to Christian Street
Wall #1

Project No: 13004
Dwg. By: YY 9/11/13
Chk. By: SCS 9/12/13

σ_{tot} = (Depth at Middle of Sample) * (Assumed Unit Weight)
$\sigma_{eff} = \sigma_{tot}$ - [(Distance from Groundwater Table) * (Unit Weight of Water)]

N-VALUE CORRECTION FOR HAMMER EFFICIENCY AND OVERBURDEN PRESSURE

Ref: AASHTO (2012), Section 10.4.6.2.4

$N1_{60} = C_N N_{60} = [0.77\log(40/(\sigma_{eff}/1000))] * N_{60}$ where $C_N \leq 2.0$

N_{60} = (ER/60%)N where: ER = 60% for Safety Hammer
ER = 80% for Automatic Hammer

B-1 = Boring
9.3 = Ground Surface Elevation (ft)
2.3 = Elevation of Groundwater Table (GWT) (ft)
110.0 = Assumed Moist Unit Weight (pcf) (only an estimate for $N1_{60}$ calculations)
115.0 = Assumed Saturated Unit Weight (pcf) (only an estimate for $N1_{60}$ calculations)
62.4 = Density of Water (pcf)

-3.0 = Bottom of Footing Elevation (BFE) (ft)
12.3 = Base of Footing Depth (ft)
12 = Footing Width, B (ft)

Safety = Hammer Type ER (%) = 60

Sample No.	N	Depth to Bottom of Sample (ft)	Elevation at Middle of Sample (ft)	σ_{tot} at Middle of Sample (psf)	Distance from GWT (ft)	σ_{eff} at Middle of Sample (psf)	N_{60}	C_N	$N1_{60}$	$N1_{60avg}$	Soil Classification and Origin
1	10	1.5	8.55	82.50	0.00	82.50	10	2.000	20	20	ml/A-4 (Fill)
2	19	3.0	7.05	247.50	0.00	247.50	19	1.701	32	36	sm/a-2-4 (Fill)
3	26	4.5	5.55	412.50	0.00	412.50	26	1.530	40		
4	10	6.0	4.05	577.50	0.00	577.50	10	1.417	14	10	gm/a-2-4 (Fill)
5	5	7.5	2.55	742.50	0.00	742.50	5	1.333	7		
6	5	9.0	1.05	913.75	1.25	835.75	5	1.294	6	6	SM/A-4(0) (Alluvial)
7	8	10.5	-0.45	1086.25	2.75	914.65	8	1.263	10		
8	4	12.0	-1.95	1258.75	4.25	993.55	4	1.236	5		
9	3	13.5	-3.45	1431.25	5.75	1072.45	3	1.210	4		
10	6	15.0	-4.95	1603.75	7.25	1151.35	6	1.186	7	6	mh/a-7-5 (Alluvial)
11	5	16.5	-6.45	1776.25	8.75	1230.25	5	1.164	6		
12	22	18.0	-7.95	1948.75	10.25	1309.15	22	1.144	25	83	sm/a-2-4 (Residual)
13	100	19.2	-9.30	2104.00	11.60	1380.16	100	1.126	113		
14	100	19.5	-10.20	2207.50	12.50	1427.50	100	1.115	111		

Base of Footing Depth
12.3

Notes:
(1) For SPT N = 50/0.X - **USE:** N = 100

Project: Schuylkill River Trail Extension, South Street to Christian Street
Wall #1

Project No: 13004
Dwg. By: YY 9/11/13
Chk. By: SCS 9/12/13

σ_{tot} = (Depth at Middle of Sample) * (Assumed Unit Weight)
$\sigma_{eff} = \sigma_{tot}$ - [(Distance from Groundwater Table) * (Unit Weight of Water)]

N-VALUE CORRECTION FOR HAMMER EFFICIENCY AND OVERBURDEN PRESSURE

Ref: AASHTO (2012), Section 10.4.6.2.4

$N1_{60} = C_N N_{60} = [0.77\log(40/(\sigma_{eff}/1000))] * N_{60}$ where $C_N \leq 2.0$

$N_{60} = (ER/60\%)N$ where: ER = 60% for Safety Hammer
ER = 80% for Automatic Hammer

B-2 = Boring
10.5 = Ground Surface Elevation (ft)
3.2 = Elevation of Groundwater Table (GWT) (ft)
110.0 = Assumed Moist Unit Weight (pcf) (only an estimate for $N1_{60}$ calculations)
115.0 = Assumed Saturated Unit Weight (pcf) (only an estimate for $N1_{60}$ calculations)
62.4 = Density of Water (pcf)

-3.0 = Bottom of Footing Elevation (BFE) (ft)
13.5 = Base of Footing Depth (ft)
12 = Footing Width, B (ft)

Safety = Hammer Type ER (%) = 60

Sample No.	N	Depth to Bottom of Sample (ft)	Elevation at Middle of Sample (ft)	σ_{tot} at Middle of Sample (psf)	Distance from GWT (ft)	σ_{eff} at Middle of Sample (psf)	N_{60}	C_N	$N1_{60}$	$N1_{60avg}$	Soil Classification and Origin
1	10	1.5	9.75	82.50	0.00	82.50	10	2.000	20		
2	13	3.0	8.25	247.50	0.00	247.50	13	1.701	22		
3	5	4.5	6.75	412.50	0.00	412.50	5	1.530	8		
4	3	6.0	5.25	577.50	0.00	577.50	3	1.417	4	10	sm/a-2-4 (Fill)
5	4	7.5	3.75	742.50	0.00	742.50	4	1.333	5		
6	3	9.0	2.25	912.25	0.95	852.97	3	1.287	4		
7	4	10.5	0.75	1084.75	2.45	931.87	4	1.257	5		
8	5	12.0	-0.75	1257.25	3.95	1010.77	5	1.230	6	6	sc/a-2-6 (Alluvial)
9	5	13.5	-2.25	1429.75	5.45	1089.67	5	1.205	6		
10	9	15.0	-3.75	1602.25	6.95	1168.57	9	1.181	11		
11	4	16.5	-5.25	1774.75	8.45	1247.47	4	1.160	5	6	MH/A-7-5(22) (Alluvial)
12	3	18.0	-6.75	1947.25	9.95	1326.37	3	1.139	3		
13	20	19.5	-8.25	2119.75	11.45	1405.27	20	1.120	22		
14	29	21.0	-9.75	2292.25	12.95	1484.17	29	1.102	32		
15	100	21.8	-10.90	2424.50	14.10	1544.66	100	1.088	109		
R-1	100	23.8	-12.30	2585.50	15.50	1618.30	100	1.073	107	84	sm/a-2-4 (Residual)
16	100	24.1	-13.45	2717.75	16.65	1678.79	100	1.060	106		
R-2	100	25.5	-14.30	2815.50	17.50	1723.50	100	1.052	105		
17	100	25.8	-15.15	2913.25	18.35	1768.21	100	1.043	104		

Base of Footing Depth
13.5

Notes:
(1) For SPT N = 50/0.X - **USE:** N = 100
(2) Where coring was attempted, **USE** N =100.

4 of 6

Project: Schuylkill River Trail Extension, South Street to Christian Street
Wall #1

Project No: 13004
Dwg. By: YY 9/11/13
Chk. By: SCS 9/12/13

σ_{tot} = (Depth at Middle of Sample) * (Assumed Unit Weight)

$\sigma_{eff} = \sigma_{tot}$ - [(Distance from Groundwater Table) * (Unit Weight of Water)]

N-VALUE CORRECTION FOR HAMMER EFFICIENCY AND OVERBURDEN PRESSURE

Ref: AASHTO (2012), Section 10.4.6.2.4

$N1_{60} = C_N N_{60} = [0.77\log(40/(\sigma_{eff}/1000))] * N_{60}$ where $C_N \leq 2.0$

$N_{60} = (ER/60\%)N$ where: ER = 60% for Safety Hammer
ER = 80% for Automatic Hammer

B-3 = Boring
13.0 = Ground Surface Elevation (ft)
4.0 = Elevation of Groundwater Table (GWT) (ft) (Note (2))
110.0 = Assumed Moist Unit Weight (pcf) (only an estimate for $N1_{60}$ calculations)
115.0 = Assumed Saturated Unit Weight (pcf) (only an estimate for $N1_{60}$ calculations)
62.4 = Density of Water (pcf)

-3.0 = Bottom of Footing Elevation (BFE) (ft)
16.0 = Base of Footing Depth (ft)
12 = Footing Width, B (ft)

Safety = Hammer Type ER (%) = 60

Sample No.	N	Depth to Bottom of Sample (ft)	Elevation at Middle of Sample (ft)	σ_{tot} at Middle of Sample (psf)	Distance from GWT (ft)	σ_{eff} at Middle of Sample (psf)	N_{60}	C_N	$N1_{60}$	$N1_{60avg}$	Soil Classification and Origin
1	9	1.5	12.25	82.50	0.00	82.50	9	2.000	18	39	sm/a-2-4 (Fill)
2	22	3.0	10.75	247.50	0.00	247.50	22	1.701	37		
3	40	4.5	9.25	412.50	0.00	412.50	40	1.530	61		
4	33	6.0	7.75	577.50	0.00	577.50	33	1.417	47	29	ml/a-4 (Alluvial)
5	10	7.5	6.25	742.50	0.00	742.50	10	1.333	13		
6	26	9.0	4.75	907.50	0.00	907.50	26	1.266	33		
7	18	10.5	3.25	1076.25	0.75	1029.45	18	1.224	22		
8	5	12.0	1.75	1248.75	2.25	1108.35	5	1.199	6	4	sm/a-2-4 (Alluvial)
9	4	13.5	0.25	1421.25	3.75	1187.25	4	1.176	5		
10	4	15.0	-1.25	1593.75	5.25	1266.15	4	1.155	5		
11	3	16.5	-2.75	1766.25	6.75	1345.05	3	1.134	3		
12	3	18.0	-4.25	1938.75	8.25	1423.95	3	1.115	3		
13	3	19.5	-5.75	2111.25	9.75	1502.85	3	1.097	3		
14	3	21.0	-7.25	2283.75	11.25	1581.75	3	1.080	3	7	mh/a-7-5 (Alluvial)
15	11	22.5	-8.75	2456.25	12.75	1660.65	11	1.064	12		
16	45	24.0	-10.25	2628.75	14.25	1739.55	45	1.048	47	66	sm/a-2-4 (Residual)
17	64	25.5	-11.75	2801.25	15.75	1818.45	64	1.034	66		
18	73	27.0	-13.25	2973.75	17.25	1897.35	73	1.019	74		
19	44	28.5	-14.75	3146.25	18.75	1976.25	44	1.006	44		
20	100	28.7	-15.60	3244.00	19.60	2020.96	100	0.998	100		

Base of Footing Depth
16.0

Notes:

(1) For SPT N = 50/0.X - **USE:** N = 100

(2) Groundwater level is zero hour reading. Boring grouted upon completion. Because rock was cored and water was introduced to boring, water level may be artificially high (conservative to utilize).

SPECIFICATIONS

COMMENTARY

when cleaning of the bottom of the drilled excavation is specified and can be acceptably completed before concrete 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.

G.S.E. - EL. 3.0 (SOILS BEHIND PROPOSED WALL) DUE TO PRESENCE OF OF VERY LOOSE SOILS ENCOUNTERED, USE FOLLOWING PARAMETERS:
$\gamma_m = 110$ PCF
$\gamma_{SAT} = 115$ PCF
$\phi = 25°$
$C = 0$ PSF

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

CONSISTENCY	ϕ_f	N_{60}	γ(kcf)
Very Loose	25°- 30°	0 - 4	0.070-0.100
Loose	27°- 32°	4-10	0.090-0.115
Medium	30°- 35°	10-30	0.110-0.130
Dense	35°- 40°	30-50	0.110-0.140
Very Dense	38°- 43°	>50	0.130-0.150

EL. -10.0 ~ T.O.R. (EL. 17.0)
$\gamma_m = 130$ PCF
$\gamma_{sat} = 135$ PCF
$\phi = 35°$
$C = 0$ PSF

10.8.3.5.3 Shafts in Strong Soil Overlying Weaker Compressible Soil

C10.8.3.5.3

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.

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.

10.8.3.5.4 Estimation of Drilled Shaft Resistance in Rock

10.8.3.5.4a General

C10.8.3.5.4a

The following shall replace the 3rd bullet in A10.8.3.5.4a.

- A combination of both, with approval of the Chief Bridge Engineer.

The following shall supplement A10.8.3.5.4a.

The side resistance from overlying soil deposits and

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.

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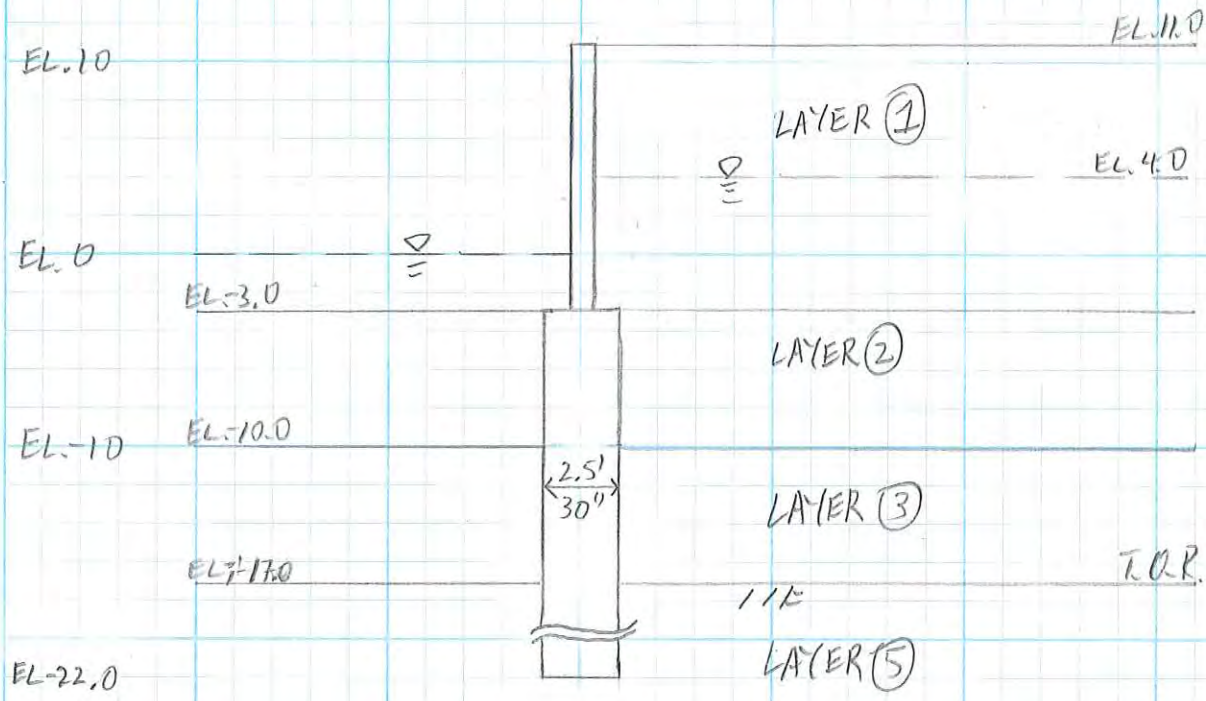
Project SCHUYLKILL RIVER TRAIL EXTENSION — Project No. 13004
WALL #1 — Sheet 1 of 5
SOLDIER PILE & LAGGING WALL — Dwg. By YY — Date 9/12/13
Chk. By SL — Date 10/14/13

- ASSUME 2.5 FT (30 IN) DIAMETER CAISSON SPACED @ 8.0 FT
- ASSUME CAISSON WILL BE EMBEDDED 5 FT INTO BEDROCK

- CONSERVATIVELY NEGLECT PASSIVE PRESSURE FROM MATERIAL INFRONT OF LAGGING
- CONSIDER WATER BEHIND THE WALL @ EL. 4.0 AND @ EL. 0.0 AT FRONT



- REFER TO "PARAMETER DEVELOPMENT" FOR SOIL AND BEDROCK PARAMETERS

- LOAD AND RESISTANCE FACTORS (DM-4, TABLE 3.4.1 P-3)

LOAD FACTOR; EARTH HORIZONTAL = 1.5
LIVE SURCHARGE = 1.75
WATER = 1.0

RESISTANCE FACTOR; PASSIVE RESISTANCE = 0.75 (SOIL & ROCK)
(DM-4, TABLE 11.5.6-1)

-

- TRAFFIC SURCHARGE;
PROPOSED WALL WILL BE SUPPORTING TRAIL AND NO VEHICULAR TRAFFIC IS ANTICIPATED. CSX RAILROAD TRACK IS ~27 FT BEHIND THE WALL AND AS PER AASHTO 3.11.6.4. LIVE LOAD FROM THE RAILROAD IS NOT EXPECTED TO ACT ON THE WALL.

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Project SCHUYLKILL RIVER TRAIL EXTENSION WALL #1 — Project No. 13004
Sheet 2 of 5
SOLDIER PILE & LAGGING WALL — Dwg. By TY Date 9/12/13
Chk. By SL Date 10-14-13

EARTH PRESSURE COEFFICIENT (FOR FRICTION ANGLES PER LAYER REFER TO "PARAMETER DEVELOPEMENT")

LAYER ①; $\phi = 25°$

$$k_a = \tan^2(45 - \frac{\phi}{2}) = 0.406$$

LAYER ②; $\phi = 21°$

$$k_a = \tan^2(45 - \frac{\phi}{2}) = 0.472$$

$$k_p = \tan^2(45 + \frac{\phi}{2}) = 2.117$$

LAYER ③; $\phi = 35°$

$$k_a = \tan^2(45 - \frac{\phi}{2}) = 0.271$$

$$k_p = \tan^2(45 + \frac{\phi}{2}) = 3.690$$

LAYER ⑤; BEDROCK

S_m = SHEAR STRENGTH OF ROCK MASS; C_o OF SCHIST = 200 ~ 3,000 KSF (CDM-4, TABLE 10.6.3.2.2-2P)
AMPHIBOLITE = 2,400 ~ 5,800 KSF

BEDROCK IS DESCRIBED AS SOFT TO HARD, HIGHLY TO SLIGHTLY WEATHERED
CONSERVATIVELY USE LOWER LIMIT OF SCHIST AS C_o FOR ANALYSIS → C_o = 200 KSF

ASSUME SHEAR STRENGTH OF ROCK MASS IS EQUAL TO 5% OF C_o
(CDM-4, 10.6.3.2.3.ap)

$S_m = 200 \cdot 0.05 = 10$ KSF $= 5$ TSF $= 10{,}000$ PSF

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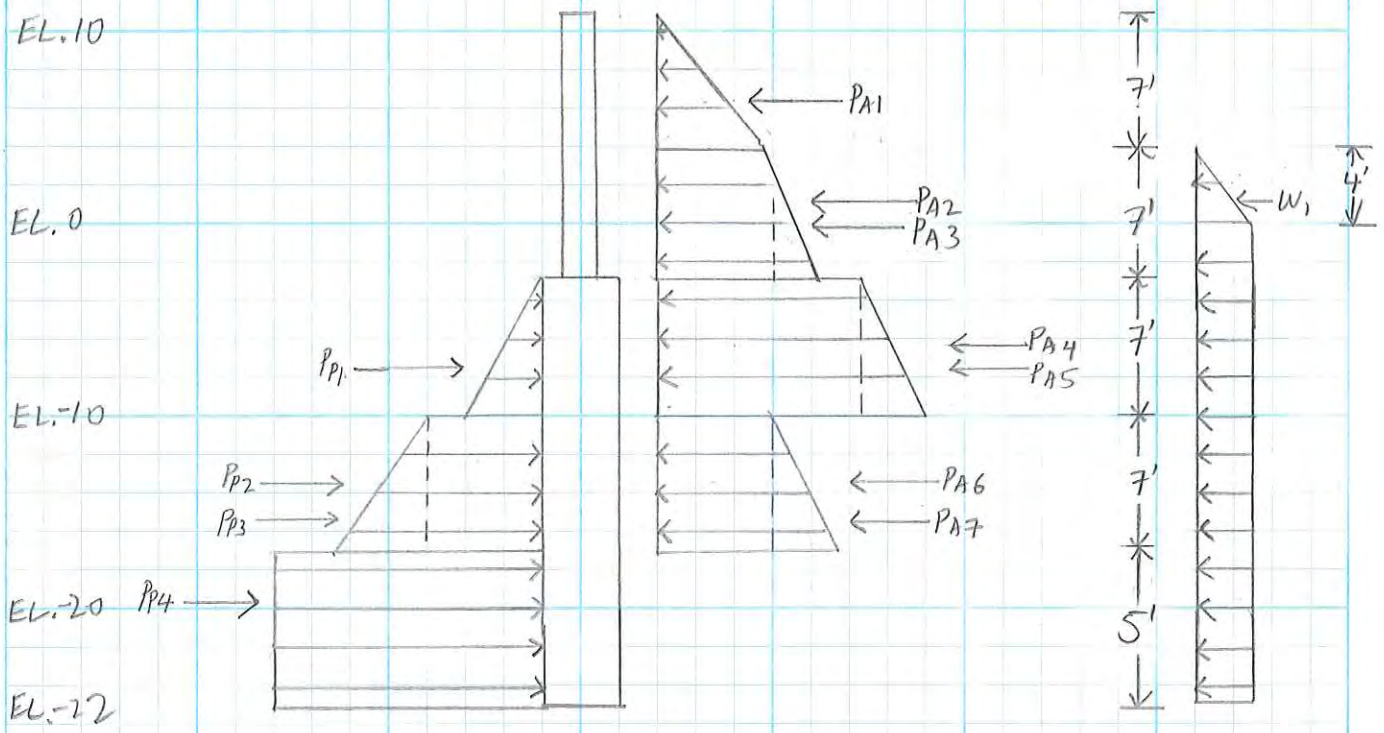
Project SCHUYLKILL RIVER TRAIL EXTENSION
WALL #1
SOLDIER PILE & LAGGING WALL

Project No. 13004
Sheet 3 of 5
Dwg. By Y.Y Date 9/12/13
Chk. By SL Date 10/14/13

FORCE DIAGRAM
(N.T.S.)

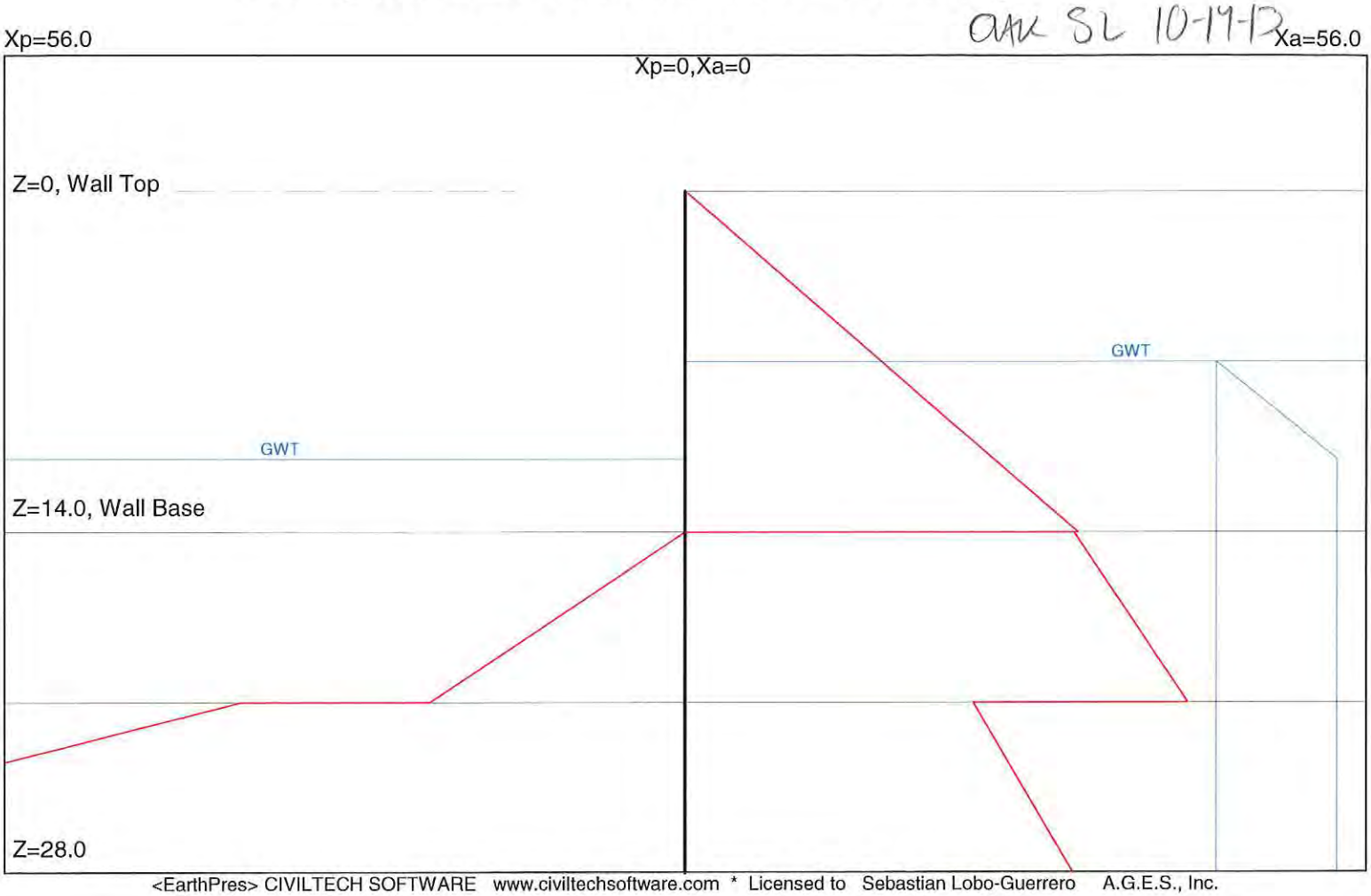


BASED ON SHORING 8 PROGRAM MINIMUM REQUIRED EMBEDMENT IS 21.45 FT BELOW BOTTOM OF LAGGING. HOWEVER SHORING 8 PROGRAM INCREASES CALCULATED EMBEDMENT BY 20% AS PER AASHTO REQUIREMENT. HOWEVER, THIS REQUIREMENT IS APPLICABLE ONLY FOR CONTINEOUS WALL. SOLDIER PILE CONSIDERED CONSISTS OF DISCRETE VERTICAL ELEMENT SO 20% INCREASE DOESN'T APPLY. SO REQUIRED EMBEDMENT IS 21.45/1.2 = 17.88 FT. → BOTTOM OF CAISSON ELEVATION = (-3.0) - 17.88 = -20.88 FT

SAY BOTTOM OF CAISSON @ EL-22.0 FT

Schuylkill River Trail Extension - Retaining Wall

OAK SL 10-19-12



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UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

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* INPUT DATA *

Wall Height=14.0 Total Soil Types= 4

Soil No.	Weight	Saturate	Phi	Cohesion	Nspt	Type	Description
1	110.0	115.0	25.00	0.0	0	4	Sand
2	105.0	110.0	21.00	0.0	0	4	Sand
3	130.0	135.0	35.00	0.0	0	4	Sand
4	150.0	150.0	0.00	10.0	0	2	Clay

Ground Surface at Active Side:

Line	Z1	Xa1	Z2	Xa2	Soil No.	Description
1	0.0	0.0	0.0	800.0	1	Sand
2	14.0	0.0	14.0	800.0	2	Sand
3	21.0	0.0	21.0	800.0	3	Sand
4	28.0	0.0	28.0	800.0	4	Clay

Water Table at Active Side:

Point	Z-water	X-water
1	7.0	0.0
2	7.0	80000.0

Ground Surface at Passive Side:

Line	Z1	Xp1	Z2	Xp2	Soil No.	Description
1	14.0	0.0	14.0	800.0	2	Sand

CHK SL 10-14-13

2	21.0	0.0	21.0	800.0	3	Sand
3	28.0	0.0	28.0	800.0	4	Clay

Water Table at Passive Side:

Point	Z-water	X-water
1	11.0	0.0
2	11.0	80000.0

Wall Friction Options: 1.* No wall friction
Wall Batter Angle = 0
Apparent Pressure Conversion: 1.* Default (Terzaghi and Peck)*
Water Density = 62.4
Water Pressure: 1.* No seepage at wall tip

* OUTPUT RESULTS *

Total Force above Base= 5.71 per one linear foot (or meter) width along wall height
Total Static Force above Base= 5.71. Distributed in Triangular Envelope along wall height. Ignore soil layers and water line

Driving Pressure above Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	K/Ka/Ko
0.00	0.00	14.00	0.82	0.0582	0.5294

Driving Pressure below Base - Output to Shoring - Multiplier of Pressure = 1.5

Z1	Pa1	Z2	Pa2	Slope	Ka/Ko
14.00	0.81	21.00	1.04	0.0337	0.7085
21.00	0.60	28.00	0.80	0.0295	0.4065

Passive Pressure below Base - Output to Shoring - Multiplier of Pressure = 0.75

Z1	Pp1	Z2	Pp2	Slope	Kp
14.00	0.00	21.00	0.53	0.076	1.5878
21.00	0.92	28.00	2.33	0.201	2.7676

Water Pressure - Output to Shoring - Multiplier of Pressure = 1

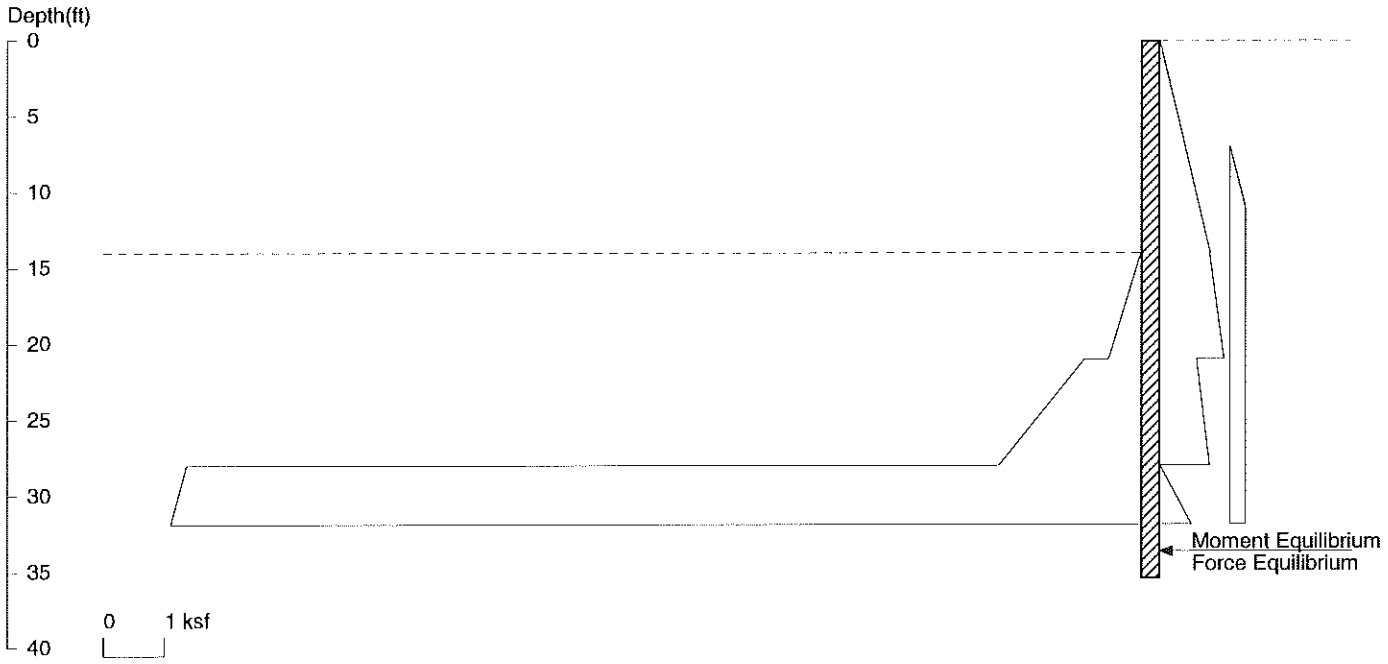
No	Z1	Pw1	Z2	Pw2	kw1
0	7.00	0.00	11.00	0.25	0.06
1	11.00	0.25	28.00	0.25	0.00

UNITS: DEPTH/DISTANCE: ft, UNIT WEIGHT: pcf, FORCE: kip/ft, PRESSURE: ksf, SLOPE: kcf

Date: 10/14/2013 File Name: N:\AGES\Projects\2013 - Jobs\13004 - Schuylkill Rvr Trail Ext S. St Christian St,Urban\Yoshi\13004 - Schuylkill River

CMK SL 10-14-13

Schuylkill River Trail Extension - Retaining Wall



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File: N:\AGES\Projects\2013 - Jobs\13004 - Schuylkill Rvr Trail Ext S. St Christian St,Urban\Yoshi\13004 - Schuylkill Rive

Wall Height=14.0 Pile Diameter=2.5 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=21.45 Min. Pile Length=35.45 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=904.09 per Pile Spacing=8.0 at Depth=27.57

THIS INCLUDES 20% INCREASE IN EMBEDMENT. MIN EMBED. = 17.00' (Ø 2)

PILE SELECTION:
Request Min. Section Modulus = 217.0 in3/pile=3555.67 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=1.0
-> Piles meet Min. Section Requirements:
W12X170J W14X145 W18X119 W21X101 W24X94
W27X94 W30X90 W33X118 W36X135 W40X149
W44X230

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	14.000	0.815	0.058231
*	Below	Base		
14.000	0.806	21.000	1.043	0.033726
21.000	0.598	28.000	0.805	0.029511
28.000	0.000	140.000	0.000	0.131400
*	Water	Pres.		
7.000	0.000	11.000	0.250	0.062400
11.000	0.250	140.000	0.250	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
14.000	0.000	21.000	0.529	0.075579
21.000	0.922	28.000	2.329	0.200930
28.000	15.631	140.000	22.989	0.065700

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ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	14.00	2.50

PASSIVE SPACING:

No.	Z depth	Spacing
1	14.00	7.50

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

****

SHDRING WALL CALCULATION SUMMARY
The leading shoring design and calculation software
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ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS: Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft, Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in

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Date: 10/14/2013 File: N:\AGES\Projects\2013 - Jobs\13004 - Schuylkill Rvr Trail Ext S. St Christian St,Urban\Yoshi\13004 - Schuylkill River Trail Retaining Wall\Foundation Report\Shoring8\Soldier Pile Lagging Wall.sh8

Title: Schuylkill River Trail Extension - Retaining Wall
Subtitle:

**********INPUT DATA**********

Wall Type: 2. Soldier Pile, Drilled
Wall Height: 14.00
Pile Diameter: 2.50
Pile Spacing: 8.00
Factor of Safety (F.S.): 1.00
Lateral Support Type (Braces): 1. No
Top Brace Increase (Multi-Bracing): No
Embedment Option: 1. Yes
Friction at Pile Tip: No
Pile Properties:
Steel Strength, Fy: 50 ksi = 345 MPa
Allowable Fb/Fy: 1.0
Elastic Module, E: 29000.00
Moment of Inertia, I: 1650
User Input Pile: W12X336J

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	*	Above	Base		
2	0.000	0.000	14.000	0.815	0.058231
3	*	Below	Base		
4	14.000	0.806	21.000	1.043	0.033726
5	21.000	0.598	28.000	0.805	0.029511
6	28.000	0.000	140.000	0.000	0.131400
7	*	Water	Pres.		
8	7.000	0.000	11.000	0.250	0.062400
9	11.000	0.250	140.000	0.250	0.000000

* PASSIVE PRESSURE *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	*	Below	Base		
2	14.000	0.000	21.000	0.529	0.075579
3	21.000	0.922	28.000	2.329	0.200930
4	28.000	15.631	140.000	22.989	0.065700

* ACTIVE SPACE *

No.	Z depth	Spacing
1	0.00	8.00
2	14.00	2.50

* PASSIVE SPACE *

No.	Z depth	Spacing
1	14.00	7.50

*For Tieback: Input1 = Diameter; Input2 = Bond Stength
*For Plate: Input1 = Diameter; Input2 = Allowable Pressure
*For Deaman: Input1 = Horz. Width; Input2 = Allowable Pressure; Angle = 0

**********CALCULATION**********

The calculated moment and shear are per pile spacing. Sheet piles are per one foot or meter; Soldier piles are per pile.

Top Pressures start at depth = 0.00

D1 - TOP DEPTH
D2 - EXCAVATION BASE
D3 - PILE TIP (20% increased, see EMBEDMENT Notes below)

MOMENT BALANCE: M=0.00 AT DEPTH=31.88 WITH EMBEDMENT OF 17.88
FORCE BALANCE: F=0.00 AT DEPTH=35.45 WITH EMBEDMENT OF 21.45

The program calculates an embedment for moment equilibrium, then increase the embedment by 20% to reach force equilibrium.
A Balance Force=464.76 is developed from depth=31.88 to depth=35.45
Total Passive Pressure = Total Active Pressure, OK!

**********RESULTS**********

* EMBEDMENT Notes *
Based on USS Design Manual, fist calculate embedment for moment equilibrium, then increased by 20 to 40 % to reach force equilibrium.
The embedment for moment equilibrium is 17.88

17

10-14-13

INCREMENT OF 20%.

* The 20% increased embedment for force equilibrium is 21.45 (Used by Program)
The 30% increased embedment for force equilibrium is 23.24
The 40% increased embedment for force equilibrium is 25.03

Based on AASHTO 2002 Standard Specifications, fist calculate embedment for moment equilibrium, then add safety factor of 30% for temporary shoring; add safety factor of 50% for permanent shoring.
The embedment for moment equilibrium is 17.88
Add 30% embedment for temporary shoring is 23.24
Add 50% embedment for permanent shoring is 26.82

* BASED ON USS DESIGN MANUAL (20% increased), PROGRAM CALCULATED MINIMUM EMBEDMENT = 21.45
TOTAL MINIMUM PILE LENGTH = 35.45

* MOMENT IN PILE (per pile spacing)*
Pile Spacing: sheet piles are one foot or one meter; soldier piles are one pile.
Overall Maximum Moment = 904.09 at 27.57
Maximum Shear = 455.05
Moment and Shear are per pile spacing: 8.0 foot or meter

* VERTICAL LOADING *
Vertical Loading from Braces = 0.00
Vertical Loading from External Load = 0.00
Total Vertical Loading = 0.00

**********SOLDIER PILE SELECTION**********

Request Min. Section Modulus = 216.98 in3/pile = 3555.67 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=1.0
The pile selection is based on the magnitude of the moment only. Axial force is neglected.

W12X170
(English Units):
Area= 50 in. Depth= 14 in. Width= 12.6 in. Height= 12 in.
Flange thickness= 1.56 in. Web thickness= 0.96 in.
Ix= 1650 in4/pile Sx= 235 in3/pile Iy= 517 in4/pile Sy= 82.3 in3/pile
(Metric Units):
Ix= 686.73 x100cm4/pile Sx= 3850.95 cm3/pile Iy= 215.18 x100cm4/pile Sy= 1348.65 cm3/pile
Top deflection = 2.363(in)
W14X145
(English Units):
Area= 42.7 in. Depth= 14.8 in. Width= 15.5 in. Height= 14 in.
Flange thickness= 1.09 in. Web thickness= 0.68 in.
Ix= 1710 in4/pile Sx= 232 in3/pile Iy= 677 in4/pile Sy= 87.3 in3/pile
(Metric Units):
Ix= 711.70 x100cm4/pile Sx= 3801.78 cm3/pile Iy= 281.77 x100cm4/pile Sy= 1430.59 cm3/pile
Top deflection = 2.280(in)
W18X119
(English Units):
Area= 35.1 in. Depth= 19 in. Width= 11.3 in. Height= 18 in.
Flange thickness= 1.06 in. Web thickness= 0.655 in.
Ix= 2190 in4/pile Sx= 231 in3/pile Iy= 253 in4/pile Sy= 44.9 in3/pile
(Metric Units):
Ix= 911.48 x100cm4/pile Sx= 3785.40 cm3/pile Iy= 105.30 x100cm4/pile Sy= 735.78 cm3/pile
Top deflection = 1.781(in)
W21X101
(English Units):

Area= 29.8 in. Depth= 21.4 in. Width= 12.3 in. Height= 21 in.
Flange thickness= 0.8 in. Web thickness= 0.5 in.
Ix= 2420 in4/pile Sx= 227 in3/pile Iy= 248 in4/pile Sy= 40.3 in3/pile
(Metric Units):
Ix= 1007.20 x100cm4/pile Sx= 3719.85 cm3/pile Iy= 103.22 x100cm4/pile Sy= 660.40 cm3/pile
Top deflection = 1.611(in)
W24X94
(English Units):
Area= 27.7 in. Depth= 24.3 in. Width= 9.07 in. Height= 24 in.
Flange thickness= 0.875 in. Web thickness= 0.515 in.
Ix= 2700 in4/pile Sx= 222 in3/pile Iy= 109 in4/pile Sy= 24 in3/pile
(Metric Units):
Ix= 1123.74 x100cm4/pile Sx= 3637.91 cm3/pile Iy= 45.37 x100cm4/pile Sy= 393.29 cm3/pile
Top deflection = 1.444(in)
W27X94
(English Units):
Area= 27.7 in. Depth= 26.9 in. Width= 10 in. Height= 27 in.
Flange thickness= 0.745 in. Web thickness= 0.49 in.
Ix= 3270 in4/pile Sx= 243 in3/pile Iy= 124 in4/pile Sy= 24.8 in3/pile
(Metric Units):
Ix= 1360.97 x100cm4/pile Sx= 3982.04 cm3/pile Iy= 51.61 x100cm4/pile Sy= 406.40 cm3/pile
Top deflection = 1.193(in)
W30X90
(English Units):
Area= 26.4 in. Depth= 29.5 in. Width= 10.4 in. Height= 30 in.
Flange thickness= 0.61 in. Web thickness= 0.47 in.
Ix= 3610 in4/pile Sx= 245 in3/pile Iy= 115 in4/pile Sy= 22.1 in3/pile
(Metric Units):
Ix= 1502.48 x100cm4/pile Sx= 4014.82 cm3/pile Iy= 47.86 x100cm4/pile Sy= 362.15 cm3/pile
Top deflection = 1.080(in)
W33X118
(English Units):
Area= 34.7 in. Depth= 32.9 in. Width= 11.5 in. Height= 33 in.
Flange thickness= 0.74 in. Web thickness= 0.55 in.
Ix= 5900 in4/pile Sx= 359 in3/pile Iy= 187 in4/pile Sy= 32.6 in3/pile
(Metric Units):
Ix= 2455.58 x100cm4/pile Sx= 5882.93 cm3/pile Iy= 77.83 x100cm4/pile Sy= 534.22 cm3/pile
Top deflection = 0.661(in)
W36X135
(English Units):
Area= 39.7 in. Depth= 35.6 in. Width= 12 in. Height= 36 in.
Flange thickness= 0.79 in. Web thickness= 0.6 in.
Ix= 7800 in4/pile Sx= 439 in3/pile Iy= 225 in4/pile Sy= 37.7 in3/pile
(Metric Units):
Ix= 3246.36 x100cm4/pile Sx= 7193.89 cm3/pile Iy= 93.65 x100cm4/pile Sy= 617.79 cm3/pile
Top deflection = 0.500(in)
W40X149
(English Units):
Area= 43.8 in. Depth= 38.2 in. Width= 11.8 in. Height= 40 in.
Flange thickness= 0.83 in. Web thickness= 0.63 in.
Ix= 9800 in4/pile Sx= 513 in3/pile Iy= 229 in4/pile Sy= 38.8 in3/pile
(Metric Units):
Ix= 4078.76 x100cm4/pile Sx= 8406.53 cm3/pile Iy= 95.31 x100cm4/pile Sy= 635.82 cm3/pile
Top deflection = 0.398(in)
W44X230
(English Units):

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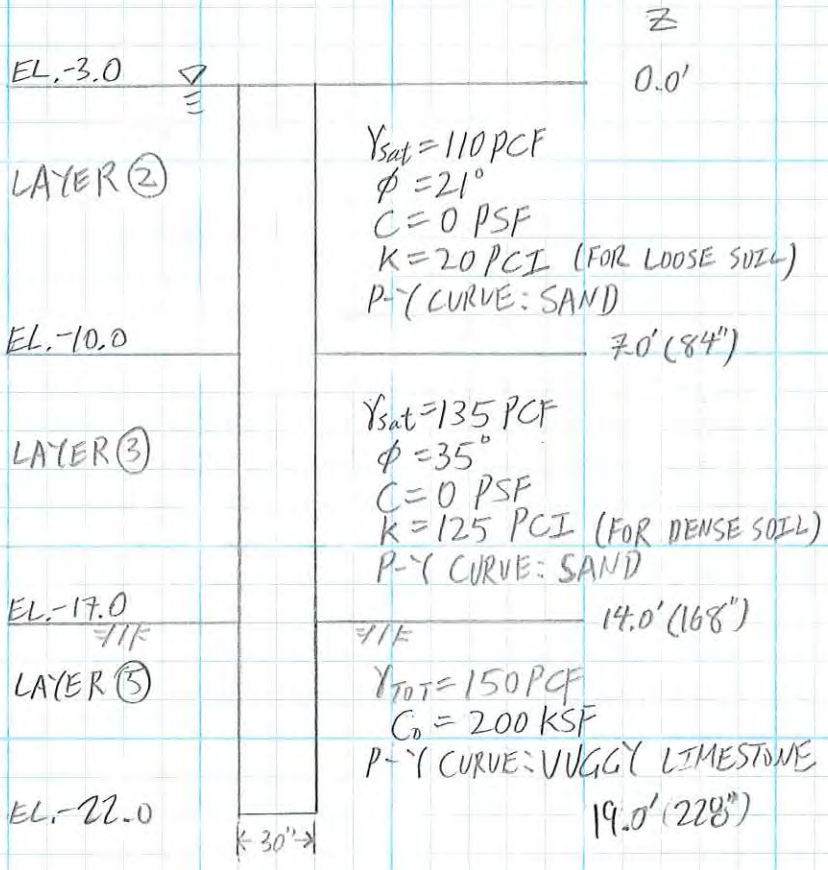
Project SCHUYLKILL RIVER TRAIL EXTENSION
WALL #1
SOLDIER PILE AND LAGGING WALL
LPILE ANALYSIS

Project No. 13004
Sheet 1 of
Dwg. By YY Date 9/30/13
Chk. By SL Date 10/14/13

- DETERMINE LATERAL DEFLECTION AT TOP OF CAISSON.
- ASSUME SERVICE CASE (DM-4, SEC. 11.5.2)
- ALLOWABLE DEFLECTION = 0.5 IN @ TOP OF CAISSON.
- REFER TO "PARAMETER DEVELOPMENT" FOR SOIL PARAMETER



- FOR LPILE ANALYSIS, NEGLECT ONLY TOP 3FT OF MATERIAL FOR PASSIVE RESISTANCE AS PER DM-4 C3.11.5.6.

  k_p FOR RIP-RAP (ϕ=36°); $\tan^2(45+\frac{36}{2}) = 3.852$

- FOR SERVICE CASE ASSUME WATER @ EL. 3.0 BASED ON BORING

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Project SCHUYLKILL RIVER TRAIL EXTENSION WALL #1
SOLDIER PILE AND LAGGING WALL
LPILE ANALYSIS

Project No. 13004
Sheet 2 of
Dwg. By YT Date 10/14/13
Chk. By SL Date 10/15/13

CAISSON PROPERTIES, 30 IN DIAMETER W/ W12x170 PILE

$D = 30\ IN$
$A = 707\ IN^2$

$I_{CONC} = \frac{\pi \cdot R^4}{4} = 39,761\ IN^4$

$I_{STEEL} = 1,650\ IN^4$

$E_{CONC} = 57,000\sqrt{f'c} = 57,000\sqrt{3000} = 3,122,019\ PSI$

$E_{STEEL} = 29,000,000\ PSI$

MODULUS RATIO $= 29,000,000 / 3,122,019 = 9.3$

CONVERT I_{CONC} TO $I_{STEEL} = 39,761 / 9.3 = 4275\ IN^4$

TOTAL $I = 1,650 + 4,275 = 5,925\ IN^4$

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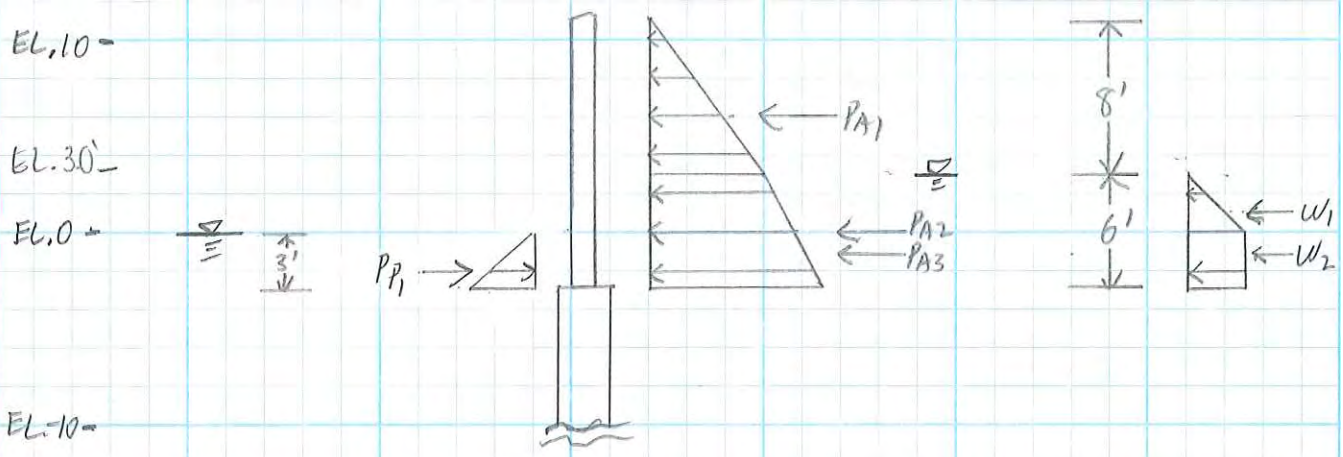
Project SCHUYLKILL RIVER TRAIL EXTENSION
WALL #1
SOLDIER PILE AND LAGGING WALL
LPILE ANALYSIS

Project No. 13004
Sheet 3 of
Dwg. By Y.Y Date 10/15/13
Chk. By SL Date 10/15/13

FORCES ACTING AT TOP OF CAISSON



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Project SCHUYLKILL RIVER TRAIL EXTENSION WALL #1 — Project No. 13004
Sheet 4 of
SOLDIER PILE AND LAGGING WALL — Dwg. By Y.Y Date 10/14/13
LPILE ANALYSIS — Chk. By SL Date 10/14/13

LOADING AT TOP OF CAISSON

LOAD	UNFACTORED FORCE, lb
P_{A1}	$\frac{1}{2}(110)(8)^2(0.406)(8) = 11,433$
P_{A2}	$(110)(8)(0.406)(6)(8) = 17,149$
P_{A3}	$\frac{1}{2}(115-62.4)(6)^2(0.406)(8) = 3075$
P_{P1}	$\frac{1}{2}(135-62.4)(3)^2(3.852)(8) = 10068$
W_1	$\frac{1}{2}(62.4)(3)^2(8) = 2246$
W_2	$(62.4)(3)(3)(8) = 4493$

TOTAL SHEAR FORCE $= P_{A1}+P_{A2}+P_{A3}-P_{P1}+W_1+W_2 = 28,328$

MOMENT;

LOAD	UNFACTORED LOAD, #	MOMENT ARM, FT	MOMENT, lb-FT
P_{A1}	11,433	8.7	+ 99,467
P_{A2}	17,149	3.0	+ 51,447
P_{A3}	3,075	2.0	+ 6,150
P_{P1}	10068	1.0	- 10,068
W_1	2,246	4.0	+ 8,984
W_2	4,493	1.5	+ 6,740
			+ 162,720 (1,952,640 lb-in)

AXIAL LOAD;

PILE; W12x170, HEIGHT LAGGING = 14FT

WEIGHT OF PILE = 170 lb/FT · 14FT = 2,380 lb

LAGGING; ASSUME 1FT THICK CONCRETE, $\gamma_{conc} = 150$ PCF

WEIGHT OF LAGGING = 8FT x 14FT x 1FT x 150 lb/FT^3 = 16,800 lb

TOTAL AXIAL LOAD = 2,380 + 16,800 = 19,180 lb

LPILE Plus for Windows, Version 5.0 (5.0.47)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

This program is licensed to:

yoshi
ages

Files Used for Analysis

Path to file locations: N:\AGES\Projects\2013 - Jobs\13004 - Schuylkill Rvr Trail Ext S. St Christian St,Urban\Yoshi\13004 - Schuylkill River Trail Retaining wall\Foundation Report\LPILE\
Name of input data file: Solider Pile.lpd
Name of output file: Solider Pile.lpo
Name of plot output file: Solider Pile.lpp
Name of runtime file: Solider Pile.lpr

Time and Date of Analysis

Date: October 15, 2013 Time: 10:37:20

Problem Title

Schuylkill River Trail Extension

Program Options

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile

- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 228.00 in

Depth of ground surface below top of pile = 0.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point No.	Point Depth in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	30.00000000	5925.0000	707.0000	29000000.
2	228.0000	30.00000000	5925.0000	707.0000	29000000.

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 0.000 in
Distance from top of pile to bottom of layer = 84.000 in
p-y subgrade modulus k for top of soil layer = 20.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 20.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 84.000 in
Distance from top of pile to bottom of layer = 168.000 in
p-y subgrade modulus k for top of soil layer = 125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 125.000 lbs/in**3

Layer 3 is strong rock (vuggy limestone)
Distance from top of pile to top of layer = 168.000 in
Distance from top of pile to bottom of layer = 228.000 in

(Depth of lowest layer extends 0.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

VC-HK SL 10-15-13

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	0.00	0.02750
2	84.00	0.02750
3	84.00	0.04200
4	168.00	0.04200
5	168.00	0.05070
6	228.00	0.05070

Shear Strength of Soils

Shear strength parameters with depth defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	0.000	0.00000	21.00	------	------
2	84.000	0.00000	21.00	------	------
3	84.000	0.00000	35.00	------	------
4	168.000	0.00000	35.00	------	------
5	168.000	1389.00000	0.00	------	------
6	228.000	1389.00000	0.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 28328.000 lbs
Bending moment at pile head = 1952640.000 in-lbs
Axial load at pile head = 19180.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head

may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computed Values of Load Distribution and Deflection for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (Pile-head Condition Type 1)
Specified shear force at pile head = 28328.000 lbs
Specified moment at pile head = 1952640.000 in-lbs
Specified axial load at pile head = 19180.000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress Es*h F/L lbs/in**2	Soil Res. p lbs/in
0.000	0.480442	1952640.	28328.0000	-0.0044323	4970.5211	0.0000
2.280	0.470366	2017421.	28320.4557	-0.0044059	5134.5239	-6.6178
4.560	0.460351	2082167.	28297.7052	-0.0043787	5298.4366	-13.3387
6.840	0.450399	2146842.	28259.5601	-0.0043507	5462.1707	-20.1220
9.120	0.440512	2211411.	28205.9240	-0.0043217	5625.6369	-26.9272
11.400	0.430692	2275839.	28136.7929	-0.0042920	5788.7454	-33.7142
13.680	0.420941	2340090.	28052.2535	-0.0042613	5951.4069	-40.4431
15.960	0.411260	2404130.	27952.4318	-0.0042299	6113.5327	-47.1198
18.240	0.401652	2467923.	27837.4357	-0.0041975	6275.0348	-53.7540
20.520	0.392119	2531435.	27707.4579	-0.0041644	6435.8259	-60.2617
22.800	0.382663	2594633.	27562.8236	-0.0041304	6595.8202	-66.6105
25.080	0.373285	2657483.	27403.9317	-0.0040955	6754.9341	-72.7684
27.360	0.363987	2719953.	27231.2530	-0.0040598	6913.0864	-78.7042
29.640	0.354772	2782013.	27045.3287	-0.0040233	7070.1989	-84.3873
31.920	0.345641	2843632.	26846.5753	-0.0039860	7226.1967	-89.9577
34.200	0.336596	2904782.	26635.3992	-0.0039479	7381.0065	-95.2845
36.480	0.327639	2965435.	26412.4187	-0.0039089	7534.5580	-100.3125
38.760	0.318771	3025564.	26178.3442	-0.0038692	7686.7850	-105.0160
41.040	0.309995	3085146.	25933.9439	-0.0038286	7837.6255	-109.3703
43.320	0.301313	3144158.	25680.0414	-0.0037873	7987.0220	-113.3513

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VSL 10-15-13

45.600	0.292725	3202578.	25417.3035	-0.0037452	8134.9222	-117.1205
912.2375						
47.880	0.284234	3260388.	25145.7963	-0.0037023	8281.2764	-121.0438
970.9582						
50.160	0.275842	3317567.	24865.7441	-0.0036587	8426.0327	-124.6161
1030.0249						
52.440	0.267551	3374096.	24577.9690	-0.0036143	8569.1442	-127.8182
1089.2341						
54.720	0.259361	3429959.	24283.3361	-0.0035691	8710.5685	-130.6317
1148.3605						
57.000	0.251276	3485140.	23982.7516	-0.0035233	8850.2687	-133.0389
1207.1552						
59.280	0.243295	3539628.	23677.1612	-0.0034767	8988.2128	-135.0228
1265.3431						
61.560	0.235422	3593412.	23366.9577	-0.0034293	9124.3748	-137.0855
1327.6366						
63.840	0.227658	3646481.	23052.2185	-0.0033813	9258.7274	-139.0015
1392.1058						
66.120	0.220003	3698826.	22733.5502	-0.0033326	9391.2453	-140.5321
1456.4015						
68.400	0.212461	3750438.	22411.8443	-0.0032831	9521.9083	-141.6660
1520.2710						
70.680	0.205032	3801311.	22088.0176	-0.0032330	9650.7014	-142.3925
1583.4334						
72.960	0.197718	3851442.	21763.0097	-0.0031823	9777.6149	-142.7021
1645.5763						
75.240	0.190521	3900829.	21437.7132	-0.0031308	9902.6448	-142.6457
1707.0660						
77.520	0.183442	3949472.	21112.4562	-0.0030787	10025.7916	-142.6674
1773.2135						
79.800	0.176482	3997371.	20787.6459	-0.0030260	10147.0551	-142.2540
1837.8009						
82.080	0.169643	4044528.	20464.2843	-0.0029727	10266.4406	-141.3966
1900.3651						
84.360	0.162927	4090948.	19964.9218	-0.0029187	10383.9592	-296.6407
4151.1940						
86.640	0.156334	4135823.	19275.2595	-0.0028641	10497.5679	-308.3263
4496.6781						
88.920	0.149866	4179094.	18560.2394	-0.0028089	10607.1128	-318.8842
4851.3583						
91.200	0.143525	4220704.	17822.5428	-0.0027532	10712.4549	-328.2181
5213.9740						
93.480	0.137312	4260605.	17064.8881	-0.0026969	10813.4713	-336.3912
5585.6211						
95.760	0.131227	4298756.	16287.8215	-0.0026401	10910.0543	-345.2462
5998.4567						
98.040	0.125273	4335109.	15491.9225	-0.0025829	11002.0874	-352.9108
6423.0767						
100.320	0.119449	4369625.	14679.9806	-0.0025251	11089.4697	-359.3189
6858.5268						
102.600	0.113758	4402270.	13854.9308	-0.0024669	11172.1167	-364.4090
7303.6673						
104.880	0.108200	4433019.	13019.8419	-0.0024083	11249.9615	-368.1251
7757.1432						
107.160	0.102776	4461851.	12177.9043	-0.0023493	11322.9550	-370.4166
8217.3486						
109.440	0.097488	4488756.	11332.0279	-0.0022899	11391.0671	-371.5802
8690.3673						
111.720	0.092335	4513726.	10484.8605	-0.0022302	11454.2824	-371.5491
9174.5954						
114.000	0.087318	4536762.	9639.5813	-0.0021701	11512.6013	-369.9239
9659.2486						
116.280	0.082439	4557872.	8799.8611	-0.0021098	11566.0451	-366.6727

10141.0268						
118.560	0.077697	4577074.	7969.4322	-0.0020492	11614.6567	-361.7737
10616.1066						
120.840	0.073095	4594392.	7152.0636	-0.0019883	11658.5004	-355.2163
11080.0778						
123.120	0.068631	4609861.	6351.5341	-0.0019273	11697.6625	-347.0025
11527.8746						
125.400	0.064306	4623523.	5566.9129	-0.0018660	11732.2512	-341.2618
12099.5528						
127.680	0.060122	4635409.	4796.5831	-0.0018046	11762.3418	-334.4661
12683.9793						
129.960	0.056077	4645554.	4043.3494	-0.0017430	11788.0240	-326.2653
13265.3180						
132.240	0.052174	4653999.	3310.3796	-0.0016813	11809.4054	-316.6907
13839.4472						
134.520	0.048411	4660796.	2600.7541	-0.0016195	11826.6123	-305.7878
14401.6841						
136.800	0.044789	4666000.	1917.4328	-0.0015576	11839.7879	-293.6168
14946.7375						
139.080	0.041308	4669676.	1263.2197	-0.0014957	11849.0926	-280.2544
15468.6629						
141.360	0.037969	4671891.	640.7252	-0.0014337	11854.7021	-265.7934
15960.8214						
143.640	0.034770	4672723.	52.3281	-0.0013717	11856.8067	-250.3444
16415.8447						
145.920	0.031714	4672250.	-499.8649	-0.0013097	11855.6099	-234.0354
16825.6107						
148.200	0.028798	4670558.	-1014.0594	-0.0012477	11851.3261	-217.0124
17181.2342						
150.480	0.026024	4667735.	-1488.8136	-0.0011858	11844.1795	-199.4387
17473.0795						
152.760	0.023391	4663873.	-1923.0778	-0.0011238	11834.4014	-181.4948
17690.8022						
155.040	0.020899	4659064.	-2325.5751	-0.0010620	11822.2278	-171.5730
18717.6445						
157.320	0.018548	4653361.	-2707.8296	-0.0010002	11807.7894	-163.7380
20126.8426						
159.600	0.016338	4646804.	-3071.5770	-0.0009385	11791.1892	-155.3387
21677.2588						
161.880	0.014269	4639437.	-3415.5639	-0.0008769	11772.5380	-146.4042
23393.5717						
164.160	0.012340	4631306.	-3738.6083	-0.0008154	11751.9531	-136.9681
25307.2837						
166.440	0.010551	4622460.	-4039.6113	-0.0007540	11729.5589	-127.0696
27459.3577						
168.720	0.008902	4612951.	-18279.8939	-0.0006927	11705.4855	-12364.4064
3166920.						
171.000	0.007392	4539164.	-44080.3554	-0.0006320	11518.6836	-10267.5773
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173.280	0.006020	4412000.	-65317.5000	-0.0005726	11196.7485	-8361.4969
3166920.						
175.560	0.004781	4241366.	-82420.1428	-0.0005152	10764.7653	-6640.8213
3166920.						
177.840	0.003671	4036209.	-95802.8325	-0.0004603	10245.3794	-5098.3801
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180.120	0.002682	3804546.	-105862.	-0.0004082	9658.8902	-3725.5519
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182.400	0.001809	3553513.	-112974.	-0.0003594	9023.3654	-2512.6016
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184.680	0.001043	3289418.	-117490.	-0.0003140	8354.7681	-1448.9801
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186.960	0.000377	3017787.	-119739.	-0.0002722	7667.0968	-523.5893
3166920.						

189.240	-0.000198	2743434.	-120022.	-0.0002340	6972.5303	274.9854
3166920.						
191.520	-0.000690	2470508.	-118616.	-0.0001994	6281.5787	958.2732
3166920.						
193.800	-0.001107	2202562.	-115771.	-0.0001684	5603.2349	1537.7432
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196.080	-0.001458	1942609.	-111709.	-0.0001409	4945.1253	2024.6553
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198.360	-0.001749	1693179.	-106631.	-0.0001167	4313.6583	2429.9334
3166920.						
200.640	-0.001990	1456381.	-100710.	-9.5842E-05	3714.1680	2764.0593
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202.920	-0.002186	1233950.	-94096.8709	-7.7993E-05	3151.0520	3036.9839
3166920.						
205.200	-0.002346	1027306.	-86920.5273	-6.2990E-05	2627.9024	3258.0544
3166920.						
207.480	-0.002474	837598.	-79289.3572	-5.0617E-05	2147.6290	3435.9545
3166920.						
209.760	-0.002576	665751.	-71292.7006	-4.0643E-05	1712.5732	3578.6565
3166920.						
212.040	-0.002659	512506.	-63002.5771	-3.2826E-05	1324.6134	3693.3817
3166920.						
214.320	-0.002726	378462.	-54475.4323	-2.6915E-05	985.2596	3786.5699
3166920.						
216.600	-0.002782	264101.	-45753.9490	-2.2651E-05	695.7384	3863.8541
3166920.						
218.880	-0.002829	169826.	-36868.9099	-1.9772E-05	457.0671	3930.0400
3166920.						
221.160	-0.002872	95980.3358	-27841.1025	-1.8009E-05	270.1169	3989.0893
3166920.						
223.440	-0.002912	42871.8226	-18683.2608	-1.7088E-05	135.6650	4044.1053
3166920.						
225.720	-0.002950	10786.1613	-9402.0364	-1.6732E-05	54.4355	4097.3196
3166920.						
228.000	-0.002988	0.0000	0.0000	-1.6660E-05	27.1287	4150.0807
1583460.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.48044203 in
Computed slope at pile head	=	-0.00443225
Maximum bending moment	=	4672723. lbs-in
Maximum shear force	=	-120021.95077 lbs
Depth of maximum bending moment	=	143.64000 in
Depth of maximum shear force	=	189.24000 in
Number of iterations	=	9
Number of zero deflection points	=	1

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1	V= 28328.	M= 1.95E+06	19180.0000	0.4804420	4672723.	-120022.

The analysis ended normally.

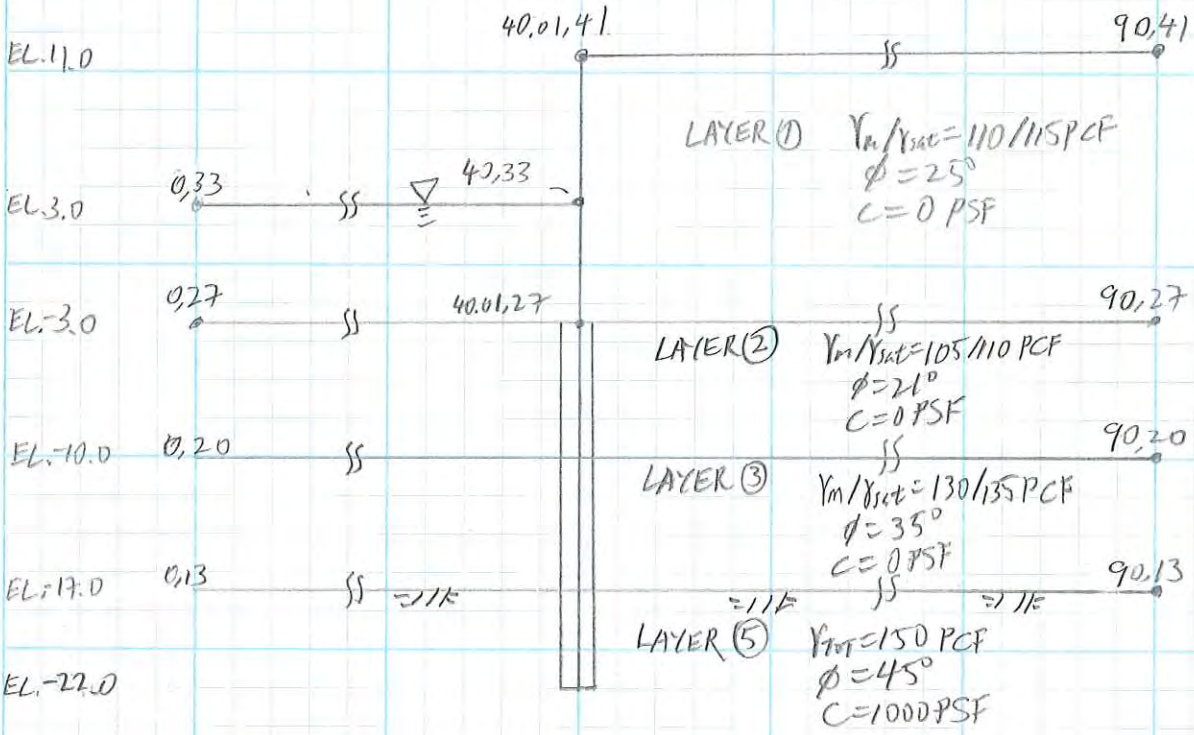
<0.5IN, OK

V SL 10-15-13

26

American Geotechnical & Environmental Services, Inc.
Southpointe Business Park
4 Grandview Circle
Canonsburg, PA 15317-6507

Project SCHUYLKILL RIVER TRAIL EXTENSION — Project No. 13004
Sheet 1 of
SOLDIER PILE AND LAGGING WALL — Dwg. By Y.Y. — Date 10/07/13
GLOBAL STABILITY — Chk. By ISL — Date 10/15/13



SHEAR STRENGTH OF CAISSON; (ASSUME STEEL SECTION ONLY)

W12X170 PILE, $A=50.0\,in^2$, $D=9.5"$, $t_w=0.960"$, $F_y=50$ KSI, $E=29{,}000$KSI

SHEAR STRENGTH OF WEB → $V_p=0.58\cdot F_{yw}\cdot D\cdot t_w$ (AASHTO Eq. 6.10.9.2-2)

$=0.58\cdot 50\cdot 9.5\cdot 0.96=264$ KIPS

C_i $\frac{D}{t_w}\le 1.12\sqrt{\frac{E\cdot k}{F_{yw}}}$ (AASHTO Eq. 6.10.9.3.2-4)

$\frac{9.5"}{0.960"}\le 1.12\sqrt{\frac{29{,}000\cdot(5.0)}{50}}$ ← K=5.0 AS PER AASHTO 6.10.9.2

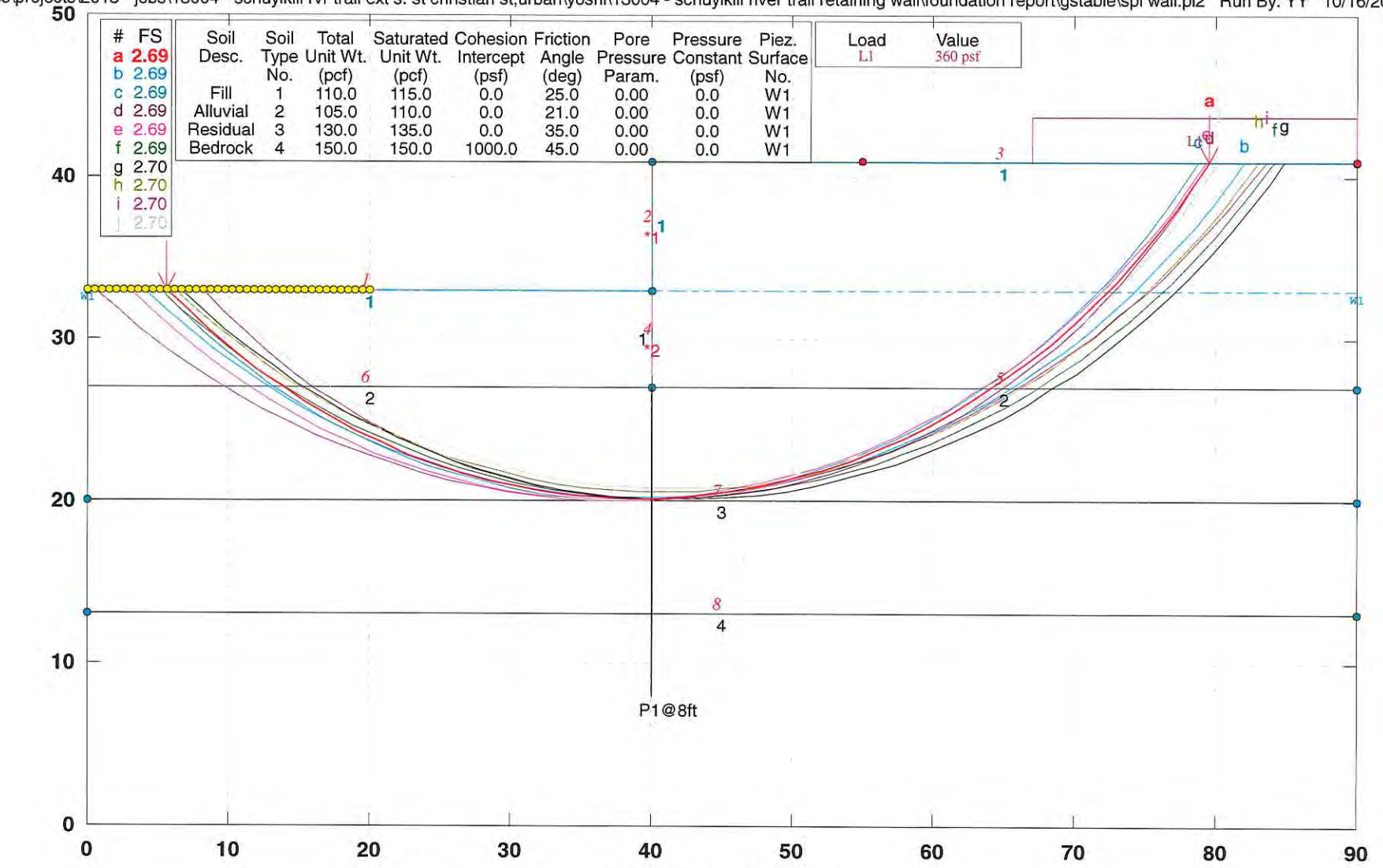
$\hookrightarrow C=1.0 \rightarrow V_n=V_p$

$V_n=264$ KIPS → AASHTO pg 6-30, RESISTANCE FACTOR 1.0.

CONSERVATIVELY USE 100 KIPS FOR SHEAR STRENGTH OF CAISSON

Schuylkill River Trail Extension Retaining Wall 1

n:\ages\projects\2013 - jobs\13004 - schuylkill rvr trail ext s. st christian st,urban\yoshi\13004 - schuylkill river trail retaining wall\foundation report\gstable\spl wall.pl2 Run By: YY 10/16/2013 08:53AM



GSTABL7 v.2 FSmin=2.69

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

CHK: VBP 10/16/13

28

spl wall.in

```
PROFIL  N:\AGES\Projects\2013 - Jobs\13004 - Schuylkill Rvr Trail Ext S. St
Christian St,Urban\Yoshi\13004 - Schuylkill River Trail Retaining Wall\Foundation
Report\GSTABLE\spl wall.in Version G7v2.004 [GSTABL72.EXE]
e
Schuylkill River Trail Extension        Retaining Wall 1
8 3
0. 33. 40. 33. 1
40. 33. 40.01 41. 1
40.01 41. 90. 41. 1
40. 33. 40.01 27. 1
40.01 27. 90. 27. 2
0. 27. 40.01 27. 2
0. 20. 90. 20. 3
0. 13. 90. 13. 4
0. 0. 0.
SOIL  Fill    AlluvialResidualBedrock
4
110. 115. 0. 25. 0. 0. 1
105. 110. 0. 21. 0. 0. 1
130. 135. 0. 35. 0. 0. 1
150. 150. 1000. 45. 0. 0. 1
WATER
1 62.4
2 0.5
0. 33.
90. 33.
LOADS
1
67. 90. 360. 0.
LIMITS
2 0
40. 33. 40.01 41.
40. 33. 40.01 27.
PIERS
1
4 40.01 0. 100000. 8. 90. 19.
CIRCL2
40 40
0. 20. 55. 90.
0. 2. 0. 0.
```

APPENDIX H

SITE PHOTOS

Photo 1: **View of proposed Plaza Area and the north end of proposed trail extension**

Photo 2: **Stakes showing approximate alignment of retaining wall**

Photo 3: **View of the wash-out area from the north**

Photo 4: **View from the wash-out area toward Schuylkill Expressway**

Photo 5: View of the north (upstream) corner of the wash-out area

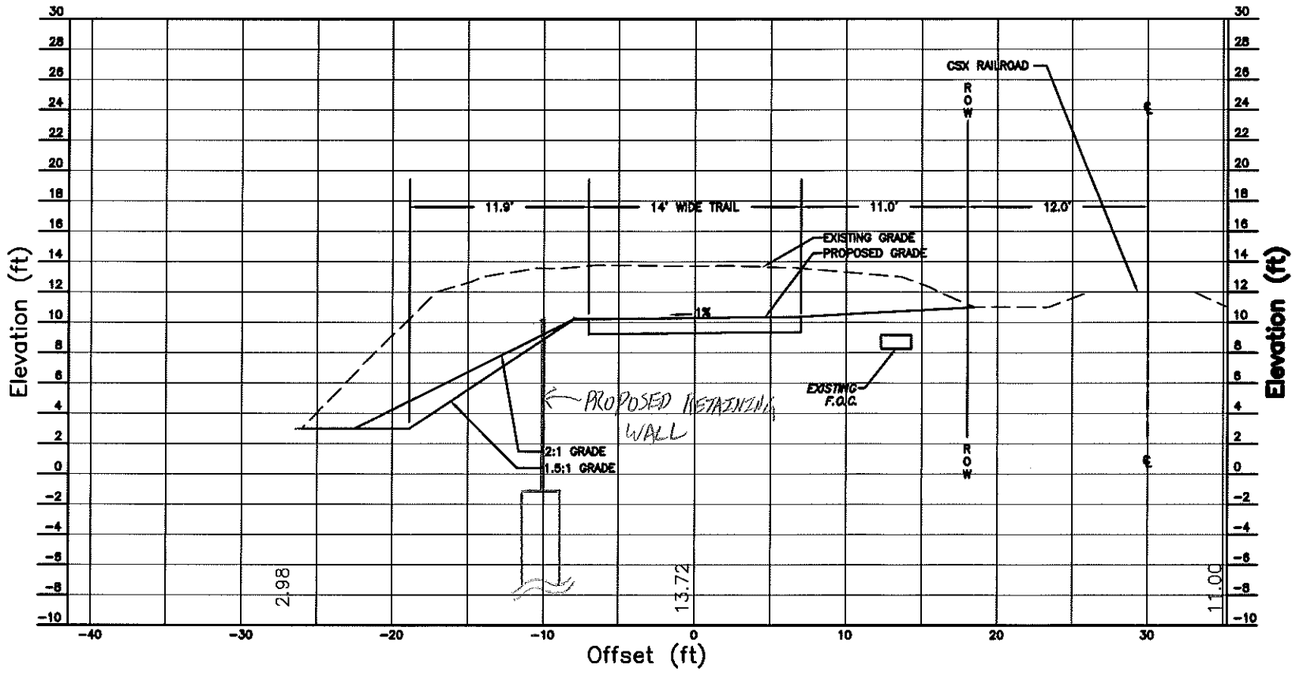
Photo 6: View of the south (downstream) corner of the wash-out area

APPENDIX I

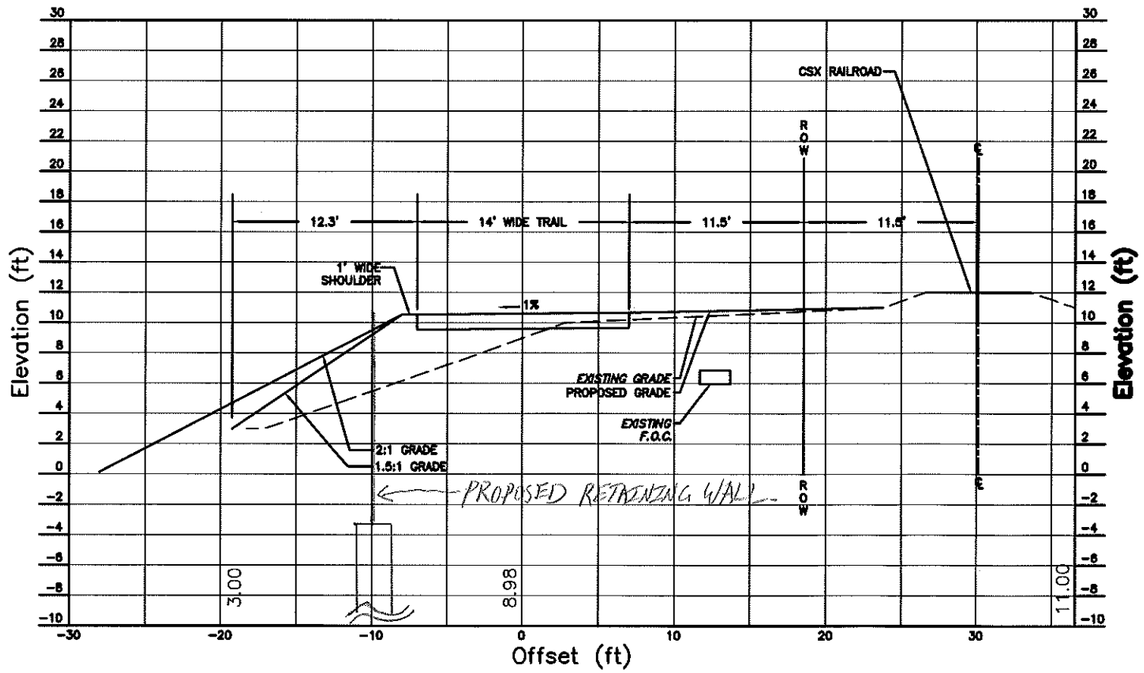
ROADWAY CROSS-SECTIONS

(Provided by Urban Engineers, Inc.)

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
6-0	PHILADELPHIA	-		
CITY OF PHILADELPHIA				
REVISION NUMBER	REVISIONS		DATE	BY



112+50



113+10.64

APPENDIX J

EXISTING BORINGS

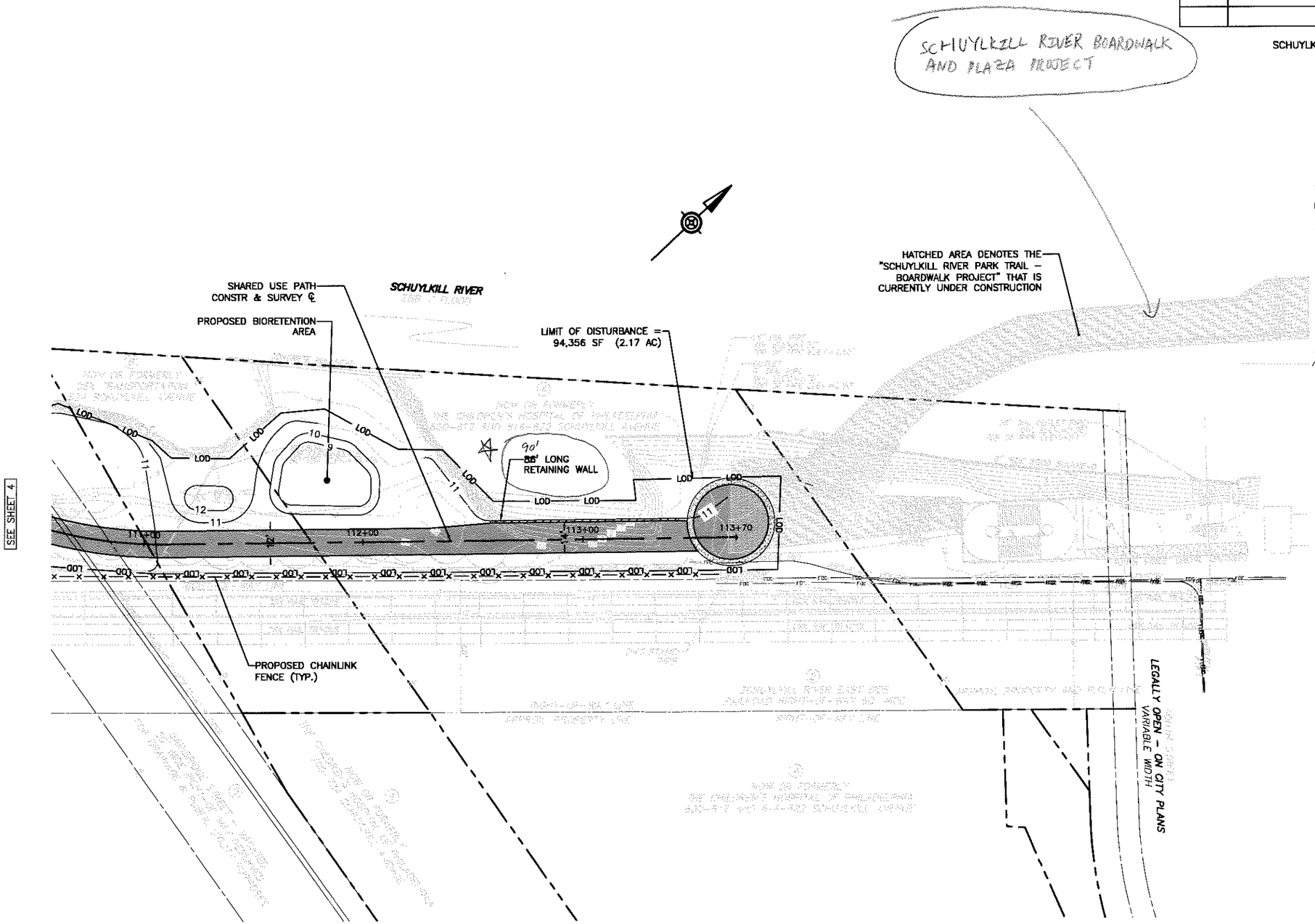
(Provided by URS Corporation)

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
6-0	PHILADELPHIA	–		5 OF 15
CITY OF PHILADELPHIA				

REVISION NUMBER	REVISIONS	DATE	BY

SCHUYLKILL RIVER TRAIL EXTENSION
GRADING PLAN

SCHUYLKILL RIVER BOARDWALK AND PLAZA PROJECT



LEGEND

- PROPOSED STEEL PIPE RAILING
- PROPOSED CHAINLINK FENCE
- PROPOSED TRAIL CENTER LINE
- PROPOSED STORMWATER PIPE
- 100-YEAR FLOODZONE BOUNDARY
- PROPOSED REST AREA
- PROPOSED ASPHALT
- PROPOSED AESTHETIC BAND
- EXISTING TREE LINE
- DEED LINE
- LEGAL RIGHT-OF-WAY
- EXISTING CHAIN LINK FENCE
- EXISTING OVERHEAD ELECTRIC LINE
- EXISTING ELECTRIC POLE
- EXISTING GUY POLE
- EXISTING GUY WIRE
- EXISTING LIGHT POST
- EXISTING WATER MANHOLE
- EXISTING STORM MANHOLE
- EXISTING ELECTRIC MANHOLE
- BENCH MARK
- EXISTING BOAT MOORING
- EXISTING ROAD SIGN
- EXISTING POST OR POLE
- EXISTING CONIFEROUS TREE
- EXISTING DECIDUOUS TREE

HORIZONTAL 0 25 50 FEET

DRAFT
PREPARED BY:

30% SUBMITTAL NOT FOR CONSTRUCTION

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
6-0	PHILADELPHIA	0000	SRG	5 OF 11
	CITY OF PHILADELPHIA			

REVISION NUMBER	REVISIONS	DATE	BY

LIMIT OF WORK

STA 0+90.40
SEG X OFFSET X
SEG X OFFSET X
SR 0000 SEC SRG
CITY OF PHILADELPHIA
PHILADELPHIA COUNTY

PROPOSED STRUCTURE
STA. 1+25.00
TYPE: 22-SPAN COMPOSITE P/S CONCRETE BOX BEAM
SPAN: 1,925'-0"
CLEAR ROADWAY WIDTH - VARIES 15'-0" TO 31'-0"
STRUCTURE S-00000 RECOMMENDED

PI STA 5+30.00
Δ=5°0'0" RT

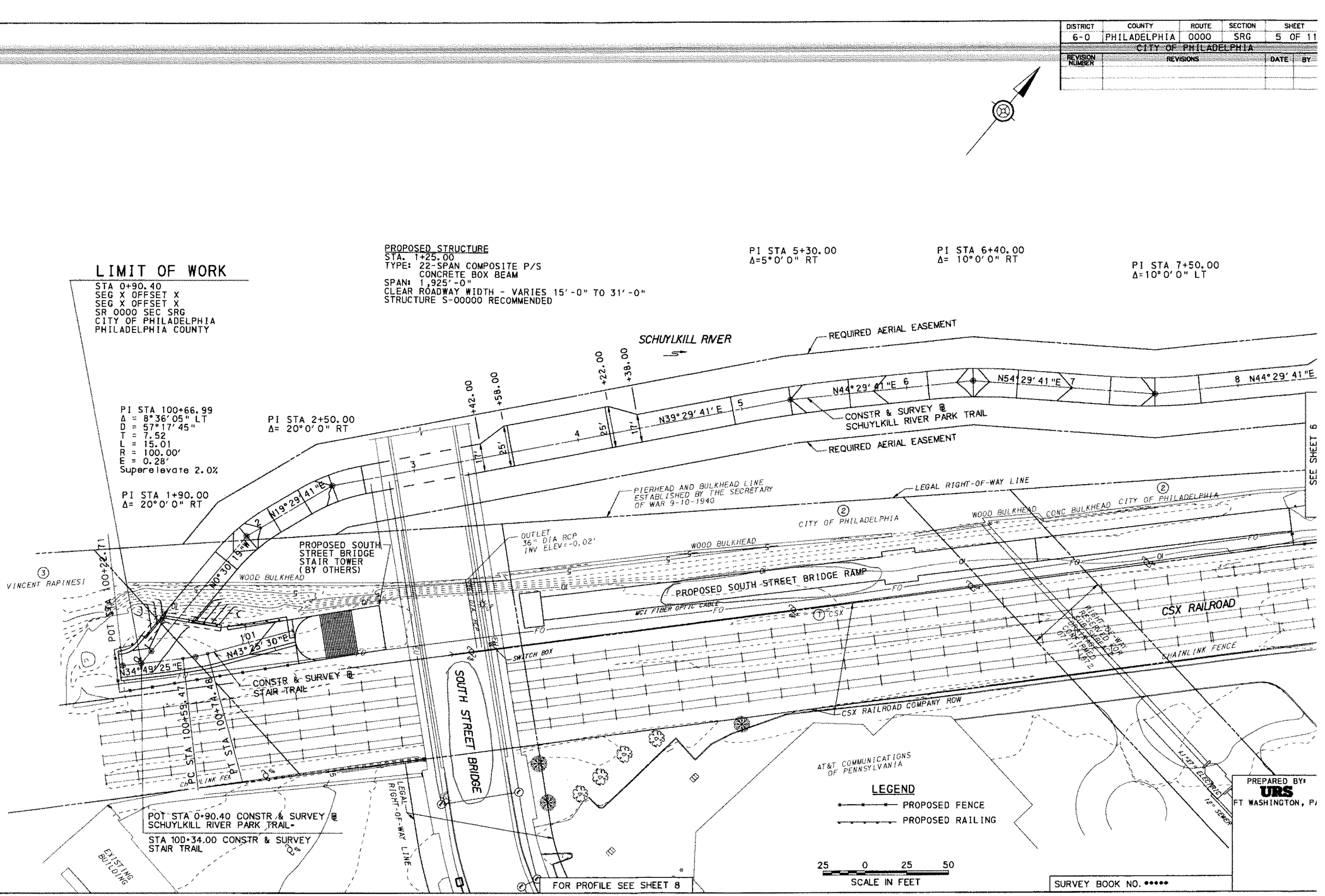
PI STA 6+40.00
Δ= 10°0'0" RT

PI STA 7+50.00
Δ=10°0'0" LT

PI STA 100+66.99
Δ = 8°36'05" LT
D = 57°17'45"
T = 7.52
L = 15.01
R = 100.00'
E = 0.28'
Superelevate 2.0%

PI STA 1+90.00
Δ= 20°0'0" RT

PI STA 2+50.00
Δ= 20°0'0" RT



LEGEND

PROPOSED FENCE

PROPOSED RAILING

25 0 25 50
SCALE IN FEET

PREPARED BY:
URS
FT WASHINGTON, PA

SURVEY BOOK NO. •••••

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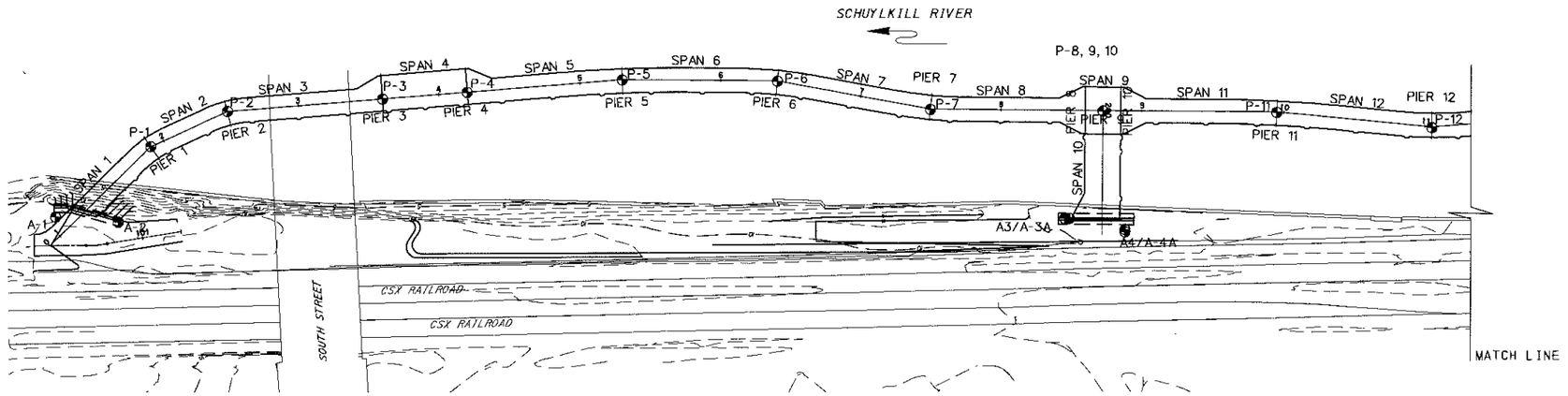
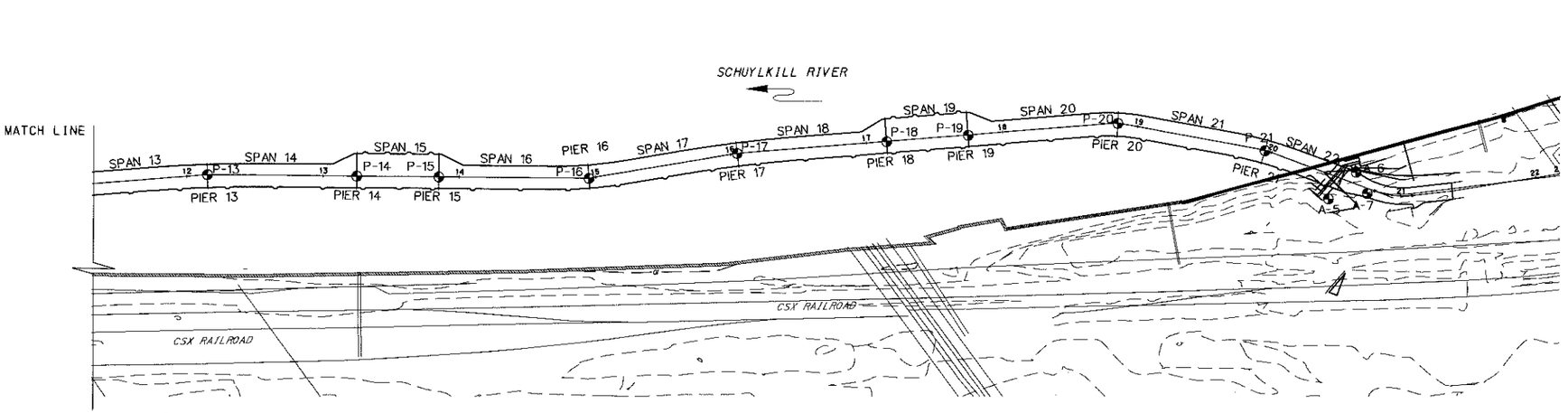
SCHUYLKILL RIVER BOARDWALK
AND PLAZE PROJECT





NOTES

COLUMN A - LOWER LIMIT OF SAMPLES & CORE RUNS
COLUMN B - SAMPLE AND CORE RUN IDENTIFICATION NUMBERS
COLUMN C - SAMPLE BLOWS PER 6" OR PERCENTAGE OF CORE RECOVERY
COLUMN D - PERCENT OF SAMPLE RECOVERY OR RQD.
CLOUMN E - USCS/AASHTO SOIL CLASSIFICATION LOWERCASE AS DETERMINED BY INSPECTOR IN FIELD. UPPERCASE WHEN DETERMINED BY LAB TESTING.
COLUMN F - SAMPLE MOISTURE CONTENT

DRILL RIG TYPE : B-57 TRUCK RIG WITH SAFETY HAMMER (ON BARGE) (UNLESS OTHERWISE NOTED)
HAMMER DROP ON SPOON SAMPLER = 30"
WEIGHT = 140 LBS. CASING SIZE = NW
SIZE OF SAMPLER = 2" O.D. , 1 3/8 " I.D.
SIZE OF CORE BIT = NQ-2"
CASING BLOWS NOT REQUIRED
VERTICAL SCALE : 1" = 5.0'
DRILL METHOD : 3.0" I.D. CASING/HOLLOW STEM AUGER, CONT. SPLIT SPOON SAMPLING, NX ROCK CORE WITH SPLIT INNER BARREL

G.E. = GROUND ELEVATION
B.F.E. = BOTTOM OF FOOTING ELEVATION
B.P.C.E. = BOTTOM OF PILE CAP ELEVATION
E.P.T.E. = ESTIMATED PILE TIP ELEVATION
T.O.R. = TOP OF ROCK ELEVATION
B.C.E. = BOTTOM OF CAISSON ELEVATION
WOH = WEIGHT OF HAMMER
WOR = WEIGHT OF RODS

SCHUYLKILL RIVER:
MEAN HIGH WATER ELEVATION = 4.16'
MEAN LOW WATER ELEVATION = -1.94'

▼ = GROUND WATER ELEVATION
⊕ = BORING LOCATION

THIS SHEET IS INCLUDED FOR THE CONVENIENCE OF THE DEPARTMENT AND IS NOT A PART OF THE CONTRACT DRAWINGS. (SEE SECTION 102.05 OF PUB. 408/2011).

BORING LOCATION PLAN

50 0 50

Mark	Description	By	Chk'd.	App'd.	Date
REVISIONS					

THE CLASSIFICATION OF THE MATERIALS ENCOUNTERED HAVE BEEN VERIFIED

William K Peterson 5-19-2011

SOILS ENGINEER / GEOLOGIST

PREPARED BY

URS

CONSULTING ENGINEERS
FORT WASHINGTON, PA.

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL ENGINEER
WILLIAM K. PETERSEN
55175-E

TEST BORINGS

MADE BY

TRC COMPANIES, INC.

FOR

URS

SCHUYLKILL RIVER DEVELOPMENT CORPORATION

PHILADELPHIA COUNTY
S.R. 0000 SECTION SRG
SCHUYLKILL RIVER PARK TRAIL
LOCUST STREET TO SOUTH STREET
22 SPAN COMPOSITE P/S CONCRETE PA BULB-TEE BEAM BRIDGE
BORING LOGS I

SHEET 72 OF 86

BPAA-672732

DES.	JJB
DWN.	IMM
CK'D.	JJB

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ABUTMENT 1

A-1
CONSTR. ℄ S.R. 0000, STATION 1+15, OFFSET 11' LT

G.E. 10.9'

	A	B	C	D	E	F	
	1.5'	S-1	23-17-10	47%	sm/a-1-b	DRY	SILTY SAND WITH GRAVEL, DARK BROWN TO DARK GRAY, LOOSE TO MEDIUM DENSE (FILL)
	3.0'	S-2	9-7-5	27%	sm/a-1-b	DRY	
	4.5'	S-3	6-4-1	33%	sm/a-1-b	DRY	
	6.0'	S-4	5-4-4	47%	SM/A-1-b	DRY	
▼ ELEV. 3.9' 0 HR. 5/6/10	7.5'	S-5	4-4-3	20%	sm/a-1-b	DRY	
B.P.C.E. 3.5'	9.0'	S-6	5-6-3	0%	--	--	
▼ ELEV. 3.3' 24 HR. 5/7/10	10.5'	S-7	3-2-1	100%	cl/a-4	WET	SANDY CLAY, BROWN TO GRAY, SOFT TO MEDIUM STIFF (FILL)
	12.0'	S-8	2-1-2	0%	--	--	
	13.5'	S-9	2-3-1	100%	cl/a-4	WET	
	15.0'	S-10	1-1-2	40%	CL/A-4	WET	
	16.5'	S-11	2-3-4	60%	cl/a-4	WET	
	18.0'	S-12	3-2-2	60%	cl/a-4	WET	
	19.5'	S-13	5-8-13	60%	sp/a-3	WET	POORLY GRADED SAND WITH GRAVEL, BLACK, MEDIUM DENSE (FILL)
T.O.R./E.P.T.E. -9.5'	20.4'	S-14	50/.4	75%	gm/a-1-b	WET	
	22.5'	R-1	90%	0%	--	--	SILTY GRAVEL, GRAY TO BLACK, VERY DENSE (RESIDUAL)
	27.5'	R-2	90%	36%	--	--	MICA SCHIST, GRAY TO PINK TO BROWN, MEDIUM HARD TO HARD, SLIGHTLY WEATHERED, INTENSELY FOLIATED (RD=75°-85° AND 35°-45°) CLOSELY TO MEDIUM JOINTED (RD=75°-85°, 5°-55°)
	30.5'	R-3	100%	17%	--	--	

END OF BORING AT 30.5'

STARTED : 5/5/2010
COMPLETED : 5/6/2010
DRILLER : FRANCO BRAVO / TRC
CASING DEPTH : 20.4'
DRILL RIG TYPE: CME 45 TRACK RIG

A-2
CONSTR. ℄ S.R. 0000, STATION 1+30, OFFSET 20' RT

G.E. 11.0'

	A	B	C	D	E	F	
	1.5'	S-1	5-13-11	33%	sm/a-2-4	DRY	SILTY SAND WITH GRAVEL AND COAL, BROWN, GRAY, BLACK AND ORANGE, VERY LOOSE TO MEDIUM DENSE (FILL)
	3.0'	S-2	14-11-11	0%	--	--	
	4.5'	S-3	7-5-4	60%	sm/a-2-4	DRY	
	6.0'	S-4	7-2-12	33%	sm/a-2-4	DRY	
▼ ELEV. 3.8' 0 HR. 5/6/10	7.5'	S-5	12-7-6	13%	sm/a-2-4	DRY	
B.P.C.E. 3.5'	9.0'	S-6	3-2-1	53%	sm/a-2-4	WET	
▼ ELEV. 3.2' 24 HR. 5/7/10	10.5'	S-7	5-9-21	13%	sc/a-2-4	WET	CLAYEY SAND WITH GRAVEL, DARK GRAY TO BLACK, MEDIUM DENSE TO VERY LOOSE (FILL)
	12.0'	S-8	19-6-4	33%	sc/a-2-4	WET	
	13.5'	S-9	3-2-2	47%	sc/a-2-4	WET	
	15.0'	S-10	5-5-3	53%	sc/a-2-4	WET	
	16.5'	S-11	1-1-1	60%	sc/a-2-4	WET	
	18.0'	S-12	2-2-2	47%	sc/a-2-4	WET	
	19.5'	S-13	6-4-5	47%	sc/a-2-4	WET	
	21.0'	S-14	5-2-3	33%	SC/A-2-4	WET	
	22.5'	S-15	5-6-10	67%	sc/a-2-4	WET	
T.O.R./E.P.T.E. -12.6'	23.6'	S-16	42-46-50/.1	100%	sm/a-2-4	MOIST	SILTY SAND, GRAY AND BLACK, MOIST, VERY DENSE (RESIDUAL)
	25.5'	R-1	63%	0%	--	--	
	27.8'	R-2	100%	26%	--	--	AMPHIBOLITE, BLACK, MEDIUM HARD TO HARD, SLIGHTLY WEATHERED, VERY INTENSELY FOLIATED (RD=40°-45°) VERY CLOSELY TO CLOSELY JOINTED (RD=40°-45°)
	32.8'	R-3	94%	44%	--	--	SCHIST, DARK GRAY, HARD TO VERY HARD, FRESH TO SLIGHTLY WEATHERED, INTENSELY FOLIATED (RD=20°-40°) CLOSELY TO MEDIUM JOINTED (RD=20°-40° AND 5°-10°)
	34.8'	R-4	100%	60%	--	--	SCHIST, DARK GRAY, HARD TO VERY HARD, FRESH, INTENSELY TO CLOSELY FOLIATED (RD=20°-40°) CLOSELY TO MEDIUM JOINTED (RD=20°-40°)

END OF BORING AT 34.8'

STARTED : 5/6/2010
COMPLETED : 5/6/2010
DRILLER : FRANCO BRAVO / TRC
CASING DEPTH : 23.0'
DRILL RIG TYPE: CME 45 TRACK RIG

NOTE: FOR BORING LOCATION PLAN, SEE SHEET 72. THIS SHEET IS INCLUDED FOR THE CONVENIENCE OF THE DEPARTMENT AND IS NOT A PART OF THE CONTRACT DRAWINGS. (SEE SECTION 102.05 OF PUB. 408/2011).

Mark	Description	By	Chk'd.	App'd.	Date
REVISIONS					

THE CLASSIFICATION OF THE MATERIALS ENCOUNTERED HAVE BEEN VERIFIED

William K Petersen 5-19-2011

SOILS ENGINEER / GEOLOGIST

PREPARED BY

URS

CONSULTING ENGINEERS
FORT WASHINGTON, PA.

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
WILLIAM K. PETERSEN
ENGINEER 55175-E

TEST BORINGS

MADE BY

TRC COMPANIES, INC.

FOR

URS

SCHUYLKILL RIVER DEVELOPMENT CORPORATION

PHILADELPHIA COUNTY
S.R. 0000 SECTION SRG
SCHUYLKILL RIVER PARK TRAIL
LOCUST STREET TO SOUTH STREET
22 SPAN COMPOSITE P/S CONCRETE PA BULB-TEE BEAM BRIDGE
BORING LOGS II

SHEET 73 OF 86

BPAA-672732

DES.	JJB
DWN.	IMM
CK'D.	JJB

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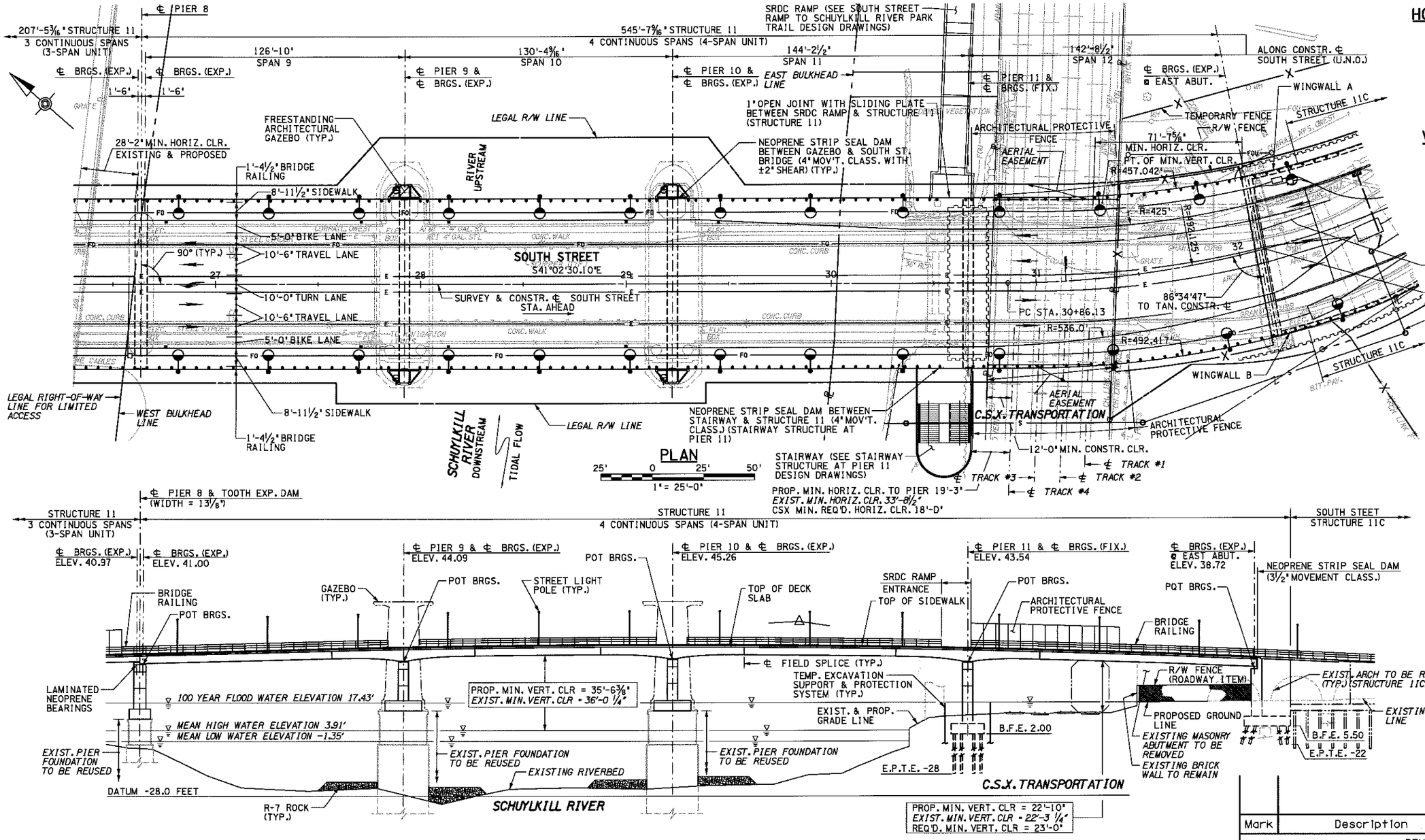
SOUTH STREET BRIDGE



ELEVATION ALONG CONSTRUCTION ℄ SOUTH STREET

25' 0 25' 50'
1"= 25'-0"

HORIZONTAL CURVE DATA

SURVEY & CONSTR. ℄ SOUTH ST.

P.I. STA. 32+33.73
Δ = 33°23'26.28"LT
T = 147.60'
L = 286.60'
R = 492.125'
E = 21.658'
S.E. = 4.00 %

VERTICAL CURVE DATA

SOUTH STREET

P.V.I. STA. 29+84.90
ELEV. = 49.21'
V.C. = 475.72'
M.O. = -4.31'
S.S.D. = 376.49'

+2.577% Δ -4.666%

NOTES:

1. FOR INDEX OF DRAWINGS, SEE INDEX OF DRAWINGS SHEET.
2. FOR BRIOGE LOAD RATINGS, SEE TYPICAL SECTIONS - I AND II SHEETS.
3. FOR LIST OF ABBREVIATIONS, SEE QUANTITIES - II SHEET.
4. FOR HYDRAULIC DATA, SEE GENERAL PLAN & ELEVATION - I SHEET.
5. FOR HORIZONTAL ALIGNMENTS OF OUTSIDE EDGES OF DECK AND CURBLINES, SEE DECK SLAB LAYOUT PLAN (4 SPAN-UNIT) SHEET.
6. FOR LIGHT POLE SPACING, SEE DECK SLAB LAYOUT PLAN (4 SPAN-UNIT) AND DECK SLAB PLAN - I THROUGH III (4-SPAN UNIT) SHEETS.

LEGEND:

- TEMPORARY EXCAVATION SUPPORT AND PROTECTION SYSTEM
- STREET LIGHT POLE (18' MOUNTING HEIGHT) (LIGHTING ITEM)
- NAVIGATION LIGHT (LIGHTING ITEM)
- TYPE 1 SCUPPER, MODIFIED
- B.F.E. BOTTOM OF FODTING ELEVATION
- E.P.T.E. ESTIMATED PILE TIP ELEVATION
- 4' OPEN MOUTH GRATE INLET WITH BICYCLE SAFE GRATE (ROADWAY ITEM)

Mark	Description	By	Chk'd.	Ream'd.	Date
REVISIONS					

PREPARED BY:
GANNETT FLEMING, INC.
VALLEY FORGE, PA

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER BHARATKUMAR V. PATEL 46752-R

02-12-08
RECOMMENDED

CITY OF PHILADELPHIA

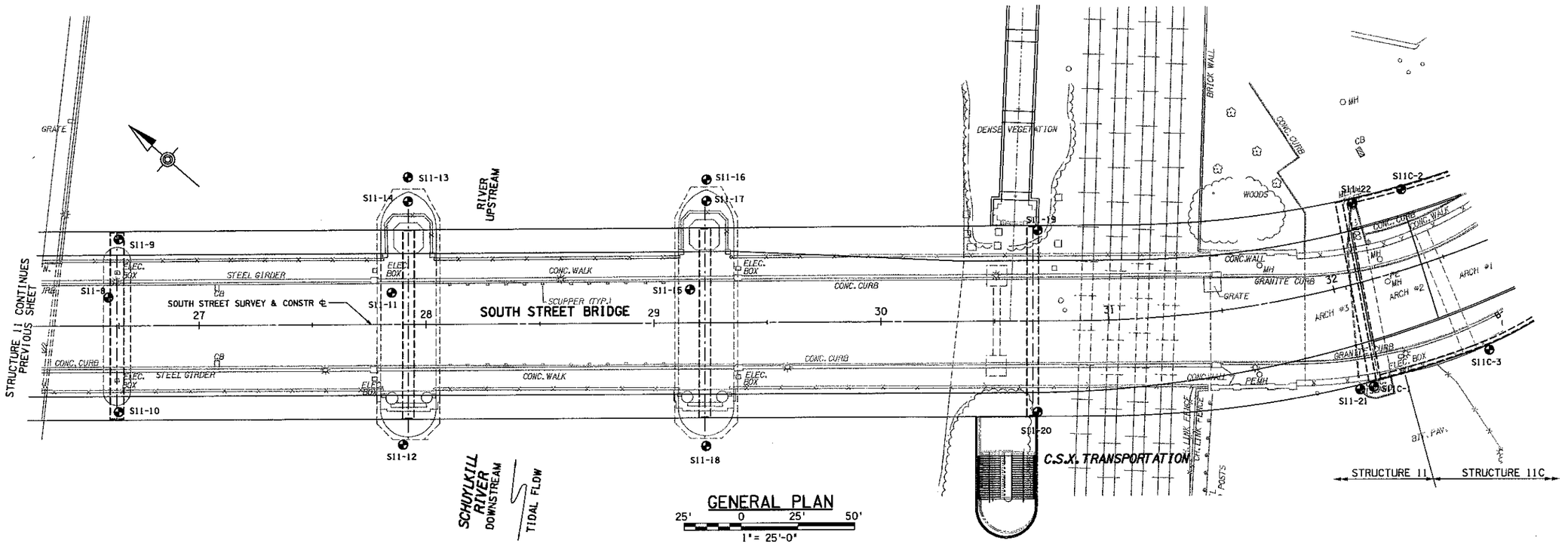
RECONSTRUCTION OF THE SOUTH STREET BRIDGE FROM 33rd STREET TO 27th STREET STRUCTURE 11 GENERAL PLAN & ELEVATION - II

PLAN PREPARED FOR
CITY OF PHILADELPHIA
DEPARTMENT OF STREETS
BUREAU OF SURVEYS & DESIGN
BRIDGE SECTION

BPAA-672642

DRAWN	CTD	DATE 9/30/07
CHECKED	PHM/YWL	DATE 9/30/07
SHEET NO. 2 OF 205	8 - 2007 - 11 - 2	

FILE: gi\42802 South St FD\struct\STRC11\S11gp02.dgn
DATE: 11-Feb-2008 07:57



GENERAL PLAN

25' 0 25' 50'

1" = 25'-0"

LEGEND:

● CORE BORING LOCATION

Mark	Description	By	Chk'd.	Recm'd.	Date
REVISIONS					

CITY OF PHILADELPHIA

RECONSTRUCTION OF THE SOUTH STREET BRIDGE FROM 33rd STREET TO 27th STREET STRUCTURE 11 STRUCTURE BORINGS

PREPARED BY:
GANNETT FLEMING, INC.
VALLEY FORGE, PA

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL ENGINEER
CRAIG M. BENEDICT

PLAN PREPARED FOR
CITY OF PHILADELPHIA
DEPARTMENT OF STREETS
BUREAU OF SURVEYS & DESIGN
BRIDGE SECTION

		BPAA-672642
DRAWN	BMJ	DATE 9/30/07
CHECKED	CMB	DATE 9/30/07
SHEET NO. 192 OF 205	B - 2007 - 11 - 192	

\42802 South St FD\GEOTECH\Final PS&E Submission\Structure 11\S11 SB02.dgn
ATE: 06-Feb-2008 10:10

STRUCTURE 11
PIER 11

S11-19
STATION 1+630.6, 12.0 LT , S.R. SOUTH ST.

G.E. 3.71M

B.P.C.E. 0.61M (2.00 FT)

E.P.T.E. -8.40M (-27.6 FT)

A	B	C	D	E	F	
0.46	S-1	5-5-9	43%		D	3.1M SILTY SAND (SM/A-1-B), BLACK TO BROWN, DRY TO WET, LOOSE TO DENSE, ASH, COAL FRAGMENTS, BRICK, TRACE GRAVEL, (FILL)
0.91	S-2	8-6-5	52%		D	
1.37	S-3	8-7-4	48%		D	
1.83	S-4	7-5-3	43%		D	
2.29	S-5	4-4-2	65%		D	
2.74	S-6	3-3-5	54%		M	
3.20	S-7	5-26-12	54%		M	ORIGINAL GROUND SURFACE 0.6M
3.66	S-8	4-2-4	33%		W	0.6M GRAVEL AND SAND (GP-SP/A-1-A), LITTLE MICA, SOME SILT WITH DEPTH, GRAYISH BROWN, WET, LOOSE
4.11	S-9	6-4-3	100%		W	0.0M
4.57	S-10	3-3-2			W	0.9M SILT WITH SAND AND GRAVEL, (ML/A-4), TRACE OF WOOD, GRAYISH BROWN, WET, LOOSE -0.9M
5.03	S-11	3-1-1	14%		W	1.2M SILTY SAND, (SM/A-4), TRACE OF FINE GRAVEL, LITTLE MICA, BROWN, WET, VERY LOOSE
5.49	S-12	1-1-1	74%		W	5.03-5.9M: LAB CLASSIFIED
5.94	S-13	2-4-5	76%		W	-2.1M
6.40	S-14	2-2-2	30%		W	1.1M GRAVEL AND SAND (GP-SP/A-1-A), BROWN, WET, LOOSE TO VERY LOOSE WITH DEPTH
6.86	S-15	1-1-1			W	-3.2M
7.32	S-16	2-3-7	76%		W	1.7M SILT, (ML/A-4), SOME TO TRACE OF FINE SAND, TRACE OF MICA AND WOOD PIECES, BROWN TO GRAYISH BROWN, WET TO MOIST, VERY LOOSE TO MEDIUM DENSE
7.77	S-17	WOH-2-2	76%		M	6.86-8.22M: LAB CLASSIFIED
8.23	S-18	3-3-3	100%		M	-4.9M
8.69	S-19	5-6-15	100%		M	0.6M SAND, (SP/A-3), TRACES OF GRAVEL, QUARTZ PIECES, LITTLE MICA, REDDISH BROWN TO REDDISH BLACK, MOIST, VERY DENSE
9.14	S-20	29-29-33	46%		M	-5.5M
9.38	S-21	33-50/ 0.09M	96%			2.0M DECOMPOSED MICA SCHIST, GRAYISH BLACK WITH RED BLOTCHES, MOIST, VERY DENSE
10.29	R-1		0%	0%		
11.20	R-2	50/0.0M	0%	0%		TOP OF ROCK -7.5M
11.20	S-22					4.6M MICA SCHIST, QUARTZ SEAMS, GRAYISH BLACK WITH WHITE SEAMS, HARD, SLIGHTLY WEATHERED TO FRESH, BEDDING NOT APPARENT, VERY CLOSELY FRACTURED TO CLOSELY FRACTURED, SLIGHTLY BROKEN TO BROKEN
12.11	R-3		25%	0%		
13.02	R-4		93%	60%		13.10-13.14M, 13.19-13.25M, 13.39-13.41M, 13.63-13.80M: VERY BROKEN SEAMS
14.54	R-5		64%	18%		13.70-13.73M: VERY SOFT SEAMS
15.76	R-6		89%	38%		-12.1M

STARTED: 11-12-98, COMPLETED: 11-12-98
DRILLER: S. PARISANO/SITE BLAUVELT
CASING LENGTH:
DRILLING METHOD: HSA, SPLIT SPOON SAMPLING, NX CORING
RIG TYPE: CME 45C SKID RIG

S11-20
STATION 1+630.6, 12.0 RT , S.R. SOUTH ST.

G.E. 3.78M

B.P.C.E. 0.61M (2.00 FT)

0.2M 24 HRS

E.P.T.E. -7.19M (-23.6 FT)

A	B	C	D	E	F	
0.46	S-1	1-2-4	33%		D	2.9M ASHES, CINDERS, ORGANICS, TRACES OF BRICK AND MICA, SOME SAND, BLACK TO GRAYISH BLACK, DRY TO MOIST, LOOSE TO DENSE (FILL)
0.91	S-2	22-18-6	80%		D	
1.37	S-3	10-12-9	72%		D	
1.83	S-4	18-21-23	100%		D	2.24-2.84M: SAND WITH GRAVEL
2.29	S-5	21-20-20	65%		D	
2.74	S-6	29-20-13	43%		M	ORIGINAL GROUND SURFACE 0.9M
3.20	S-7	3-2-4	52%		M	2.2M SANDY SILT WITH FINE GRAVEL TO NO GRAVEL WITH DEPTH (ML/A-4), LITTLE MICA, BROWN, MOIST TO WET, LOOSE
3.66	S-8	2-2-2	57%		W	
4.11	S-9	3-2-1	33%		W	
4.57	S-10	1-1-1	0%			
5.03	S-11	2-2-2	65%		W	-1.3M
5.49	S-12	4-2-3	87%		W	2.6M SILTY SAND WITH GRAVEL (SM/A-1-B), LITTLE MICA, BROWN, MOIST TO WET, LOOSE TO VERY LOOSE
5.94	S-13	2-2-2	100%		W	5.03-5.92M: LAB CLASSIFIED
6.40	S-14	2-1-1	9%		M	
6.86	S-15	4-3-3	35%		M	
7.32	S-16	3-3-4	54%		M	
7.77	S-17	4-30-34	54%		M	-3.9M
8.01	S-18	54-50/ 0.09	83%		M	0.9M SAND WITH GRAVEL (SP/A-1-A), DECOMPOSED MICA SCHIST, GRAYISH BLACK WITH YELLOW BLOTCHES, MOIST, VERY DENSE
8.53	--					TOP OF ROCK -4.8M
9.44	R-1		44%	0%		5.8M MICA SCHIST, GRAYISH BLACK, SLIGHTLY WEATHERED TO FRESH, MEDIUM TO HARD, BEDDING NOT APPARENT, VERY CLOSELY TO WIDELY SPACED FRACTURES,
10.06	R-2		39%	39%		8.62-8.65M: VERY SOFT SEAM
10.97	R-3		0%	0%		
11.89	R-4		51%	18%		11.89-12.02M: VERY BROKEN
12.80	R-5		71%	19%		12.13-12.15M: SOFT SEAM 12.60-12.69M: VERTICAL FRACTURE
14.33	R-6		75%	57%		-10.6M

STARTED: 11-16-98, COMPLETED: 11-16-98
DRILLER: S. PARISANO/SITE BLAUVELT
CASING LENGTH:
DRILLING METHOD: HSA, SPLIT SPOON SAMPLING, NX CORING
RIG TYPE: CME 45C SKID RIG

GENERAL NOTES

COLUMN A - LOWER LIMIT OF SAMPLES OR CORE RUNS IN METERS
COLUMN B - SAMPLE OR CORE RUN IDENTIFICATION NUMBERS
COLUMN C - SAMPLE BLOWS PER 150MM
COLUMN D - PERCENTAGE OF SOIL SAMPLE RECOVERY OR ROCK CORE RECOVERY
COLUMN E - POCKET PENETROMETER TEST READING (KPA) OR ROCK CORE RQD
COLUMN F - WATER CONTENT
COLUMN G - DESCRIPTION
▼ ELEV. GROUND WATER ELEVATION AT TIME SHOWN
HR.
GE - GROUND ELEVATION
B.P.C.E. - MAXIMUM BOTTOM OF PILE CAP ELEVATION IN METERS
E.P.T.E. - ESTIMATED PILE TIP ELEVATION IN METERS

SITE BLAUVELT

DRILLER
GANNETT FLEMING, INC.
CONSULTANT

THE CLASSIFICATION OF THE MATERIALS ENCOUNTERED HAS BEEN VERIFIED.
Craig Benedict 2/6/08
SOILS ENGINEER / GEOLOGIST

THIS SHEET IS INCLUDED FOR THE CITY OF PHILADELPHIA DEPARTMENT OF STREETS, AND SHALL NOT BE CONSIDERED AS PART OF THE CONTRACT DRAWINGS.
(SEE PAOOT PUBLICATION 408M, SECTION 102.05)

Mark	Description	By	Chk'd.	Recm'd.	Date
REVISIONS					

PREPARED BY:
GANNETT FLEMING, INC.
VALLEY FORGE, PA

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER CRAIG M. BENEDICT

CITY OF PHILADELPHIA

RECONSTRUCTION OF THE SOUTH STREET BRIDGE FROM 33rd STREET TO 27th STREET
STRUCTURE 11
STRUCTURE BORINGS

PLAN PREPARED FOR
CITY OF PHILADELPHIA
DEPARTMENT OF STREETS
BUREAU OF SURVEYS & DESIGN
BRIDGE SECTION

BPAA-672642

DRAWN	BMJ	DATE 9/30/07
CHECKED	CMB	DATE 9/30/07
SHEET NO. 204 OF 205	B - 2007 - 11 - 204	

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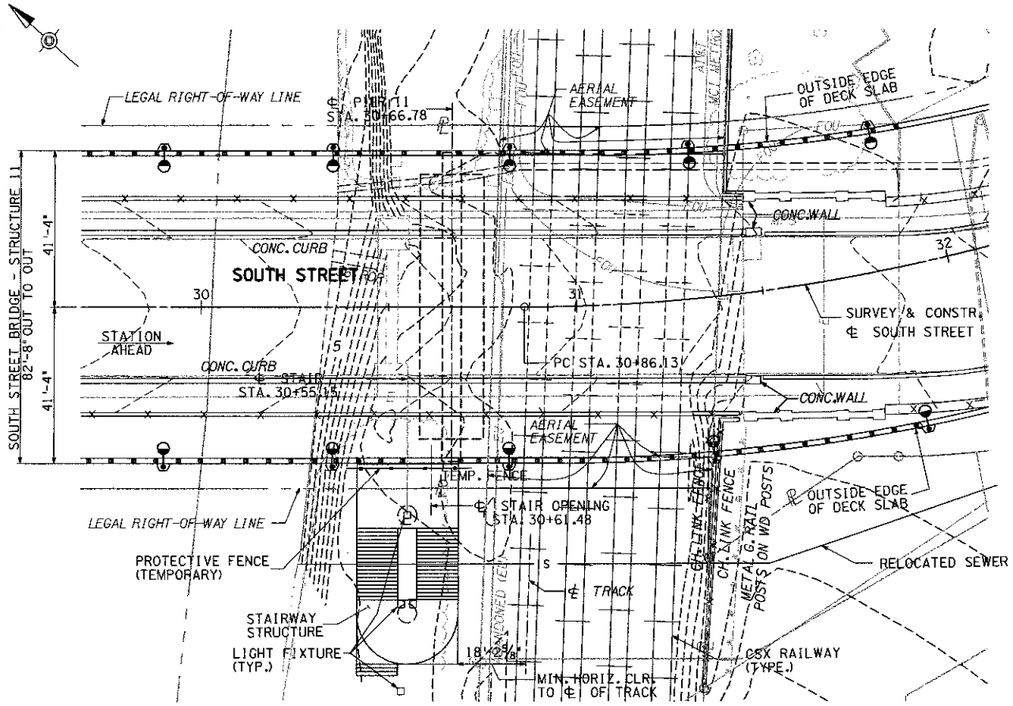
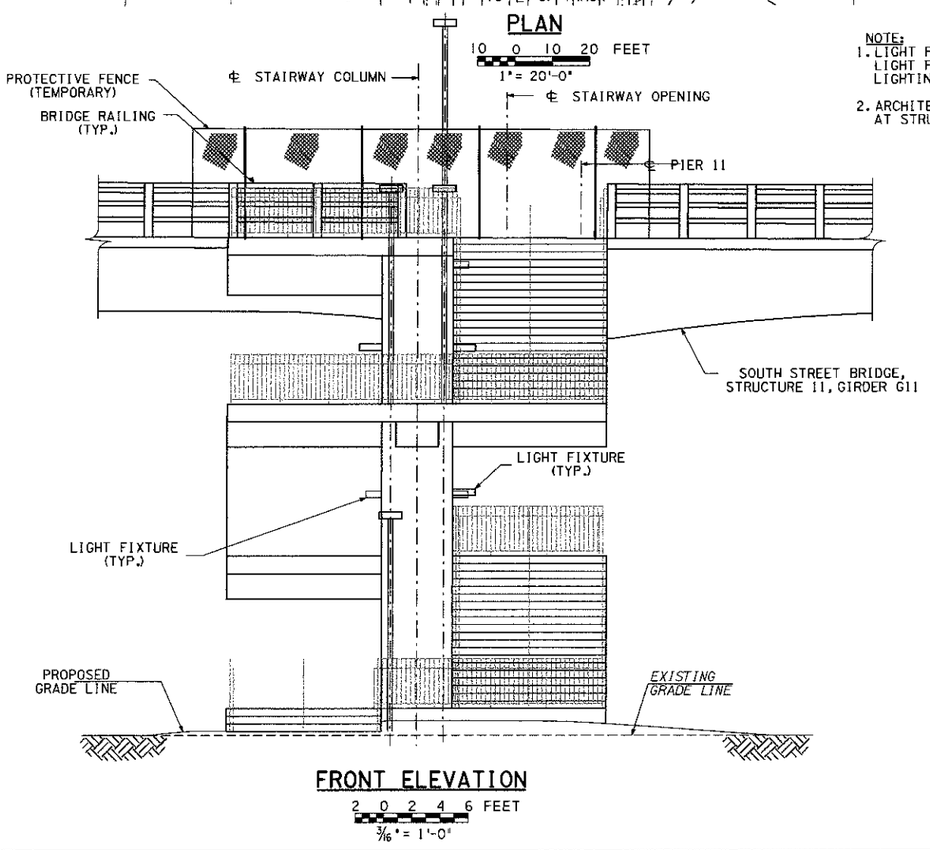


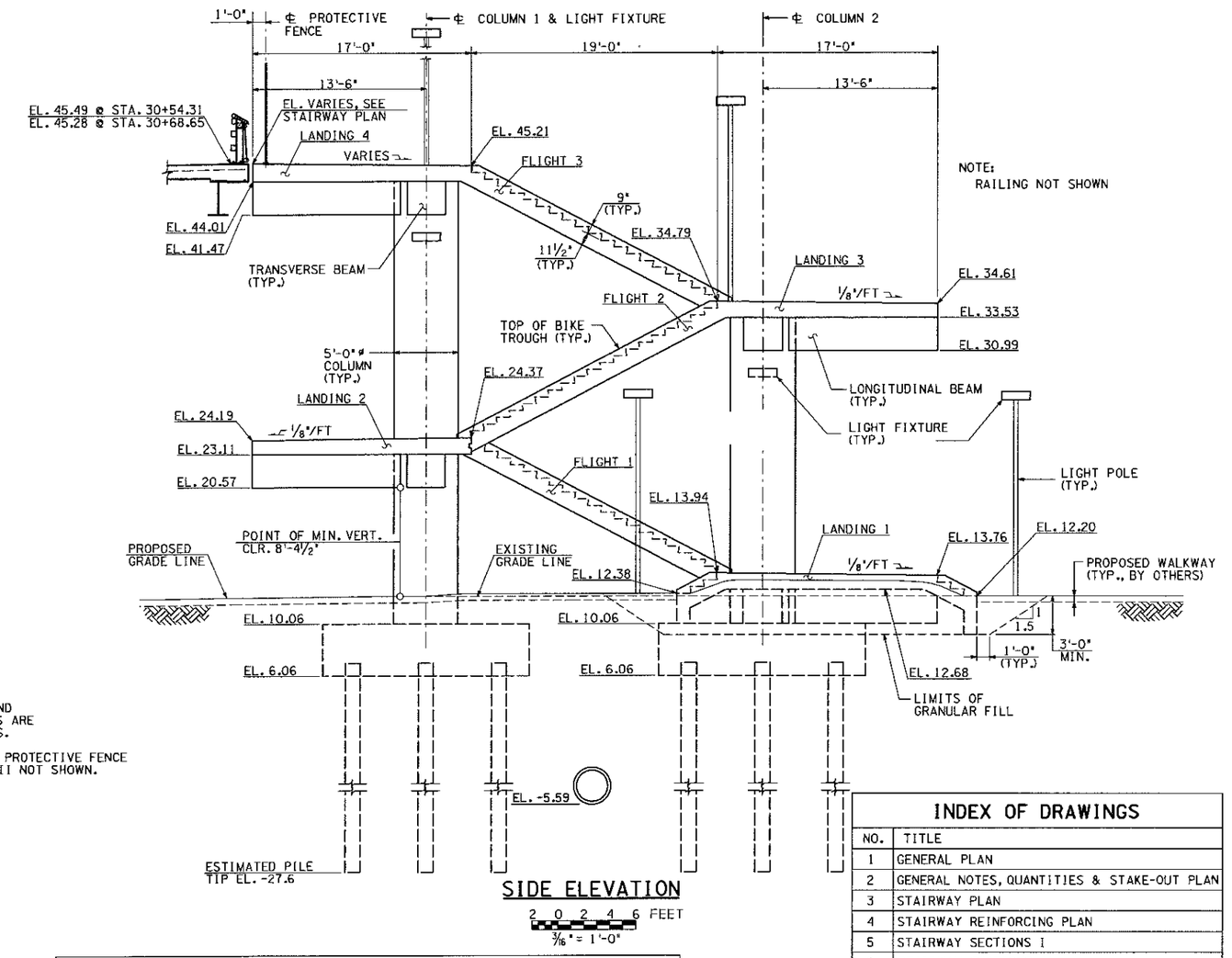
PLAN

0 0 10 20 FEET
1" = 20'-0"



FRONT ELEVATION

2 0 2 4 6 FEET
3/16" = 1'-0"



NOTE:
RAILING NOT SHOWN

SIDE ELEVATION

2 0 2 4 6 FEET
3/16" = 1'-0"

NOTE:
1. LIGHT POLES AND LIGHT FIXTURES ARE LIGHTING ITEMS.
2. ARCHITECTURAL PROTECTIVE FENCE AT STRUCTURE 11 NOT SHOWN.

PILE LOADS AT STAIRWAY STRUCTURE (KIPS)

TYPE	LOADINGS \ LOCATION	AXIAL	LATERAL		UPLIFT
			STRONG	WEAK	
NON-SEISMIC GROUP	MAXIMUM ALLOWABLE	196	21.6	10.2	0.0
	MAXIMUM DESIGN	176	2.6	2.8	0.0
SEISMIC GROUP	MAXIMUM ALLOWABLE	—	—	—	—
	MAXIMUM DESIGN	—	—	—	—

INDEX OF DRAWINGS

Mark	Description	By	Chk'd.	Recm'd.	Date
REVISIONS					

SUPPLEMENTAL DRAWINGS

CLASSIFICATION OF EARTHWORK FOR STRUCTURES	RC-12M	3-30-2006
BACKFILL AT STRUCTURES	RC-11M	4-15-2004
PROTECTIVE FENCE	BC-701M	T-24-2006
ELECTRICAL DETAILS	BC-721M	7-29-2005
LIGHTING POLE ANCHORAGE	BC-722M	7-24-2006
ANCHOR SYSTEMS	BC-734M	4-15-2004
REINFORCEMENT BAR FABRICATION DETAILS	BC-736M	1-21-2003
CONCRETE DECK SLAB DETAILS	BC-752M	7-29-2005
STEEL PILE TIP REINFORCEMENTS	BC-757M	1-21-2003
NEOPRENE STRIP SEAL DAM	BC-767M	7-20-2007
DESCRIPTION	DWG. NO.	APP. DATE

PREPARED BY:
SPECIALTY ENGINEERING, INC.
BRISTOL, PA

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL ENGINEER — LUNG-YANG LAI — No. 40072-E

February 11, 2008

CITY OF PHILADELPHIA

RECONSTRUCTION OF THE SOUTH STREET BRIDGE FROM 33rd STREET TO 27th STREET STAIRWAY STRUCTURE AT PIER 11 GENERAL PLAN

CORRECT — PROJECT MANAGER, SPECIALTY ENGINEERING, INC.

APPROVED — CHIEF BRIDGE ENGINEER, CITY OF PHILADELPHIA

RECOMMENDED — DISTRICT BRIDGE ENGINEER

PLAN PREPARED FOR
CITY OF PHILADELPHIA
DEPARTMENT OF STREETS
BUREAU OF SURVEYS & DESIGN
BRIDGE SECTION

+ SUPPLEMENTAL DRAWINGS

DRAWN	FCS	DATE 9/30/2007
CHECKED	LAB	DATE 9/30/2007
SHEET NO. 1 OF 10	8 - 2007 - STAIR -1	

2/11/2008 CM
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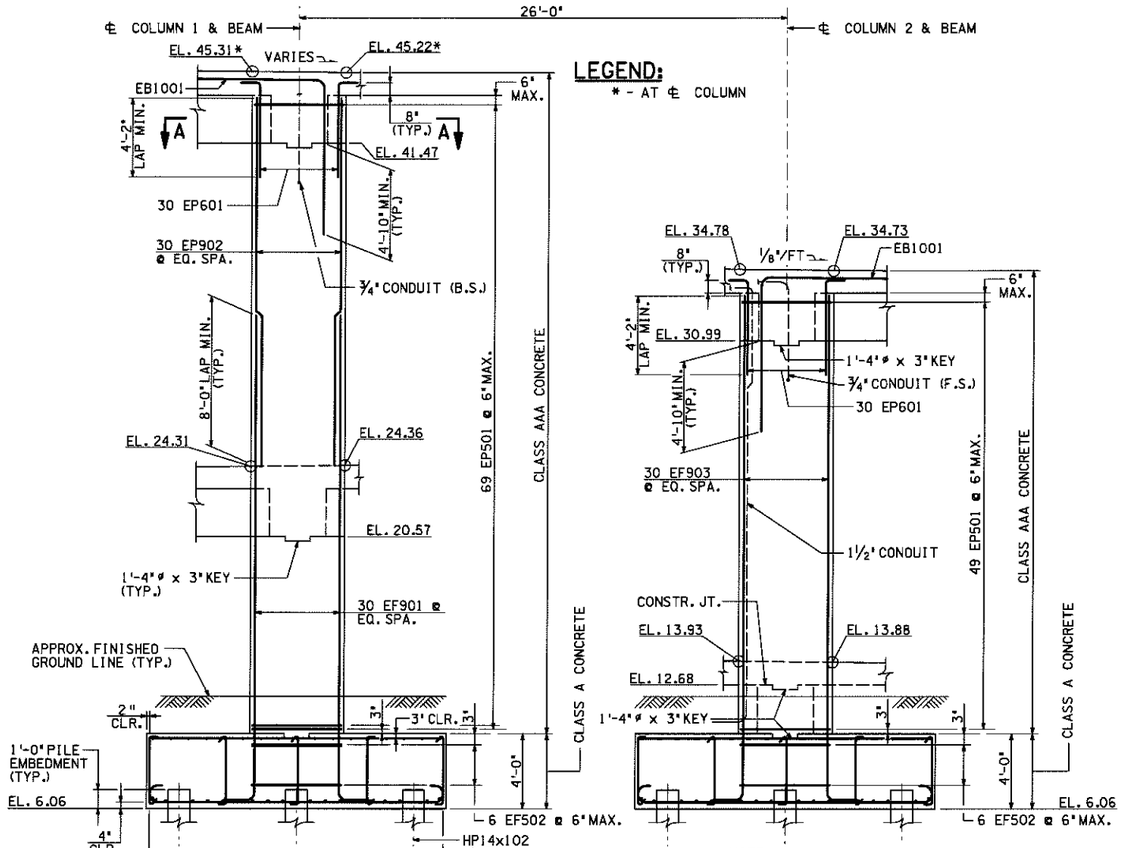


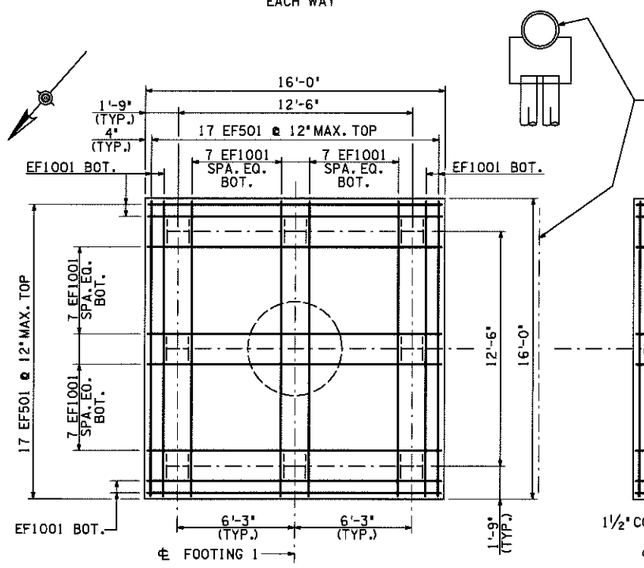
LEGEND:

* - AT ℄ COLUMN

NOTE:
FOR INFORMATION NOT SHOWN REFER TO FOOTING 1 & COLUMN 1.

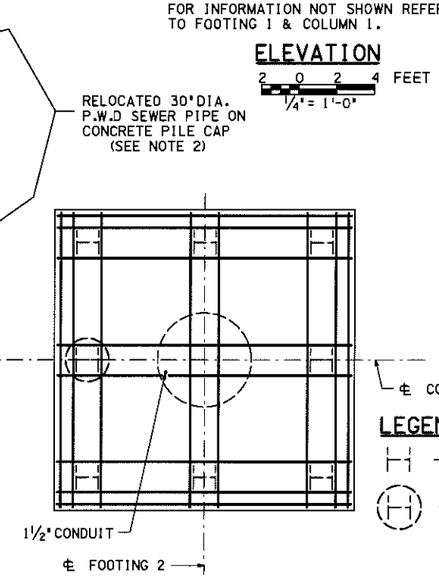
ELEVATION

2 0 2 4 FEET
¼" = 1'-0"



FOOTING PLAN

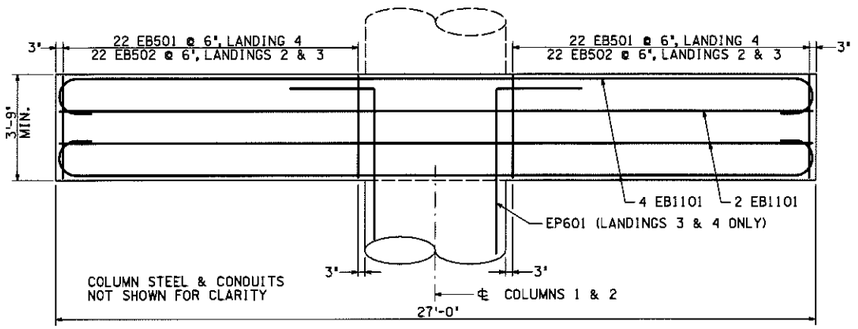
2 0 2 4 FEET
¼" = 1'-0"



NOTE:
FOOTING 2 SAME AS FOOTING 1.

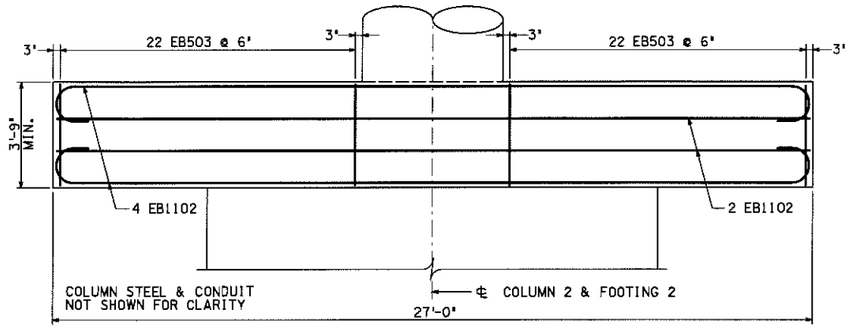
LEGEND:

- DENOTES BEARING PILE
- DENOTES TEST PILE



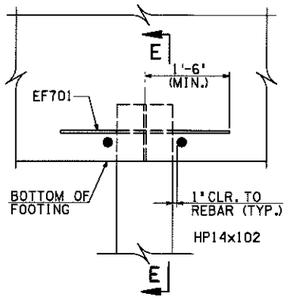
TRANSVERSE BEAM ELEVATION - LANDINGS 2, 3 & 4

0 1 2 3 FEET
⅜" = 1'-0"



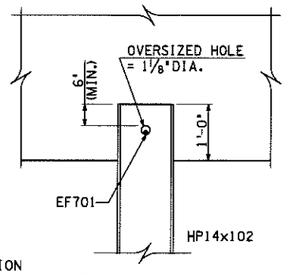
TRANSVERSE BEAM ELEVATION - LANDING 1

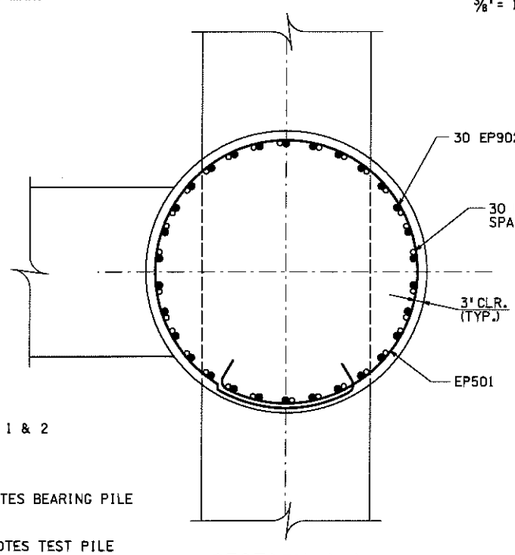
0 1 2 3 FEET
⅜" = 1'-0"



H-PILE ANCHORAGE

2 0 2 INCHES
¾" = 1'-0"





SECTION A-A

12 0 12 INCHES
¾" = 1'-0"

NOTES:

1. WORK THIS SHEET WITH SHEETS:
   STAIRWAY REINFORCING PLAN
   STAIRWAY SECTIONS I
   STAIRWAY SECTIONS II
   STAIRWAY BEAM DETAILS
2. CONTRACTOR TO FIELD VERIFY LOCATION OF RELOCATED P.W.D STORM SEWER PIPE PRIOR TO CONSTRUCTION OF FOUNDATION. CONTRACTOR TO PROVIDE THE MEANS AND METHODS NECESSARY TO PROTECT AND MAINTAIN THE PIPE DURING CONSTRUCTION. COST IS INCIDENTAL TO THE COST OF CONSTRUCTION OF THE STAIWAY STRUCTURE.

SECTION E-E

12 0 12 INCHES
¾" = 1'-0"

Mark	Description	By	Chk'd.	Recm'd.	Date
REVISIONS					

PREPARED BY:
SPECIALTY ENGINEERING, INC.
BRISTOL, PA

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL ENGINEER — LUNG-YANG LAI

CITY OF PHILADELPHIA

RECONSTRUCTION OF THE SOUTH STREET BRIDGE FROM 33rd STREET TO 27th STREET STAIRWAY STRUCTURE AT PIER 11 STAIRWAY COLUMNS & FOOTINGS

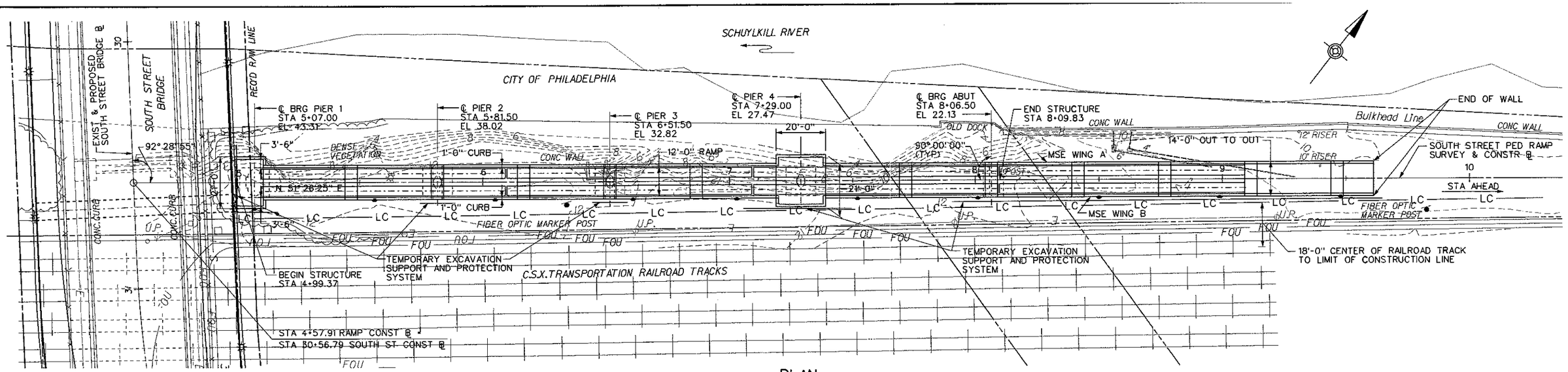
PLAN PREPARED FOR
CITY OF PHILADELPHIA
DEPARTMENT OF STREETS
BUREAU OF SURVEYS & DESIGN
BRIDGE SECTION

02-12-08
RECOMMENDED

DRAWN	FCS	DATE 9/30/2007
CHECKED	LAB	DATE 9/30/2007
SHEET NO. 8 OF 10	8 - 2007 - STAIR - 8	

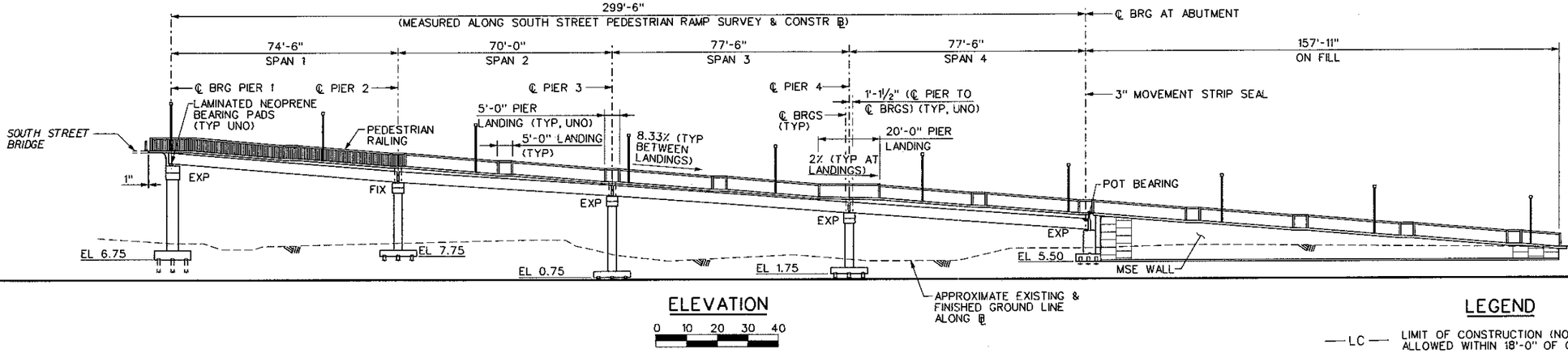
2/7/2008 ...\column.dgn CM

SOUTH STREET BRIDGE TO THE SCHUYLKILL RIVER TRAIL



PLAN

0 10 20 30 40



ELEVATION

0 10 20 30 40

ESTIMATED PILE TIP ELEVATIONS	
LOCATION	ELEVATION
PIER 1	-28.0
PIER 2	-28.0
PIER 3	-28.0
PIER 4	-28.0
ABUTMENT	-28.0

NOTE:

1. FOR VERTICAL GEOMETRY SEE ROADWAY PLANS.

LEGEND

—LC— LIMIT OF CONSTRUCTION (NO CONSTRUCTION ACTIVITIES ALLOWED WITHIN 18'-0" OF CENTERLINE OF THE RAILROAD TRACK)

DESCRIPTION	DWG NO	APP. DATE
CLASSIFICATION OF EARTHWORK FOR STRUCTURES	RC-11M	4-15-04
BACKFILL AT STRUCTURES	RC-12M	3-30-06
ELECTRICAL DETAILS	BC-721M	7-29-06
PERMANENT METAL DECK FORMS	BC-732M	7-24-06
ANCHOR SYSTEMS	BC-734M	4-15-04
WALL CONSTRUCTION & EXPANSION JOINT DETAILS	BC-735M	1-21-03
REINFORCEMENT BAR FABRICATION DETAILS	BC-736M	1-21-03
CONCRETE DECK SLAB DETAILS	BC-752M	7-29-05
BEARINGS	BC-755M	7-29-05
STEEL PILE TIP REINFORCEMENT & SPLICES	BC-757M	1-21-03
NEOPRENE STRIP SEAL DAM	BC-767M	7-24-06
MISCELLANEOUS PRESTRESS DETAILS	BC-775M	7-29-05
TYPICAL WATERPROOFING AND EXPANSION DETAILS	BC-788M	1-21-03
GENERAL NOTES AND LEGENDS FOR SOIL/ROCK DESCRIPTION	BC-795M	1-21-03
MECHANICALLY STABILIZED EARTH RETAINING WALLS	BC-799M	7-24-06

SUPPLEMENTAL DRAWINGS

REFERENCES:

	SHEET:
1. GENERAL NOTES	2
2. SLOPE DRAINAGE PROTECTION DETAIL	2
3. QUANTITIES	3-4
4. TYPICAL SECTION	4
5. DECK ELEVATIONS	28
6. BRIDGE LOAD RATINGS	5

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL — AUDREY ANN CORRADO — ENGINEER PE062425

REGISTERED PROFESSIONAL ENGINEER

DATE: 2/11/08

PREPARED BY
MICHAEL BAKER JR., INC
1818 MARKET STREET, SUITE 3005
PHILADELPHIA, PA 19103-3681

Mark	Description	By	Chk'd.	App'd.	Date
REVISIONS					

SCHUYLKILL RIVER DEVELOPMENT CORPORATION

PHILADELPHIA COUNTY
SCHUYLKILL RIVER PARK TRAIL

SOUTH STREET RAMP TO SCHUYLKILL RIVER PARK TRAIL
4 SPAN COMPOSITE P/S CONCRETE BOX BEAM BRIDGE
GENERAL PLAN & ELEVATION

RECOMMENDED _____

SHEET 1 OF 33

BPAA 672611

Design:	BTD
Drawn:	EAR
Checked:	KMA

E:\SOUTHST_RAMP\STRUCTURES\FINALS\SOUTH_GPE.DGN 2/11/2008 E:\SOUTHST_RAMP\STRUCTURES\FINALS\SOUTH_GPE.PRF

KLEINFELDER

800 E. WASHINGTON STREET
WEST CHESTER, PA 19380
(610) 430-7866 FAX(610) 430-7872

TEST BORING LOG

TB-01

PROJECT NAME: South Street Pedestrian Bridge | **PROJECT NUMBER:** 6254-01-G
PROJECT LOCATION: Philadelphia, PA | **P~H REPRESENTATIVE:** EAD
DRILLING CONTRACTOR: Site Blauvelt Engineering | **DRILLED BY:** Pat Flaherty
DATE STARTED: 6/14/05 | **DATE FINISHED:** 6/14/05
BORING ELEVATION: ±10 ft.phila.datum **TOTAL DEPTH:** ±34.2 ft.BGS **WATER DEPTH:** ±10.5 ft.BGS
COMMENTS:

ELEVATION/ DEPTH (ft)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	SAMPLE NUMBER	BLOW COUNTS
B.O.F. 7.75 (PIER 2)				
B.O.F. 6.75 (PIER 1)				
10 / 0		FILL: Black Cinder	S-1	2-3-3-6
		FILL: Black Cinder, Pieces of Red Brick, Brown Fine to Medium Sand w/Silt	S-2	14-16-18-24
		FILL: Black Cinder, Pieces of Red Brick, Medium Brown Silt	S-3	16-8-8-6
		FILL: Black Cinder, Pieces of Red Brick, Medium Brown Sandy Silt, Fine Gravel	S-4	8-10-11-6
		FILL: Damp Dark Brownish Gray Sandy Silt, Fine Gravel, Rock Fragments	S-5	4-4-4-4
0 / 10				
		FILL: Dark Brown Wet Silty Sand, Gravel, Dark Grayish Brown Organic Matter	S-6	1-2-2-24
		FILL: Wood from 15.0-17.0'		
		FILL: Damp Medium Brown Silt with Clay and Fine to Medium Sand, Gravel	S-7	2-2-3-2
-10 / 20		"Petroleum-Like" Odor @ 20'		
		Very Wet Brownish Gray Sandy Silt with Gravel	S-8	9-6-4-3
		Wet Brownish Gray Silt with some Clay and Medium Sand	S-9	3-3-3-13
-20 / 30				
		Dark Grayish Brown Weathered Schist with Medium Sand and Silt	S-10	70-50/0"
		34.2 ft. - End of Test Boring - Auger Refusal		
B.P.E. -28.00				
-30 / 40				
-40 / 50				
-50 / 60				
-60 / 70				

KLEINFELDER

800 E. WASHINGTON STREET
WEST CHESTER, PA 19380
(610) 430-7866 FAX(610) 430-7872

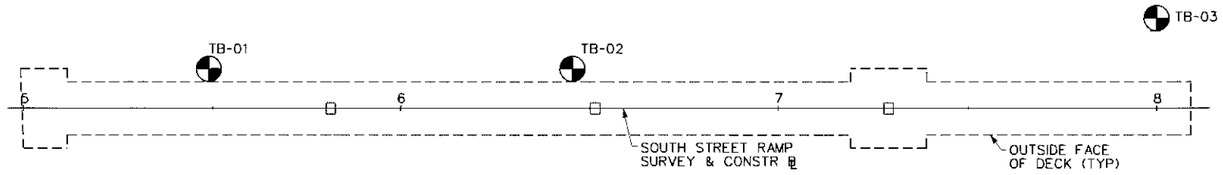
TEST BORING LOG

TB-02

PROJECT NAME: South Street Pedestrian Bridge | **PROJECT NUMBER:** 6254-01-G
PROJECT LOCATION: Philadelphia, PA | **P~H REPRESENTATIVE:** EAD
DRILLING CONTRACTOR: Site Blauvelt Engineering | **DRILLED BY:** Pat Flaherty
DATE STARTED: 6/15/05 | **DATE FINISHED:** 6/15/05
BORING ELEVATION: ±11 ft.phila.datum **TOTAL DEPTH:** ±44.1 ft.BGS **WATER DEPTH:** ±11.5 ft.BGS
COMMENTS:

ELEVATION/ DEPTH (ft)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	SAMPLE NUMBER	BLOW COUNTS
10 / 0		FILL: Black Cinder, Black Organic Material	S-1	2-2-2-3
		FILL: Black Cinders w/Silty Fine to Medium Sand, Gravel	S-2	6-5-5-5
B.O.F. 5.50 (ABUT.)		FILL: Damp Dark Brownish Gray Silt with Black Cinder and Brick Fragments	S-3	3-5-3-4
		FILL: Dark Brownish Gray Silt with Fine Sand, Black Cinder and Brick Fragments	S-4	9-9-10-8
B.O.F. 1.75 (PIER 4)		No Recovery; Coarse Gravel coming up with Auger	S-5	6-6-6-6
B.O.F. 0.75 (PIER 3)				
0 / 10				
		FILL: Wet Dark Gray/Brown Fine to Medium Sand and Silt	S-6	1-1-2-1
		FILL: Wood from 15.0-17.0'		
		FILL: Wet Dark Grayish Brown Sandy Silt with Gravel and Piece of Black Coal	S-7	6-4-5-7
-10 / 20		FILL: Gravel and Sandy Silt		
		FILL: Wood from 23-23.5	S-8	100/1"
		No Recovery	S-9	5-12-3-5
-20 / 30		Dark Gray Organic Silt with Fine Sand	S-10	2-3-3-3
B.P.E. -28.00		Wet Dark Grayish Brown Sandy Silt	S-11	5-3-5-5
-30 / 40				
		Light Gray and White Weathered Schist	S-12	42-50/0"
		44.1 ft. - End of Test Boring - Auger Refusal		
-40 / 50				

NOTES
B.O.F. - BOTTOM OF FOOTING (ESTIMATED)
B.P.E. - BOTTOM OF PILE ELEVATION (ESTIMATED)



BORING LOCATION PLAN
0 10 20 30 40

Mark	Description	By	Chk'd.	App'd.	Date
REVISIONS					

PREPARED BY
MICHAEL BAKER JR., INC
1818 MARKET STREET, SUITE 3005
PHILADELPHIA, PA 19103-3681

SCHUYLKILL RIVER DEVELOPMENT CORPORATION

PHILADELPHIA COUNTY
SCHUYLKILL RIVER PARK TRAIL

SOUTH STREET RAMP TO SCHUYLKILL RIVER PARK TRAIL
4 SPAN COMPOSITE P/S CONCRETE BOX BEAM BRIDGE
BORING LOG 1 & 2

RECOMMENDED _____

SHEET 32 OF 33

BPAA 672611

Design
Drawn
Checked

E:\SOUTHST.RAMP\STRUCTURES\FINAL\SOUTH.BOR1.DGN 2/11/2008 E:\SOUTHST.RAMP\STRUCTURES\FINAL\SOUTH.BOR1.PRF

KLEINFELDER
800 E. WASHINGTON STREET
WEST CHESTER, PA 19380
(610) 430-7866 FAX(610) 430-7872

TEST BORING LOG

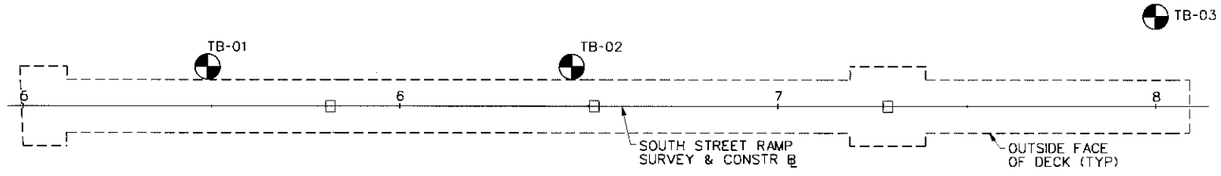
TB-03

PROJECT NAME: South Street Pedestrian Bridge
PROJECT NUMBER: 6254-01-G
PROJECT LOCATION: Philadelphia, PA
P~H REPRESENTATIVE: EAD
DRILLING CONTRACTOR: Site Blauvelt Engineering
DRILLED BY: Pat Flaherty
DATE STARTED: 6/16/05
DATE FINISHED: 6/16/05
BORING ELEVATION: ±4.5 ft.phila.datum **TOTAL DEPTH:** ±39.5 ft.BGS **WATER DEPTH:** ±0 ft.BGS
COMMENTS: Boring Located 27' Into River From Bulkhead

ELEVATION/ DEPTH (ft)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	SAMPLE NUMBER	BLOW COUNTS
0		Water Surface		
FILL: Dark Grayish Brown Silt with Coarse Sand, Gravel and some Wood; "Petroleum-Like" Odor			S-1	3-3-27-25
FILL: Very Oily Wood with Dark Gray Silt; "Petroleum-Like" Odor			S-2	11-3-3-4
B.P.E. -28.00		No Recovery	S-3	5-4-4-3
-30		Dark Gray Silt with Gravel and Clay	S-4	1-1/12"-1
		Dark Gray Silt with Gravel and Clay	S-5	1-1-1-1
		Dark Gray SILT and Fine to Medium SAND, Trace Clay	S-6	2-3-15-26
-40		Dark Gray and White Weathered Schist	S-7	16-100/1"
		39.5 ft. - End of Test Boring - Auger Refusal		

0, 10, -10, 20, -20, 30, -30, 40, -40, 50, -50, 60, -60, 70

NOTES
B.O.F. = BOTTOM OF FOOTING (ESTIMATED)
B.P.E. = BOTTOM OF PILE ELEVATION (ESTIMATED)



BORING LOCATION PLAN
0 10 20 30 40

Mark	Description	By	Chk'd.	App'd.	Date
REVISIONS					

PREPARED BY
MICHAEL BAKER JR., INC
1818 MARKET STREET, SUITE 3005
PHILADELPHIA, PA 19103-3681

SCHUYLKILL RIVER DEVELOPMENT CORPORATION

PHILADELPHIA COUNTY
SCHUYLKILL RIVER PARK TRAIL

SOUTH STREET RAMP TO SCHUYLKILL RIVER PARK TRAIL
4 SPAN COMPOSITE P/S CONCRETE BOX BEAM BRIDGE
BORING LOG 3

RECOMMENDED _____

SHEET 33 OF 33

BPAA 672611

Design:
Drawn:
Checked:

E:\SOUTHST-RAMP\STRUCTURES\FINAL\SOUTH-BOR2.DGN 2/11/2008 E:\SOUTHST-RAMP\STRUCTURES\FINAL\SOUTH-BOR2.PRF

APPENDIX K

QA FORM

D-517 (5-12)
REPRODUCE LOCALLY

SHEET NO. 1 OF 4

QUALITY ASSURANCE FORM FOR FINAL DESIGN OF FLEXIBLE RETAINING WALLS

Designer: JOHN E. FEDERICO, P.E., P.P., A.I.C.P. / URBAN ENGINEERS, INC. Date: OCT. 2013
(DESIGN OFFICE & NAME OF DESIGNER)

1. PROJECT INFORMATION

SCHUYLKILL RIVER TRAIL

Project MPMS/ECMS No.: _____

County: PHILADELPHIA S.R.: 6 Sec.: _____ Along: SCHUYLKILL RIVER
(STREAM, RAILROAD, OR ROAD)

S-No.: _____ Stations: Begin Wall 112+54.00 ; End Wall 113+44.00

2. GEOMETRIC DESIGN INFORMATION

Wall Type: Permanent ☒ or Temporary ☐

Cantilever ☒ or Tie Back/Anchored ☐

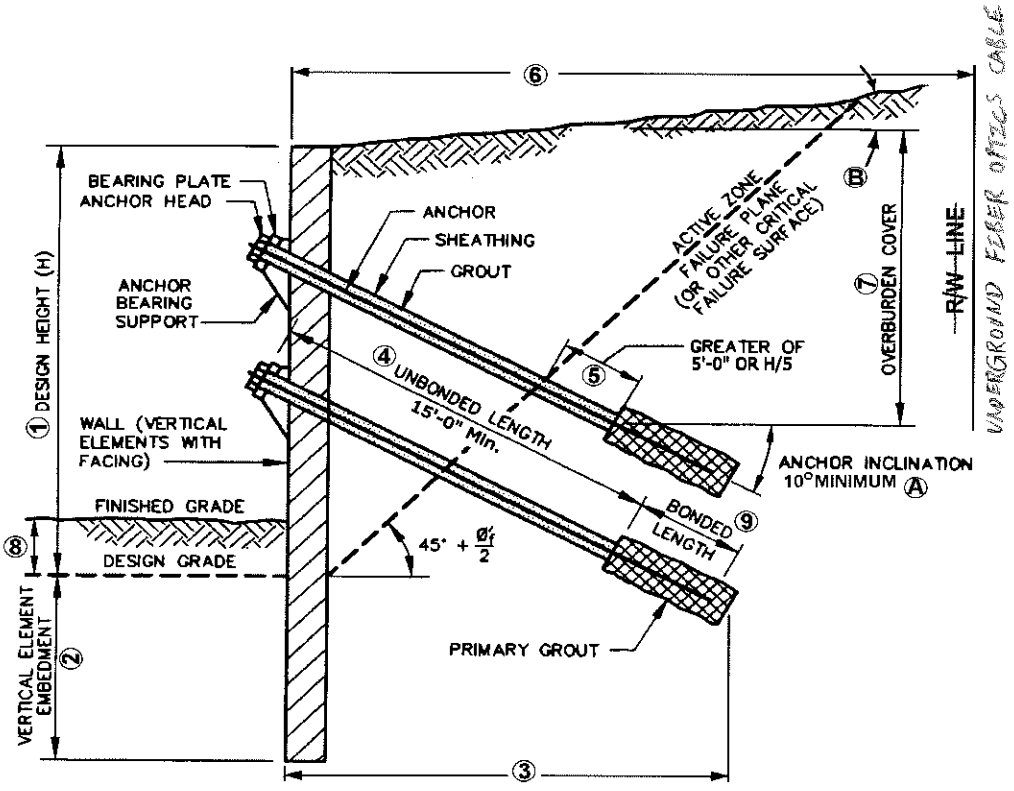
If Tie Back/Achored Wall, No. of Anchors per Vertical Element: N/A

Permanent Tie Back/Anchored Walls:

Method of Installation: Top Down ☒ or Bottom Up ☐

Lagging Type: Precast ☒ ; Timber ☐ or N / A ☐

Support/Pile Type: Double Pile ☐ ; Single Pile ☒ or Internal ☐



QUALITY ASSURANCE FORM FOR FINAL DESIGN OF FLEXIBLE RETAINING WALLS

Designer: JOHN E. FEDERICO, P.E., P.P., A.I.C.P. / URBAN ENGINEERS, INC. Date: OCT. 2013
(DESIGN OFFICE & NAME OF DESIGNER)

Design Dimensions →

1 = 14.0 ft.; Calc. Page 10

2 = 12.2 TO 19.0 (VARIES) ft.; Calc. Page 10

3 = N/A ft.; Calc. Page –

4 = N/A ft.; Calc. Page –

5 = N/A ft.; Calc. Page –

6 = 19.0 ft.; Calc. Page 10

7 = N/A ft.; Calc. Page –

8 = 6.0 ft.; Calc. Page 10

9 = N/A ft.; Calc. Page –

Angles →

A = N/A Degrees; Calc. Page –

B = 0 Degrees; Calc. Page 10

3. SOIL AND FOUNDATION DATA

In-Situ Soil Type: SANDY SILT TO SILTY GRAVEL ; Calc. Page 4-5

Moist/Saturated Unit Density = 110/115 ~~kcf~~ pcf, Cohesion (c) = 0 kcf; Calc. Page

Angle of Internal Friction = 25° ; Calc. Page

Stability Number (N) (D3.11.5.7) = N/A ≤ 3.0; Calc. Page

Foundation Material:

Soil ☒ Rock ☒ ELASTIC SILT/RESIDUAL/BEDROCK ; Calc. Page

Type ELASTIC SILT/SILTY SAND/SCHIST AND AMPHIBOLITE ; Calc. Page

Moist/Saturated Unit Density = ~~110/135/150~~ 105/130/150 kcf; Cohesion (c) = 0/0/10.0 ~~kcf~~ ksf; Calc. Page

Angle of Internal Friction = 21°/35°/0° ; Calc. Page

Stability Number (N) (D3.11.5.7) = N/A ≤ 3.0; Calc. Page ✓

Foundation Design:

Pressure: Resistance = N/A ; Actual = N/A ; Calc. Page –

Settlement: Allowable = 1.0" ; Actual = < 1.0" ; Calc. Page –

QUALITY ASSURANCE FORM FOR FINAL DESIGN OF FLEXIBLE RETAINING WALLS

Designer: JOHN E. FEDERICO, PE, PP, AICP / URBAN ENGINEERS, INC Date: OCT 2013
(DESIGN OFFICE & NAME OF DESIGNER)

Slope Stability Analysis Performed? Yes ☒ No ☐ (GSTABL) ; Calc. Page 25-27

Bearing Resistance = N/A ; Calc. Page —

Maximum Bearing Pressure = N/A ; Calc. Page —

Live Load Surcharge Used = N/A ; Calc. Page —

Earth Pressure Used: Active ☒ Passive ☒ ; Calc. Page 10-14

4. VERTICAL ELEMENT DATA

Type: CAISSON ; Size: 2.5' DIA. CAISSON ; Calc. Page 10-14

Spacing: 8.0 FT ; Embedment Length = 12.2 TO 19.0 FT (VARIES) Calc. Page 10-14

Design Checked for Staged Construction? Yes ☐ No ☒ ; Calc. Page —

Corrosion Protection UTILIZE GALVANIZED STEEL

Special Details: N/A

5. ANCHOR DATA N/A

Type: _____ ; Calc. Page _____

Size: _____ ; Spacing: _____ ; Calc. Page _____

Loads: Resistance = _____ ; Design: _____ ; Calc. Page _____

Bond Length based on: Soil ☐ Rock ☐ ; Calc. Page _____

Corrosion Protection _____

Is Anchor Installation Procedure included? Yes ☐ No ☐

6. LAGGING AND FACING DATA

Lagging: Temporary ☐ Permanent ☒ ;Calc. Page —

Type: PRE-CAST CONCRETE PANEL ; Calc. Page —

Maximum Design Bending Moment = N/A ; Calc. Page —

QUALITY ASSURANCE FORM FOR FINAL DESIGN OF FLEXIBLE RETAINING WALLS

Designer: JOHN E. FEDERICO, P.E., P.P., A-I.C.P / URBAN ENGINEERS, INC. Date: OCT. 2013
(DESIGN OFFICE & NAME OF DESIGNER)

Facing: Cast-in-Place Concrete ☐ Precast Concrete ☐ N/A ; Calc. Page _____

Concrete Class = _____; Thickness = _____ ; Calc. Page _____

Reinforcement: Wire Mesh ☐ or Bars ☐ ; Calc. Page _____

Plain ☐ or Epoxy-Coated ☐; Calc. Page _____

Maximum Design Bending Moment = _____ ; Calc. Page _____

Attachment Details Designed? Yes ☐ No ☐; Calc. Page _____

7. DRAINAGE DETAIL DATA

Are Drainage Panels provided behind wall? Yes ☐ No ☐

Do Drainage Panels extend full height of wall? Yes ☐ No ☐

Is Insulation provided to prevent freeze/thaw damage Yes ☐ No ☒

8. MISCELLANEOUS DATA N/A

If Tie Back/Anchored Wall is in a fill situation, is the necessary approval from the Chief Bridge Engineer included with the submission? Yes ☐ No ☐

For Tie Back/Anchored Walls, do the plans and special provisions for this submission contain the proof, performance, creep, and lift off testing of the anchors? Yes ☐ No ☐

9. COMMENTS

_____

_____

_____

_____

APPENDIX L

SPECIAL PROVISION

SPECIAL PROVISION
FOR
DESIGN-BUILD RETAINING WALL

SPECIAL BIDDING – DESIGN-BUILD

The Retaining Wall component of this project will utilize the Design-Build method of contracting. This component will be included in the overall contract between the Owner and the successful Bidder.

I. DESIGN ACTIVITIES

Design activities include:

- DESIGN OF RETAINING WALL (AS DESIGNED FOUNDATION PROVIDED)

II. REVIEW SUBMISSION CONTACTS

Include all design activities, submission dates, and review periods in the construction schedule. Include the submission schedule in the Quality Plan. Make all required submissions for each design activity to the Owner Representative, as defined in **Section 011000 – Summary**.

III. SUBMISSION REQUIREMENTS/REVIEW TIMES:

The following table provides the required number of plans and/or documents and the schedule of review times for complete submissions. Partial submissions, where specified, will be reviewed in the time specified below for each submission. Partial submissions will require the submission of the number of plan sets and calculations specified below for the applicable design activity. Be responsible for reproduction costs for submissions and final drawings, including providing the Owner with two half-size sets of all final drawings for use during construction, in addition to any copies specified below.

Item	Plan Sets	Sets of Calculations	Initial Submission Review Time (working days)	Subsequent Submission Review Time (working days)
Quality Plan	2	2	10	5
Preliminary Structure Plans	2	2	10	5
Final Structure Plans	2	2	10	5
Foundation Submission *	2	2	10	5
As-Built Plans	2	2	10	5

* Only applicable if “Alternate Wall” specification is used

Review times begin and end when a submission is logged in and out, respectively, by all designated reviewers. The login time will be taken as the latest date in which the submission is received by the reviewers. Submittals received after 11:00 a.m. will be logged in as the next working day following receipt of the submission. For electronic submissions, the login time will be taken when the appropriate reviewer and Owner Representative receive an email stating a submission is ready for review. Logout time occurs when the reviewer sends an email to the Contractor with an approval and/or comments. If a submission is incomplete or otherwise requires additional information or data to complete the review properly, the review time will begin as specified for the submission when all required information is received.

Additional contract time or price adjustment to any contract items will not be considered due to failure to obtain approvals within the specified review times resulting from incomplete or non-conforming submissions. Working days are weekdays, Monday through Friday, excluding official holidays. Include all review periods identified above as activities in the project schedule.

IV. GENERAL DESIGN REQUIREMENTS

Have the design completed by a Professional Engineer licensed in the State. Have all surveys completed by a Professional Land Surveyor licensed in the State. Provide all Professional Engineer's seals in accordance with Pa. Code § 37.59.

Provide the Design Engineer's P.E. seal, the date signed, and business name and address on the first sheet of all computations, including computations for partial submissions. Provide the appropriate seal and signature on plan sheets in accordance with the Pennsylvania Department of Transportation's Design Manuals. Also, provide the Design Engineer's P.E. seal, signature, and date signed on the first sheet of all computations, including computations for partial plans submissions.

Designs copied directly from Pennsylvania Department of Transportation Standard Drawings need not be documented through independent computations. List such designs on the submission by referencing the drawing number of the applicable standard, and the sheet number, table, or graph.

Experimental or demonstration-type design concepts, products, structures, or elements not pre-approved by the Owner for general usage at the time of bid, will not be allowed. Designs that take advantage of any errors and/or omissions in the following requirements will not be accepted. In the event any such error, omission, or discrepancy is discovered, immediately notify the Owner. Failure to notify the Owner will constitute a waiver of all claims for misunderstanding, ambiguities, or other situations resulting from the error, omission, or discrepancy.

Final Plans must include a note on all tabulation of quantities sheets included therein that states "Item numbers and descriptions listed in Tabulations are solely for the purposes of identifying the specified units of work and locations, and are not to be construed as contract or pay items."

Design and construct any support of excavation required by any Design Activities identified in Section I of this Special Provision in accordance with the Special Provision titled TEMPORARY EXCAVATION SUPPORT AND PROTECTION SYSTEM FOR DESIGN-BUILD PROJECTS.

During construction, Contractor's engineer shall be responsible for reviewing and approving shop drawings. A copy of each shop drawing must also be submitted to Owner.

Design Specifications

Perform the design activities identified in Section I, Design Activities, in accordance with the latest published edition of all Pennsylvania Department of Transportation Standards, Specifications, Regulations, Strike-off Letters, and other industry standards, at the time of advertisement, unless directed otherwise, or as identified in the bid package. These include, but are not limited to the following:

- Special Provisions;
- Publication 408, Specifications
- Publication 72M, Standards for Roadway Construction
- Publication 218M, Standard Drawings for Bridge Design
- Publication 219M, Standard Drawings for Bridge Construction
- Publication 10 Design Manual Part 1 – Transportation Program Development and Project Delivery Process
- Publication 10A Design Manual Part 1A – Pre-TIP and TIP Program Development Procedures
- Publication 10B Design Manual Part 1B – Post-TIP NEPA Procedures
- Publication 10C Design Manual Part 1C – Transportation Engineering Procedures
- Publication 10X Design Manual Part 1X – Appendices to Design Manuals 1, 1A, 1B, and 1C
- Publication 13M Design Manual Part 2 – Highway Design
- Publication 14M Design Manual Part 3 – Plans Presentation
- Publication 15M Design Manual Part 4 – Structures
- Publication 16M Design Manual Part 5 – Utility Relocation
- Publication 584, Drainage Manual
- Publication 46, Traffic Engineering Manual
- Publication 149, Traffic Signal Design Handbook

- Publication 35, Approved Construction Materials
- Publication 203, Work Zone Traffic Control
- Publication 213, Temporary Traffic Control Guidelines
- Publication 222, Subsurface Boring, Sampling, and Testing Contract
- Publication 293, Geotechnical Engineering Manual
- Publication 378, Right-of-Way Manual
- Pa Code Title 67, Chapter 204, Guidelines to Implement Act 229 of 2002, Additional Traffic Control Devices in Highway Work Zones, Statement of Policy
- Pa Code Title 67, Chapter 212, Official Traffic Control Devices (Publication 212)
- Publication 236M, Handbook of Approved Signs
- Publication 242, Pavement Policy Manual
- Publication 281, Waste Site Evaluation Procedures for Highway Project Development Process;
- Publication 371, Grade Crossing Manual
- Publication 122M, Surveying and Mapping Manual
- Publication 111M, Traffic Control – Pavement Markings and Signing Standards
- Publication 148, Traffic Standards – Signals
- Publication 611, Waste Management Guidance Manual
- Publication 7, Items Catalog
- Manual on Uniform Traffic Control Devices (FHWA)
- A Policy on Geometric Design of Highway and Streets, AASHTO "Green Book"
- A Policy on Design Standards – Interstate System (AASHTO)
- AASHTO Guide Specifications for Horizontally Curved Highway Bridges
- AASHTO LRFD Bridge Design Specifications or, when applicable, AASHTO Standard Specifications for Highway Bridges

The design should be performed using the most conservative design criteria from the sources listed above. In the event that a clear order of predominance cannot be established, or a difference in interpretation of the design cannot be resolved, the Owner Representative will be the arbiter and his/her decision will be final. For bridge/structures related design activities, refer to the "Bridge/Structures Related Effective Policy Letters" for additional design policy Strike-Off Letters that are applicable to the structure design.

In the event that certain design parameters, stresses, or specifications are in conflict regarding bridge/structures related design activities, the following order of predominance governs:

- Design requirements listed herein and addenda (addendum) to the proposal.
- Design related Strike-Off Letters in effect on the date of project advertisement.
- Publication 15M Design Manual Part 4, Structures
- Publications 218M and 219M Standard Drawings for Bridge Design and Bridge Construction
- AASHTO LRFD Bridge Design Specifications or, when applicable, AASHTO Standard Specifications for Highway Bridges

The design should be performed using the most conservative design criteria from the sources listed above. In the foregoing instances, in the event that a clear order of precedence cannot be established, or a difference in the interpretation of the design criteria, standards, specifications, or methodology cannot be resolved, the Owner Representative will be the arbiter and whose decision will be final.

V. SCHEDULE OF VALUES

Where indicated, partial payment for lump sum design-build items will be made on Current Estimate Payments based on the amount of work completed during the estimate period based on a payout schedule (Schedule of Values). The Owner will base amount of the partial payments on the total value of the work performed to the date of the estimate cut-off, less payments previously made, in accordance with the approved Schedule of Values.

Prepare a Schedule of Values for each lump sum Item associated with the design or construction of the Design Activities identified in Section I of this Special Provision, where the Special Provision for that "Design" or "Construct" Item indicates lump sum measurement and payment by Schedule of Values, using the attached Schedule of Values template as a guide. Hereinafter, Design Items are defined as the Contract Item associated with the Design Activities identified in Section I, and Construct Items are defined as the Contract Item associated with the construction of the Design Activities identified in Section I. Distribution of payments among Schedule of Values Components must bear a reasonable resemblance to the actual value of work.

(a)For Design items, if a Component is not applicable, indicate 0%; otherwise do not indicate values less than 5% in any Component. Include those Schedule of Values Components identified in the associated Design Item Special Provisions. Payment for Design Item Schedule of Values Components will be made in the amount of the approved percentage upon completion of the identified task. When Schedule of Values Components are identified in the Special Provisions with “Approval” in the Schedule of Values Component title, 75% of the approved percentage may be paid on the next estimate following login of that submission, and the remaining 25% of the approved percentage will be paid following approval of that submission. Otherwise, no partial payment will be made for Design Item Components.

(b)For Construct Item, include Schedule of Values Components relevant to the scope of work of the particular item, using the attached Schedule of Values template as a general guide. No partial payment will be made for Construct Item Schedule of Values Components. Accordingly, develop the Schedule of Values to include Schedule of Values Components in sufficient numbers and detail to be payable upon semi-monthly estimates throughout the duration of the Contract.

Submit the Schedules of Values to the Owner for review and approval. No estimate will be processed until all Schedules of Values are approved.

VI. CONSTRUCTION CONTACT

The Owner's contact for Current Estimate Payments as defined in Section 110.05 will be:

- The Project Manager identified in Section II of this Special Provision.

DESIGN OF RETAINING WALL

(AS DESIGNED FOUNDATION PROVIDED)

DESCRIPTION

This work is the design and preparation of construction plans for a retaining wall of the type indicated on the Owner's Conceptual Structure Plans or an alternate type retaining wall. Preparation of a Preliminary Structure Submission for the proposed retaining wall type is also required.

DESIGN

(a) General

The Owner's Conceptual Structure Plans represent a retaining wall type and layout that will meet safety, hydraulic, geometric, environmental, and load carrying capacity requirements for the project. A retaining wall type and configuration as that shown on the Conceptual Structure Plans or an alternate type retaining wall subject to the requirements specified herein may be designed and constructed. Prepare and submit a Preliminary Structure submission for the proposed retaining wall for review and approval.

Foundation type(s) along with geotechnical design parameters are provided for the retaining wall foundation. Use the foundation type(s) and design parameters (hereinafter referred to as "as-designed") to design the retaining wall or develop an alternate foundation type and design parameters subject to the limitations specified. Provide design and drawings in the units of measurement shown on the Conceptual Structure Plans.

Provide a complete set of computations for the retaining wall, excluding piles and drilled caissons. If an alternate foundation is proposed, also provide a complete set of computations for the proposed foundation type. Provide additional calculations, as requested by the Owner's Representative, to evaluate any details throughout the life of the contract.

Design wall for the models provided in Appendix M of the Preliminary Geotechnical Summary Report. No live load surcharge is required for design of the wall.

Structure types, concepts, construction sequencing, or other details that are not covered in the design and construction specifications or standards, or practice not commonly used in Pennsylvania are allowed only when specifically indicated herein. Where design or construction

that deviates from standard Pennsylvania Department of Transportation practice is proposed, submit a conceptual design before the Preliminary Structure Plans for review and approval. Include in the submittal conceptual plans, and a list of items that deviate from standard design and construction, including but not limited to design methodology, the computer program that will be used in the design, construction sequencing, and any specialized construction techniques. No extensions of contract time will be granted for pursuits of alternates or non-standard designs.

(b) Additional Designer Qualifications

None.

(c) Additional Information/Data Made Available to the Contractor by the Owner

The following information/data will be made available to the Contractor during the advertisement period: ***(List the following, as applicable)***

- Test Boring Core Boxes: Test boring core boxes are available for inspection. Contact ***Lane Fike at 215-222-6030*** to arrange for a date and time to inspect the core boxes.

(d) Design Specifications

Develop the Preliminary Structure Plans and prepare the structure construction plan in accordance with the Special Provision titled SPECIAL BIDDING – DESIGN-BUILD, Section IV – General Design Requirements, Design Specifications.

(e) Design Requirements

1. General

- Slip-formed barriers are not allowed.
- Lightweight concrete is not allowed.
- MSE walls are not allowed.
- Precast modular wall are not allowed.
- Precast barriers are not allowed.
- Barrier type differing from that shown on the Conceptual Structure Plan is not allowed.
- Post and Panel type walls are allowed.
- Permanent anchored walls <u>are not</u> allowed.

    - Driven piles are not permitted for use with precast concrete wall panels.
- Cast-In-Place concrete wall panels are allowed.
- Shotcrete wall panels or facing is not allowed.
- Timber lagging wall panels are not allowed.
- The base of the wall or wall panel must extend 6 feet minimum below the proposed ground line.
- Secant walls are not allowed.
- Reinforced Soil Slopes are not allowed.
- Soil Nail Walls are not allowed.
- Design for the presence of water behind the wall as shown on design models.
- Limit the allowable lateral deflection at the top of caissons to ½ inch for service condition
- Cast-in-place reinforced concrete walls supported on piles are allowed.
- Provide galvanized steel piles.
- Excavate according to OSHA or other applicable local, state, and federal regulations. Provide temporary shoring of excavated areas as necessary. It is the contractor's responsibility to ensure stability of the excavation.

2. Geometry

Design the structure according to the geometrics shown on the Conceptual Structure Plans, except changes will be allowed as follows:

- Horizontal Alignment: No Change Allowed.
- Vertical Alignment: No Change Allowed.
- Wall Length: No Change Allowed.

3. Seismic

Site Class is not Class E.

4. Maintenance of Traffic During Construction

Not Applicable.

5. Railroad Requirements

Design the wall to meet the following railroad requirements:

- Minimum Horizontal Clearance: CSX Railroad right-of-way line is located approximately 27 feet behind the front face of the proposed wall.
- Temporary Support for Railroad Tracks: Not Applicable.

6. Inspection and Maintenance Accessibility

Provide inspection and maintenance accessibility equivalent to that provided in the Conceptual Structure Plans, or alternate means acceptable to the Owner. In case of a disagreement on accessibility, the Owner Representative's decision will be binding.

7. On-Wall Lighting

None.

8. Waterway Requirements

None.

8.a. Structure Shown on the Conceptual Structure Plan:

See attached plans for Conceptual Structure Plan.

9. Environmental

Refer to **Section 026113 – Excavation of Contaminated Materials Handling**.

10. Utilities

Design the retaining wall to accommodate the existing utility facilities at the retaining wall.

Underground fiber optics cable is located approximately 19 feet behind the front face of the proposed retaining wall. Do not excavate any soils within 5 feet of the underground fiber optics cable. If necessary, utilize temporary excavation support system to avoid any disturbance to the underground fiber optics cable.

If utility relocations are required as part of an alternate structure, be responsible for securing approvals from the affected utility companies.

11. Other

None.

(f) Foundations

1. **General -** Design the retaining wall using as-designed geotechnical design parameters and requirements or an alternate foundation type as allowed herein.

    - The construction, including any temporary construction, is to be performed in accordance with PennDOT Publication 408. The Contractor is responsible for the stability of all excavated slopes. Perform all excavation in accordance with OSHA requirements.

    - Recommended wall type for the proposed retaining wall is a soldier pile and lagging wall. Allowable alternate wall type is a cast-in-place reinforced concrete wall supported on piles.

    - Design retaining wall so that none of the wall elements will encroach within 5.0 feet of existing underground fiber optic cable and do not extend into CSX Railroad right-of-way.

    - Utilize frost depth of 3.0 feet in design.

    - Consider extreme event condition (i.e., rapid draw down) in design.

    - Backfill behind the retaining wall in accordance with PennDOT Standard RC-12M. Structure backfill may consist of material meeting AASHTO No. 57 or PennDOT Open Graded Subbase (OGS) criterion.

    - Temporary shoring and/or stream diversion barriers along with dewatering techniques may be required for construction of substructure units.

    - Treat project location as potentially corrosive environment and corrosion protection measures are required.

- All excavated material shall be handled based on **Section 026113 – Excavation of Contaminated Materials Handling**.

- Provide riprap rock scour protection as per DM-4, Section PP.7.2.5 and as shown on the plans. Bottom of riprap shall extend to bottom of lagging elevation.

2. As-Designed Foundation - Use the following in conjunction with the foundation type(s) shown on the Conceptual Structure Plans:

2.a. Geotechnical Design Parameters

2.a.1. Spread Footings on Soil: Not Applicable.

2.a.2. Spread Footing on Rock: Not Applicable.

2.a.3. Pile Supported Footings: Not Applicable.

2.a.4. Drilled Caisson Supported Footings:

Bottom of Footing Elevation: Refer to the Conceptual Structure Plans

Estimated Length of Shaft in Soil: Refer to the Conceptual Structure Plans

Estimated Length of Shaft in Rock: Refer to the Conceptual Structure Plans

Estimated Length of Rock Socket: Refer to the Conceptual Structure Plans

Extend caissons a minimum of 5.0 feet into bedrock.

The caisson diameter is 2.5 feet with center-to-center spacing of 8.0 feet.

Utilize galvanized steel piles.

Design wall utilizing the models provided in Appendix M of the Preliminary Geotechnical Summary Report

2.a.5. Permanent Anchored Walls: Not Applicable.

2.b. Foundation Design Information

- The soldier pile wall must be designed in accordance with all requirements listed in the AASHTO 2010 LRFD Bridge Design Specifications and PennDOT Design Manual -4, 2012, including all revisions.

- Temporary casing may be required to maintain an open borehole. If temporary casing is utilized, maintain concrete levels above the bottom of casing at all times during extraction to prevent caved material from contaminating the concrete.

- Backfill caisson borehole within 24 hours after drilling to limit the deterioration of the bearing material.

- The minimum required pile size is W12 x 190.

- The caisson diameter is 2.5 feet.

- Place bottom of lagging at elevation -3.0 feet.

- Extend caissons a minimum of 5.0 feet into bedrock.

- If subsurface condition encountered during construction varies from what was encountered during subsurface exploration program, perform global stability analysis of the retaining wall as directed by the Engineer.

- Design soldier pile and lagging wall with the following parameters.

	Moist Unit Weight, pcf	Saturated Unit Weight, pcf	Internal Friction Angle, ϕ degrees	Cohesion, c, psf	Modulus of Subgrade Reaction, k, pci (above water /below water)	Axial Strain at 50% of Strength, ε50	p-y curve
Soil Retained Behind the Wall	110	115	25	0	25/20	-	Sand
Alluvial Soil Below Bottom of Lagging	105	110	21	0	25/20	-	Sand
Residual Soil	130	135	35	0	225/125	-	Sand
Bedrock	150	150	0	200,000[(1)]	-	-	Vuggy Limestone

[(1)] Unconfined compressive strength of bedrock.

- Perform lateral load analysis of caisson with LPILE or COM 624P program using parameters presented above. A maximum allowable deflection at the top of caisson is 0.5 inches.

- Design the soldier pile and lagging wall utilizing the following Load and Resistance Factors:
  - Load Factor:
  - Earth Horizontal = 1.5
  - Live Surcharge = 1.75
  - Hydrostatic Pressure = 1.0

  - Resistance Factor:
    - Passive Resistance = 0.75

- Hydrostatic Pressure = 1.0

- Fill the gap between permanent lagging and temporary timber lagging with AASHTO No. 57 coarse aggregate.
- Provide galvanized steel pile and utilize Type II Cement for corrosion protection
- Blasting is not permitted as a method of excavation.

2.c. Construction Requirements

2.c.1. Test Piles - Not Applicable.

2.c.2. Subgrade Preparation – Not Applicable.

2.c.3. Pile Dynamic Analysis – Not Applicable.

2.c.4. Load Tests – Not Applicable.

2.c.5. Settlement Monitoring – Not Applicable.

3. Relocated Retaining Wall Using the As-Designed Foundation

Relocation of Retaining Wall is not allowed.

4. Alternate Foundations – Alternate foundation designs must be completed in accordance with the "Alternate Walls" specification. Alternate walls are allowed as follows:

4.a. Allowable Foundation Types

Cast-in-place reinforced concrete wall supported on piles.

4.a.1. Geotechnical Design Parameter Limitations

Determine the applicable resistances to be used to design the substructures, limited to the maximum Ultimate Capacities given below. Designs utilizing Ultimate Capacities exceeding the maximum values indicated below will not be accepted.

4.a.2. Spread footings on Soil

Not Applicable.

4.a.3. Spread Footings on Rock

Not Applicable.

4.a.4. Pile Supported Foundations

Point Bearing Piles:

Ultimate pile capacity is limited to a maximum yield strength of 50 ksi.

Utilize 1/16 inch reduction in the pile section for design.

End Bearing Piles:

Ultimate pile capacity is limited a maximum yield strength of 50 ksi.

Utilize 1/16 inch reduction in the pile section for design.

- Support cast-in-place reinforced concrete wall on piles.
- A minimum pile length of 10.0 feet is required.
- Use a resistance factor of 0.35 to determine the axial structural pile resistance at the strength limit state.
- Use a resistance factor of 0.25 to determine the axial structural pile resistance at the service limit state.
- Drive piles to Case 2 Absolute End Bearing Refusal in bedrock in accordance with Pub. 408/2011, Section 1005.3(b)4. Use driving method A as per DM-4, Part A, Section 1.7.5.
- Design cast-in-place reinforced wall with following parameters.

	Moist Unit Weight, pcf	Saturated Unit Weight, pcf	Internal Friction Angle, ϕ degrees	Cohesion, c, psf	Modulus of Subgrade Reaction, k, pci (above water /below water)	Axial Strain at 50% of Strength, $\varepsilon 50$	p-y curve
Soil Retained Behind the Wall	110	115	25	0	25/20	-	Sand
Alluvial Soil Below Bottom of Lagging	105	110	21	0	25/20	-	Sand

Residual Soil	130	135	35	0	225/125	-	Sand
Bedrock	150	150	0	200,000[(1)]	-	-	Vuggy Limestone

[(1)] Unconfined compressive strength of bedrock.

- Utilize 1/16" reduction in the pile section for design.

- Backfill behind the proposed wall in accordance with PennDOT Standard RC-12M.

Friction Piles:

Not Applicable.

4.a.5. Drilled Caisson Supported Foundations

Not Applicable.

4.b. Required Geotechnical Exploration

None.

4.c. Foundation Submission

Prepare and submit a foundation report according to the requirements of Publication 15M, Design Manual Part 4 (DM 4), Policies and Procedures (PP), Section 1.9.4. Cost comparisons per Section 1.9.4.3(c) are not required.

4.d. Construction Requirements

4.d.1. Test Piles

Not Applicable.

4.d.2. Subgrade Preparation

Not Applicable.

4.d.3. Pile Dynamic Analysis

Not Applicable.

4.d.4. Load Tests

Not Applicable.

4.d.5. Settlement Monitoring

Not Applicable.

4.d.6. Other

Not Applicable.

(g) Submittals

1. Preliminary Structure Submission

Include the following information in the Preliminary Structure submission:

1. Preliminary Structure submission letter: In accordance with DM 4, PP Section 1.9.3.3.1(a).

2. Preliminary Structure plans: In accordance with DM 4, PP Section 1.9.3.3.1(b).

3. Supply the following additional information:

(a) Name of Lead Design Engineer

2. Foundation Submission

Not applicable for as-designed foundation.

3. Final Structure Plans and Computations

In accordance with applicable sections of DM 4. Include in the Final Structure Plans the Core Boring Logs as provided in the Conceptual Drawings in unmodified form; with the exception of superimposition of sheet numbering consistent with the Final Structure Plans and prominent designation of each sheet as "Information Provided by Others." Sign and seal each plan sheet per DM 4, Section PP 1.6.3.1, with the exception of the aforementioned Core Boring Logs. Upon completion of Quality Assurance Review, or Owner's Perspective Review, as applicable, and receipt of drawings stamped "Recommended for Construction," provide the Owner with one paper copy for signature by the Owner Representative.

4. Revisions During Construction, As-Built Drawings, and Shop Drawings

In accordance with DM 4, PP Section 1.10, except that the Lead Design Engineer is responsible for making changes to the contract drawings, and making and distributing necessary copies of the revised plans to all affected parties. PP Section 1.10.5 is modified as follows: If a design error occurs, the Contractor is fully responsible for the costs associated with providing additional design analysis and construction modifications, acceptable to the Owner, to correct the problem. The Owner will require reimbursement for design errors to cover engineering review costs. This amount shall be deducted from the lump sum cost for the construction of structure item via work order.

Maintain and submit As-Built Drawings in accordance with Publication 10C, Design Manual Part 1C, Transportation Engineering Procedures, Section 5.7, As-Built Plans, except include major quantity changes (such as foundation pile length changes, etc).

All as-built drawings are the sole responsibility of the Contractor and must be submitted to the Owner within 3 months of final inspection acceptance as defined in Section 110.08(a).

During construction, Contractor's engineer shall be responsible for reviewing and approving shop drawings. A copy of each shop drawing must also be submitted to the Owner.

(h) Submittal Review, Approval, and Distribution

Make all submissions in accordance with the Special Provision titled SPECIAL BIDDING – DESIGN-BUILD, except as follows;

- Partial Plans Submissions: None.
- Utilities: Additional contract time will not be considered for additional utility relocation work associated with an alternate structure.

MEASUREMENT AND PAYMENT – Lump Sum

Partial payment will be made for the design activity based on the approved Schedule of Values in accordance with Section V of Special Provision titled SPECIAL BIDDING – DESIGN-BUILD, utilizing the following components:

- Preliminary Plan Approval
- Final Plan Approval
- Final Plan – for Signature
- As-Built Drawings

ALTERNATE WALLS

DESCRIPTION

This work is for construction of retaining walls as-designed or designing and constructing equivalent retaining walls of an alternate design in place of the "as-designed" retaining walls.

DESIGN

(a) General. If alternate design retaining walls are bid, furnish, to the Owner, preliminary conceptual design calculations and drawings for the alternate retaining walls. Provide an alternate design equivalent to the original design and meeting applicable design criteria for strength and serviceability. Submit the alternate design to the Owner for acceptance. Refer to PennDOT Design Manual Part 4, PP 1.10, Bridge Submissions-Construction Phase, for details on procedures for contractor submissions. If the equivalency of an alternate design cannot be clearly established, the Owner Representative will be arbiter and the Owner Representative's decision will be final. Furnish, with the preliminary conceptual design submission, a tabulation identifying the differences between the "as designed" retaining walls and the alternate design retaining walls.

On the alternate design plans include the type of wall, location, length, top elevation(s), proposed bottom of footing/leveling pad elevation(s), cross-sections including backfill material type and limits, and quantities. Also show, as required, details for concrete bridge barriers and/or railings, copings, conduit, or other attachments to precast wall panels/units. Show complete layout plans and fabrication details for precast wall panels/units and footings/leveling pads including reinforcement and attachments, and step-by-step erection instructions. Include details for strip or wire mesh reinforcement and attachments, for anchoring panels into the soil. Any fabrication done before acceptance of the plans will be at the Contractor's risk.

Any delay in submission and acceptance of a proposed alternate design or a revision, and/or approval of required permits, will not extend the contract time.

If alternate design retaining walls is bid, and an acceptable preliminary conceptual design is not approved within 30 calendar days from the award date (6 days for the submission and 24 days for Owner review), construct the "as-designed" retaining walls at no additional cost to the Owner.

Alternate designs which take advantage of any errors and/or omissions in the plans for the "as-designed" wall or discrepancies between the "as-designed" wall plans and the special provisions covering alternate designs, will not be accepted. In the event any such error, omission, or discrepancy is discovered, immediately notify the Owner. Failure to notify the Owner will constitute a waiver of all claims for misunderstandings, ambiguities, or other situations resulting from the error, omission, or discrepancy.

Experimental or demonstration-type design concepts; or products, structures, or elements not preapproved by the Owner for general usage, will not be allowed in the alternate design.

Value Engineering may be applied to the "as-designed" retaining walls, but do not Value Engineer alternate design retaining walls.

Have the alternate design completed by a Professional Engineer registered in the Commonwealth of Pennsylvania. All engineering firms must have a current Annual Qualification Package on file with the Bureau of Project Delivery's Consultant Management Section and be registered business partners in ECMS.

Submit an affidavit, before or along with the preliminary conceptual design submission, stating that the designer is familiar with AASHTO, PennDOT, and other applicable design criteria, standards, and construction specifications. Also, submit a list of similar retaining walls and/or wingwalls/bridges designed within the past 7 years.

In identifying alternate design retaining walls, retain the "as designed" retaining wall number, but suffix the number with the letters A, B, etc. Proprietary walls shall have a P suffix as detailed in Design Manual Part 4 PP3.3.4.7(k).

Show, on first sheet of the alternate design, the seal of a Professional Engineer registered in the Commonwealth of Pennsylvania, a valid signature in ink, the date signed, a business name, a business address, and the note "These drawings (S-XXXXXA) supersede drawings (S-XXXXX) approved (insert appropriate date)". Also include a statement "All assumptions made in the design are validated either by details or notes on these drawings."

The Owner will furnish CADD files for the "as-designed" retaining walls upon request.

Prepare alternate design plans using Pennsylvania Department of Transportation drafting standards.

(b) Design Computations and Design Specifications. On the first sheet of the computations for the alternate design, show the seal of a Professional Engineer registered in the Commonwealth of Pennsylvania, a valid signature in ink, and the date signed.

Provide a complete set of computations for the alternate design of the retaining walls. Reproduce and insert computations from the "as-designed" walls, as needed. Provide additional calculations, as requested by the Owner Representative to justify the design, throughout the life of the contract.

Designs copied directly from approved Pennsylvania Department of Transportation Standards need not be documented through independent computations. List such designs on the submission by referencing the drawing number of the applicable standard, and the sheet number, table, or graph.

Use PennDOT Design Manual Part 4 for design policy procedures and criteria. All design related Strike-off Letters listed in PART B, "SPECIAL DRAWINGS AND SPECIAL DESIGN REQUIREMENTS", are applicable to the alternate design.

In the event that certain design parameters, stresses, or specifications are in conflict, the following order of predominance governs:

- Design requirements listed herein, in PART B, "SPECIAL DRAWINGS AND SPECIAL DESIGN REQUIREMENTS" and addenda (addendum) to the proposal.
- Design related Strike-off Letters in effect on the date of project advertisement.
- PennDOT Design Manual Part 4, "Structures" including revisions (Publication 15M).
- PennDOT Bridge Design and Bridge Construction Standards (Publications 218M and 219M).
- AASHTO LRFD Bridge Design Specifications as indicated for the "as-designed" walls.

In the event that a clear order of predominance cannot be established, or a difference in the interpretation of the design criteria, standards, specifications, or methodology cannot be resolved, the Owner Representative will be arbiter and the Owner Representative's decision will be final.

Submit shop drawings to the Owner as specified in Section 105.02 for review and acceptance. The Owner is not responsible for work done without approved shop drawings.

If any provisions in PART B conflict with those in PART A, the provisions in PART B are to govern.

Within 60 calendar days after completion of the walls, revise the original drawings to show "as-built" conditions and submit them to the Owner Representative.

(c) Design Requirements. In the design of alternate retaining walls, comply with PennDOT Design Manual Part 4, "Structures", Section 11, and other design criteria as specified for the "as-designed" retaining walls, subject to the exceptions and/or additions in PART B, "SPECIAL DRAWINGS AND SPECIAL DESIGN REQUIREMENTS".

Provide equivalent inspection and maintenance accessibility for the alternate retaining wall as for the "as-designed" retaining wall. In case of a disagreement on accessibility, the Owner Representative's decision will be final.

Do not change the indicated horizontal and vertical alignment of retaining walls, except as noted in PART B, "SPECIAL DRAWINGS AND SPECIAL DESIGN REQUIREMENTS".

Design alternate retaining walls to be within the indicated limits of factored foundation bearing resistance and factored pile resistance as indicated for the "as designed" walls.

Provide clear span(s) and/or distances from wall faces of not less than the minimum values indicated for the "as-designed" retaining walls, except as noted in PART B, "SPECIAL DRAWINGS AND SPECIAL DESIGN REQUIREMENTS".

Comply with all requirements of the approved permit(s). Obtain approved/amended waterway permit(s) for alternate structures if necessary.

Be responsible for the cost and delay of any additional utility relocation that results from changes in the Contractor's plans or construction sequences made subsequent to (1) acceptance of the utility's relocation plans and (2) where the utility has physically moved its facilities based upon those relocation plans.

MATERIALS

As indicated and as specified for each respective item included in the "as-designed" retaining walls.

CONSTRUCTION

In accordance with Publication 408, Special Provisions for each respective item, and any additional requirements specified herein. Submit construction procedures for an alternate design for acceptance, if other than those specified herein.

If utility relocations are required as part of an alternate design, be responsible for the cost of the utility relocations and any related delay claim costs.

MEASUREMENT AND PAYMENT – Lump Sum

For the type of alternate design wall selected; subject to a reduction equal to the amount of the Contractor's share of the Owner's engineering costs as follows:

- For each alternate wall $100,000 or less.....$1,000
- For each alternate wall over $100,000 but less than $500,000.....$2,000
- For each alternate wall over $500,000 but less than $1,000,000.....$3,500
- For each alternate wall $1,000,000 or more $5,000

The Contractor's share of the Owner's engineering costs will be recovered by processing a contract adjustment (Alternate Design Review) to reduce the contract lump sum price by an amount equal to the Contractor's share.

A utility company's share of fabricated structural steel and/or installation of sleeves, inserts, casings, hanger assemblies, ducts, etc. for utilities is to be a separate item. Do not include the utility company's share in the bid price for the alternate design walls unless otherwise specified.

All items of work are to be included in and will be paid for as part of the contract lump sum price; except, bearing piles; pile tip reinforcement; pile load tests; dynamic pile testing; Class C cement concrete under footings; Class 3 excavation, reinforcement bars, and Class A cement concrete for pedestals; and caissons.

(a) Retaining Walls As Designed. If the "as-designed" retaining walls are bid, submit the "Component Item Schedule", included with the Proposal, as specified in Section 103.01(a).

Make the "Total" at the end of the "Component Item Schedule" equal the amount of the lump sum bid for Retaining Walls As Designed.

(b) Alternate Retaining Walls. If an alternate design retaining wall is bid, the apparent low bidder is required to submit a "Component Item Schedule for Alternate Design" as specified in Section 103.01(a). Tabulate the quantities, unit prices, and bid prices for excavation, select granular material, precast wall panels/units, and footings/leveling pads. Furnish a similar tabulation for any miscellaneous items such as concrete bridge barriers, copings, conduit, junction boxes, lighting pole anchorages, and lighting poles. No adjustments will be made to the contract lump sum price bid for alternate design retaining walls for any field adjustments necessary to complete the structures.

Make the "Total" at the end of the "Component Item Schedule for Alternate Design" equal the amount of the lump sum bid for Alternate Retaining Walls.

(c) Alternate Structure Design Costs. The apparent low bidder is to include a component item for Alternate Design Costs in the Component Item Schedule when an alternate design is bid. Include the cost of this item in the total of the lump sum bid price. Payment of 25% of the total design costs will be made upon approval of the preliminary conceptual design. The remaining amount will be paid for in a proportionate manner, designated by the Owner, on the basis of approval of the final design.

CONSTRUCTION OF RETAINING WALL

DESCRIPTION

This work is the construction of a retaining wall of the type bid in the corresponding specification entitled "Design of Retaining Wall" and in accordance with the approved design and structure drawings. Construction of a temporary excavation support and protection system is included, if applicable.

MATERIALS

As indicated and as specified for each respective item included in the retaining wall.

CONSTRUCTION

In accordance with Publication 408, Special Provisions for each respective item, and any additional requirements specified herein.

Prepare and submit Shop Drawings in accordance with Publication 15M, Design Manual Part 4 (DM 4), Policies and Procedures (PP) Section 1.10.2.

Prepare and submit Pile Hammers for approval in accordance with DM 4, PP Section 1.10.3.

Prepare and submit Pile Load Test Evaluations in accordance with DM 4, PP Section 1.10.4.

The Owner will require reimbursement for design errors to cover engineering review costs. This amount will be deducted from the lump sum cost for the construction of structure item in accordance with Section 110.03.

Be responsible for making changes to the contract drawings, and making and distributing necessary copies of revised plans to all affected parties in accordance with applicable sections of DM4, PP Section 1.10.6.

Do not start construction until structure plans stamped “Released for Construction” are transmitted by a letter indicating which work can proceed. Construction may start on components of the structure provided that partial structure plans stamped “Released for Construction” are transmitted by a letter indicating which work can proceed.

If utility relocations are required as part of an alternate retaining wall, be responsible for the cost and delay of the utility relocations in excess of those indicated in the contract documents. Additional contract time will not be considered for additional utility relocation work associated with an alternate retaining wall.

MEASUREMENT AND PAYMENT – Lump Sum

(a) General

Partial payment will be made for all work indicated on the Final Structure Drawings based on the approved Schedule of Values in accordance with Section V of the Special Provision titled SPECIAL BIDDING – DESIGN-BUILD, except as indicated otherwise herein.

(b) Bearing Piles

Bearing piles furnished in accordance with the as-designed foundation parameters will be considered as included in the contract lump sum price, except adjustment to the contract lump sum price, via work order, will be made for driving bearing piles to elevations beyond the as-designed estimated pile tip elevations using the following methodology:

- Determine the average overlength or underlength for all point bearing piles based on the estimated pile tip elevations. Determine the average overlength or underlength for each pile size separately.

- Adjustment to the contract lump sum price will be determined as follows:

A = “Average overlength or underlength of Bearing Piles” x “Total Number of Bearing Piles” x “Bid rate for Bearing Piles” (positive value for overlength, negative value for underlength)

Cost Adjustment = SUM (“A” for each pile size), except that no adjustment will be made when SUM (“A” for each pile size) is a negative value.

Test pile extensions, if necessary, will be considered as included in the lump sum price.

Bearing piles for relocated retaining walls and bearing piles designed by the Contractor as an alternate to the as-designed foundation will be considered as included in the contract lump sum price.

(c) Drilled Caissons

Drilled caissons furnished in accordance with the as-designed foundation parameters will be considered as included in the contract lump sum price, except adjustment will be made to the contract lump sum price, via work order, for installing shaft sections or rock sockets to lengths beyond the as-designed lengths using the following methodology:

- Determine the average overlength or underlength for all drilled shafts based on the as-designed lengths and the actual lengths. Determine the average overlength or underlength for each caisson diameter separately for: shaft section in soil; shaft section in rock; and rock socket.

- Adjustment to the contract lump sum price will be determined as follows:

A = “Average overlength or underlength of Shaft In Soil” x “Total Number of Caissons” x “Bid rate for Shaft in Soil” (positive value for overlength, negative value for underlength)

B = “Average overlength or underlength of Shaft In Rock” x “Total Number of Caissons” x “Bid rate for Shaft in Rock” (positive value for overlength, negative value for underlength)

C = “Average overlength or underlength of Rock Socket” x “Total Number of Caissons” x “Bid rate for Rock Socket” (positive value for overlength, negative value for underlength)

Cost Adjustment = SUM [(A + B + C) for each caisson diameter], except that no adjustment will be made when SUM [(A + B + C) for each caisson diameter] is a negative value.

Caissons for relocated retaining walls and caissons designed by the Contractor as an alternate to the as-designed foundation will be considered as included in the contract lump sum price.

(d) Bearing Piles and Caissons

Adjustment to the contract lump sum price for projects with both as-designed bearing piles and as-designed caissons will be computed as follows:

Cost Adjustment = [Cost Adjustment for Bearing Piles] + [Cost Adjustment for Caissons], except that no adjustment will be made when [Cost Adjustment for Bearing Piles] + [Cost Adjustment for Caissons] is a negative value.

(e) Other

Not Applicable

TEMPORARY EXCAVATION SUPPORT AND PROTECTION SYSTEM

FOR DESIGN BUILD PROJECTS

DESCRIPTION

This work is the design and construction of a temporary excavation support and protection system or appropriately designed open cut excavation, as indicated, with a service life of less than or equal to 36 months.

MATERIALS

Provide certification or laboratory test results verifying material properties. For used steel, the salvage design values from AASHTO Guide Design Specification for Bridge Temporary Works (AASHTO Guide Spec) may be used as an alternate to testing to determine grade of steel. Materials need not be new but must be in serviceable condition as determined by the Engineer. Temporary material used does not have to be from a Bulletin 15 source, but must meet the following:

- Structural Steel.....….....AASHTO M 270M/270 (ASTM A709M/A709) Grade 250(Grade 36), Grade 345(Grade 50) or Grade 345W(Grade 50W)
- Steel Sheet Piling.....…..... .....ASTM A328M/A328, ASTM A572M/A572
- Steel H-Piles.....….....AASHTO M 270M/270 (ASTM A709M/A709), Grade 250(Grade 36)
- Wood Lagging.....…..... .....Rough Cut Species in AASHTO Guide Spec Appendix A and AASHTO Construction Handbook for Bridge Temporary Works Appendix C
- Cement.....…..... .....AASHTO M85 and AASHTO M240
- Pre-Stressing Steel.....…..... .....ASTM A416 Grade 270
- Welded Wire Fabric.....…..... .....AASHTO A55 (ASTM A185)
- Reinforcement Bars.....…..... .....AASHTO M 31M/31 (ASTM A615M/A615), AASHTO M42M/M42, (ASTMA616M/A616), Grade 420(Grade 60)
- Other Material.....….....….....In accordance with applicable Sections of Publication 408

DESIGN

Design the temporary excavation support and protection system in accordance with current AASHTO LRFD Bridge Design Specifications and Design Manual, Part 4 Specifications,

current FHWA guidelines and AASHTO Guide Spec. Design temporary excavation support and protection system for final condition and all construction conditions, including surcharge loads due to vehicle traffic and construction equipment. Submit 4 sets of design calculations and 4 sets of completed detailed drawings, signed and sealed by a Professional Engineer, registered in the Commonwealth of Pennsylvania to the Owner Representative for review. Include in the design calculations all material properties, design loads, and design assumptions. Include on the completed detailed drawings all design dimensions, limits of work, elevations, material, member sizes and construction sequence. Provide cutoff elevation of steel and wooden components for work in streambed. Include specific installation procedures and testing requirements as part of the submittal. Allow 14 days for the review by the Owner.

Ensure that temporary excavation support and protection system design and construction conforms to the following:

a) Open cut excavations are allowed, provided they meet OSHA requirements, the safety of the traveling public, the approved traffic control plan and existing structure is assured, and they stay within the legal right-of-way lines. Cuts can extend beyond legal right-of-way lines only with the written approval of the Owner and written permission of the property owners. Ensure environmental compliance if cut extends beyond area cleared by the Owner. Submit slope stability analysis in accordance with Publication 293.

b) The temporary excavation support and protection system will be selected by the Contractor. Examples include anchored walls, mechanically stabilized earth walls, prefabricated modular walls, cantilever walls, cofferdams, and soil nailing walls. These systems may be comprised of one or more of the following: Soldier Piles, Timber Lagging, Steel Sheet Piling, Caissons, Slurry Walls, Tiebacks, Soil Nails, Shotcrete, Deadman Anchors, Wales, Cross lot Bracing, Raker Braces, Precast Concrete, Precast Lagging, Soil Cement Lagging, Cement Bentonite, Gabions, Minipiles, Concrete Reaction Blocks, Mechanically Stabilized Earth Walls or other methods.

c) Design temporary excavation support and protection system based on the following parameters:

1. Soil parameters (***see Project Specific Details for following parameters***):

1.a Effective angle of friction _____

1.b Moist unit weight of soil _____

1.c Saturated unit weight of soil _____

1.d Effective cohesion _____

1.e Static groundwater level at elevation _____

1.f Undrained shear strength of cohesive soil _____

1.g Shear strength for rock mass _____

Provide other soil/rock properties with test data, needed in the design of the temporary excavation support and protection system.

2. Ensure that all components stay within the legal right-of-way unless an easement is obtained by the Contractor.

CONSTRUCTION

Install temporary excavation support and protection system in accordance with applicable sections of Publication 408. All steel and wooden components may remain in place to pavement subgrade or 0.6 meters (2 feet) below finish grade, whichever is higher elevation. Treated wood is not required unless it is within 2 meters (6 feet) of finish grade and is to remain in place. Pressure treat with chromate copper arsenate (CCA) to refusal. Finish grade is defined as top of pavement when a roadway is behind the temporary excavation support and protection system. Have a Professional Engineer, registered in the Commonwealth of Pennsylvania, certify that the temporary excavation support system or open cut excavation has been installed as shown on the Professional Engineer's signed and sealed drawings. Submit the certification to the Representative within 3 working days of completion of the system.

QUALIFICATIONS

The work must be supervised by a superintendent or foreman who is experienced, in the construction of temporary excavation support and protection system proposed. If the design height of the temporary excavation support and protection system exceeds 6 meters (20 feet), provide the following with the design submission:

- For the superintendent or foreman who will supervise the work, submit a list containing at least 5 projects which demonstrate a minimum of 3 years experience in the construction of the temporary excavation support and protection system proposed. Include a brief description of each project and the name and phone number of the owner's representative knowledgeable in each project listed.

- The name of the Professional Engineer, registered in the Commonwealth of Pennsylvania and having at least 3 years experience in the design and construction of temporary excavation support and protection systems, who will design and specify the sequence of construction of the temporary excavation support and protection of system.

MEASUREMENT AND PAYMENT – Incidental to construction of the retaining wall.

If an acceptable open cut excavation is provided in lieu of the temporary excavation support indicated, payment will be made for the as-bid lump sum temporary excavation support item, but no additional payment will be made for any class of excavation, structure backfill or additional shoring as a result of the open cut excavation or to restore the facilities to their original condition.

PROJECT SPECIFIC DETAILS

The Soil Parameters as indicated in III. (c) 1. are:
1.a Effective angle of friction: 21 degrees
1.b Moist unit weight of soil: 110 pcf
1.c Saturated unit weight of soil: 115 pcf
1.d Effective cohesion: 0 psf
1.e Static groundwater level at elevation: Elevation 3.0 feet or stream level of Schuylkill River, whichever is higher.
1.f Undrained shear strength of cohesive soil: N/A
1.g Shear strength of rock mass: 10 ksf

APPENDIX M

DESIGN MODEL

American Geotechnical &
Environmental Services, Inc.
Southpointe Business Park
4 Grandview Circle
Canonsburg, PA 15317-6507

Project SCHUYLKILL RIVER TRAIL EXTENSION Project No. 13004

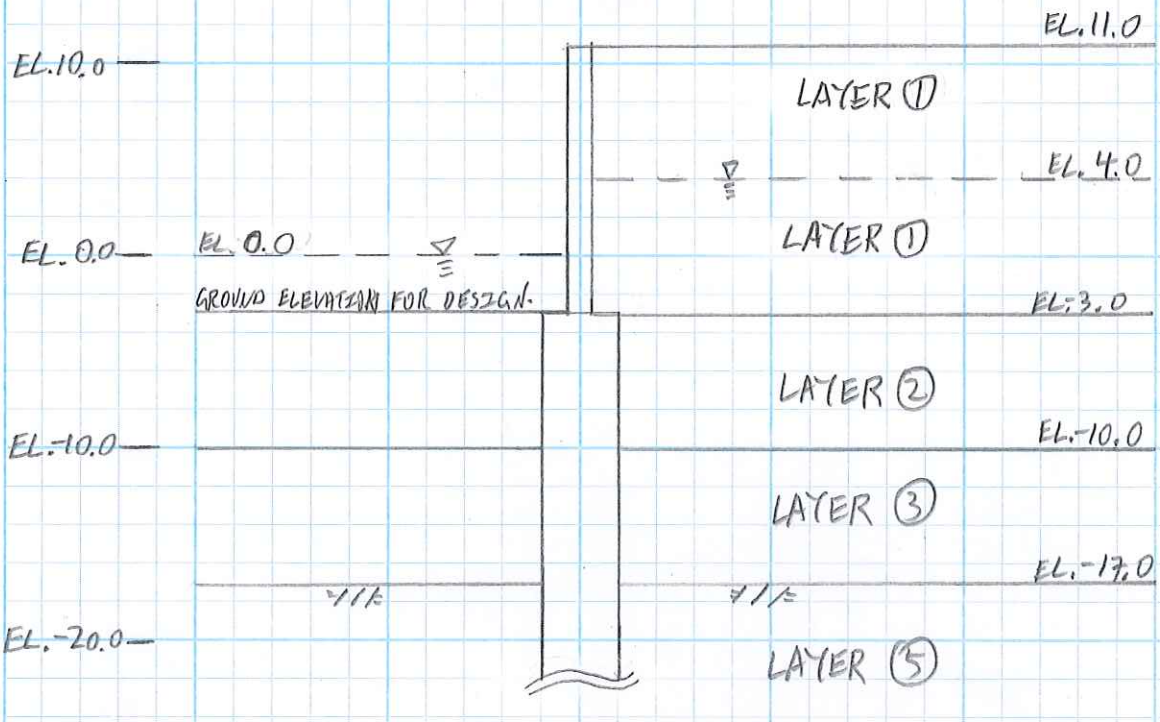
Sheet 1 of

SOLDIER PILE AND LAGGING WALL Dwg. By Y.Y Date 10-17-13

DESIGN MODEL #1 Chk. By SL Date 10-17-13

DESIGN MODEL #1

- DETERMINE NECESSARY PILE SIZE AND CAISSON EMBEDMENT DEPTH, USING FOLLOWING MODEL CONSIDERING RAPID DRAWDOWN CONDITION.
- LIMIT DEFLECTION AT TOP OF CAISSON TO 0.5IN
- ASSUME NO SOIL INFRONT OF LAGGING.



		γ_m/γ_{sat}, PCF	ϕ	C, PSF	K, PCI ABOVE WATER/ BELOW WATER	ε_{50}	P-Y CURVE
LAYER ①	SOIL RETAINED BEHIND THE WALL	110/115	25	0	25/20	-	SAND
LAYER ②	ALLUVIAL SOIL BELOW BOTTOM OF LAGGING	105/110	21	0	25/20	-	SAND
LAYER ③	RESIDUAL SOIL	130/135	35	0	225/125	-	SAND
LAYER ⑤	BEDROCK	150/150	0	200,000*	-	-	VUGGY LIMESTONE

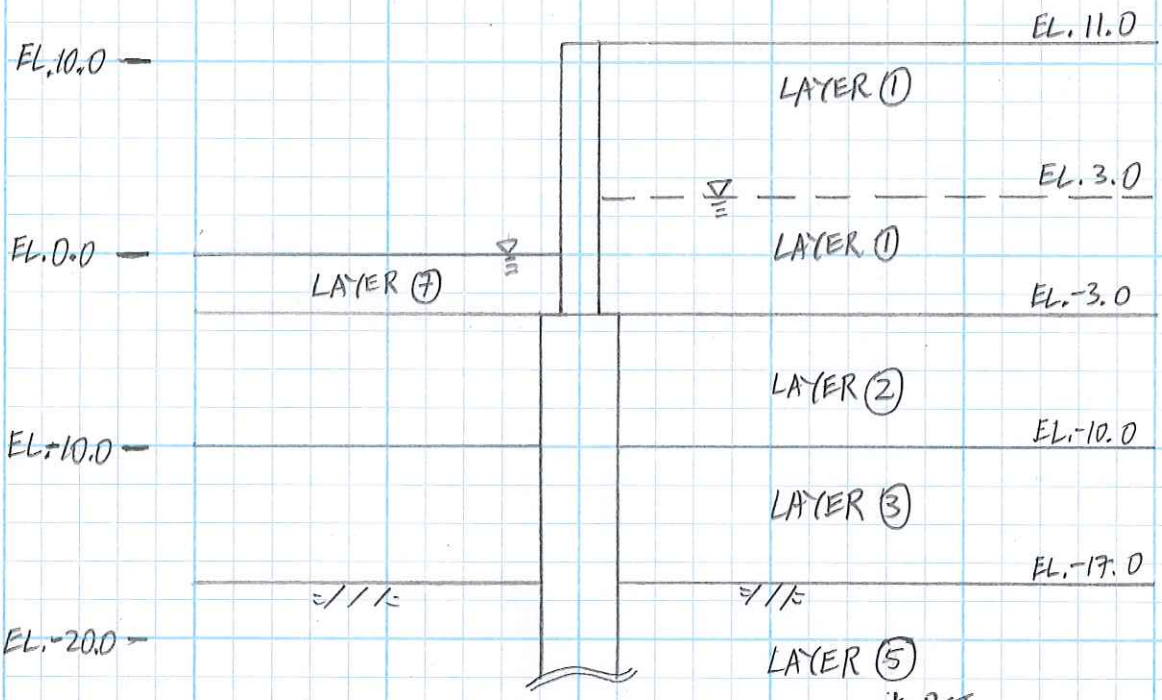
*UNCONFINED COMPRESSIVE STRENGTH OF BEDROCK.

American Geotechnical & Environmental Services, Inc.
Southpointe Business Park
4 Grandview Circle
Canonsburg, PA 15317-6507

Project SCHUYLKILL RIVER TRAIL EXTENSION Project No. 13004
Sheet 1 of
SOLDIER PILE AND LAGGING WALL Dwg. By Y.Y Date 10-17-13
DESIGN MODEL #2 Chk. By SL Date 10/17/13

DESIGN MODEL # 2

- DETERMINE LATERAL DEFLECTION AT TOP OF CAISSON USING FOLLOWING MODEL, MODEL CONSIDERS SERVICE CASE CONDITION.
- LIMIT DEFLECTION AT TOP OF CAISSON TO 0.5 IN
- NEGLECT PASSIVE PRESSURE FROM TOP 3FT OF RIP-RAP IN FRONT OF WALL.



		γ_m/γ_{sat}, PCF	ϕ	C, PSF	k, PCI ABOVE WATER/ BELOW WATER	ε_{50}	P-Y CURVE
LAYER ①	SOIL RETAINED BEHIND THE WALL	110/115	25	0	25/20	-	SAND
LAYER ②	ALLUVIAL SOIL BELOW BOTTOM OF LAGGING	105/110	21	0	25/20	-	SAND
LAYER ③	RESIDUAL SOIL	130/135	35	0	225/125	-	SAND
LAYER ⑤	BEDROCK	150/150	0	200,000*	-	-	VUGGY LIMESTONE
LAYER ⑦	RIP-RAP	130/135	36	0	225/125		SAND

*UNCONFINED COMPRESSIVE STRENGTH OF BEDROCK.

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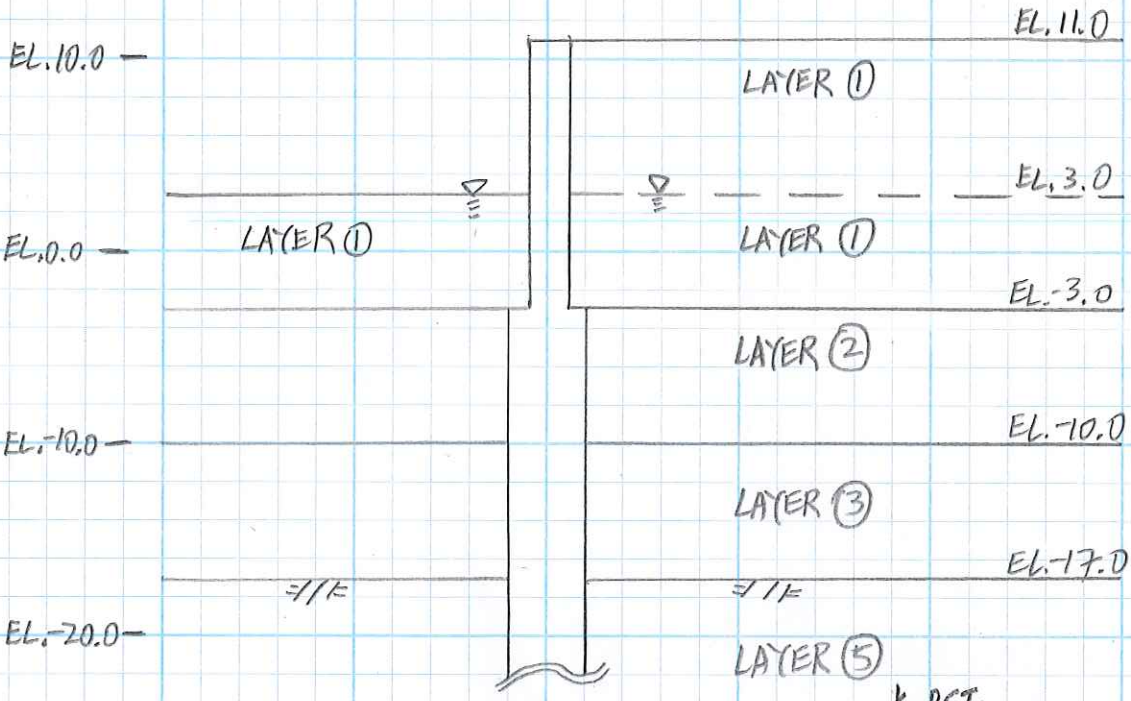
Project SCHUYLKILL RIVER TRAIL EXTENSION | Project No. 13004
Sheet 1 of
SOLDIER PILE AND LAGGING WALL | Dwg. By Y.Y | Date 10-17-13
DESIGN MODEL #3 | Chk. By SL | Date 10-17-13

- DESIGN MODEL #3
- PERFORM GLOBAL STABILITY ANALYSIS USING FOLLOWING MODEL.
- LIMIT DEFLECTION AT TOP CAISSON TO 0.5 IN



		γ_m/γ_{sat}, PCF	ϕ	C, PSF	k, PCI ABOVE WATER/ BELOW WATER	ε_{50}	P-Y CURVE
LAYER ①	SOIL RETAINED BEHIND THE WALL	110/115	25	0	25/20	-	SAND
LAYER ②	ALLUVIAL SOIL BELOW BOTTOM OF LAGGING	105/110	21	0	25/20	-	SAND
LAYER ③	RESIDUAL SOIL	130/135	35	0	225/125	-	SAND
LAYER ⑤	BEDROCK	150/150	0	200,000*	-	-	VUGGY LIMESTONE

*UNCONFINED COMPRESSIVE STRENGTH OF BEDROCK.