

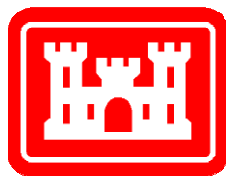
Delaware River Basin
Comprehensive Flood Risk Management
Interim Feasibility Study and Integrated
Environmental Assessment for
New Jersey



Flooding in the Study Area, April 2005

June 2015

APPENDIX A: Draft Engineering Technical Appendix



**U.S. ARMY CORPS OF
ENGINEERS
PHILADELPHIA DISTRICT**



**NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL
PROTECTION**

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

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APPENDIX A: ENGINEERING TECHNICAL APPENDIX

| | |
|--|-----------|
| COST TABLES | II |
| 1 GENERAL | 1 |
| 2 HYDROLOGY AND HYDRAULICS | 1 |
| 3 SURVEYING AND MAPPING REQUIREMENTS | 1 |
| 4 GEOTECHNICAL INVESTIGATION | 2 |
| 4.1 GENERAL | 2 |
| 4.2 DESIGN CRITERIA | 2 |
| 4.3 REGIONAL GEOLOGY | 2 |
| 4.4 SEISMOLOGICAL EVALUATION..... | 3 |
| 4.5 SUBSURFACE INVESTIGATIONS AND IN SITU TESTING | 4 |
| 4.6 DESIGN | 6 |
| 4.7 POTENTIAL DISPOSAL SITES | 6 |
| 5 PROJECT DESIGN | 6 |
| 5.1 DESCRIPTION OF THE SELECTED PLAN | 6 |
| 5.2 PROJECT ALTERNATIVES | 11 |
| 5.3 QUANTITY COMPUTATIONS | 12 |
| 5.4 ASSUMPTIONS FOR GIBBSTOWN AND LAMBERTVILLE DESIGNS..... | 13 |
| 5.4.1 Closure Gates..... | 18 |
| 5.4.2 Road/Rail Gates..... | 18 |
| 5.5 RELOCATIONS..... | 18 |
| 5.6 RISK FOR COST OVERRUNS IN CIVIL DESIGN | 18 |
| 5.6.1 Utilities..... | 18 |
| 5.6.2 Unknown Site Conditions..... | 18 |
| 5.6.3 DESIGN CRITERIA AND STANDARDS | 19 |
| 5.6.4 RAILROAD CROSSING | 19 |
| 5.6.5 ROAD GATES | 19 |
| 6 CONSTRUCTION PROCEDURE AND WATER CONTROL PLAN | 19 |
| 7 INITIAL RESERVOIR FILLING AND SURVEILLANCE PLAN | 19 |
| 8 STORM EMERGENCY PLAN | 20 |
| 9 CONSTRUCTION MATERIALS | 20 |
| 10 RESERVOIR CLEARING | 20 |
| 11 OPERATIONS AND MAINTENANCE | 20 |
| 12 ACCESS ROADS | 20 |
| 13 CORROSION MITIGATION | 20 |
| 14 PROJECT SECURITY | 20 |
| 15 COST ENGINEERING TECHNICAL SUPPORT DOCUMENT | 21 |

LIST OF FIGURES

| | |
|---|---|
| Figure 5.1.1: Lambertville | 7 |
| Figure 5.1.2: Tentatively Selected Plan (Alternative 1) | 8 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

| | |
|--|----|
| Figure 5.1.3: Gibbstown Buyout locations | 9 |
| Figure 5.1.4: 77 Asbury Road..... | 9 |
| Figure 5.1.5: 43 Asbury Station Road | 10 |
| Figure 5.1.6: A line Road..... | 11 |
| Figure 5.2.2: Gibbstown Alternative 3 | 12 |
| Figure 5.4.1: Typical Levee Section (Gibbstown and Lambertville) | 14 |
| Figure 5.4.2: Inverted T-wall Section (Gibbstown)..... | 15 |
| Figure 5.4.3: Typical Inverted T-wall Section (Gibbstown and Lambertville) | 17 |
| Figure A1: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Location Sketch | 56 |
| Figure A2: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs..... | 58 |
| Figure A2 con't: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs | 59 |
| Figure A2 con't: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs | 60 |
| Figure A3: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Location Sketch | 61 |
| Figure A4: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs..... | 62 |
| Figure A4 con't: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs | 63 |
| Figure A4 con't: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs | 64 |

LIST OF TABLES

| | |
|--|---|
| Table 1 : Gibbstown Soil Tests..... | 4 |
| Table 2 : Lambertville Soil Tests..... | 5 |

COST TABLES

| | |
|--|----|
| Table 1 : Tentatively Selected Plan Costs – Site 5 : Levee/Foodwall, Lambertville, NJ..... | 32 |
| Table 2 : Tentatively Selected Plan – Site 8 : Levee/Foodwall, Gibbstown, NJ..... | 33 |
| Table Site 1 : Concept-Level Costs for Site 1 : Floodwall, Knowlton, NJ | 36 |
| Table Site 2a : Concept-Level Costs for Site 2a : Floodwall, Phillipsburg, NJ..... | 37 |
| Table Site 2b : Concept-Level Costs for Site 2b : Floodwall, Phillipsburg, NJ..... | 38 |
| Table Site 3 : Concept-Level Costs for Site 3 : Floodwall, Frenchtown, NJ..... | 39 |
| Table Site 4 : Concept-Level Costs for Site 4 : Levee Reinforcement, Stockton, NJ..... | 40 |
| Table Site 5 : Concept-Level Costs for Site 5 : Levee/Floodwall, Lambertville, NJ..... | 41 |
| Table Site 6 : Concept-Level Costs for Site 6 : Floodwall, Ewing Township, NJ..... | 42 |
| Table Site 7a.1 : Concept-Level Costs for Site 7a.1 : Floodwall, Trenton, NJ..... | 43 |
| Table Site 7a.2 : Concept-Level Costs for Site 7a.2 : Floodwall, Trenton, NJ..... | 44 |
| Table Site 7b.1 : Concept-Level Costs for Site 7b.1 : Portable Floodwall, Trenton, NJ..... | 45 |
| Table Site 8 : Concept-Level Costs for Site 8 : Levee/Floodwall, Gibbstown, NJ..... | 46 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Alt #1: Incremental Alternative Plan Costs for Site 8: Levee/Floodwall Analysis, Gibbstown, NJ (Greenwich and Logan Townships).....47

Table Alt #2: Incremental Alternative Plan Costs for Site 8: Floodwall Analysis, Gibbstown, NJ (Greenwich and Logan Townships).....50

Table Alt #3: Incremental Alternative Plan Costs for Site 8: Levee/Floodwall Analysis, Gibbstown, NJ (Greenwich and Logan Townships).....53

LIST OF ATTACHMENTS

- Attachment 1: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Location Sketch
- Attachment 2: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs
- Attachment 3: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Location Sketch
- Attachment 4: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

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APPENDIX A: ENGINEERING TECHNICAL APPENDIX

1 General

The Tentatively Selected Plan consists of two project sites. One site is in Lambertville, New Jersey and one in Gibbstown, New Jersey. This Engineering Technical Appendix details proposed construction of these sites.

2 Hydrology and Hydraulics

See separate Hydraulics and Hydrology Appendix.

3 Surveying and Mapping Requirements

The surveying and mapping data for the project were developed using LiDAR (Light Detection and Ranging data, aerial photography, and computer modeling to combine and manipulate public domain geospatial data to engineering elevation models of the study areas. The following provides an in depth description of the LiDAR information and how it was processed to develop the elevation models.

LiDAR data is remotely sensed high-resolution elevation data collected by an airborne collection platform. LiDAR data from 2010 (for Lambertville) and 2007 (for Gibbstown) was imported into ArcMap 10.1. Digital Elevation Models were created in ArcMap and exported into a TIFF file format readable in AutoCAD. This information combined with aerial photography was utilized in AutoCAD to layout, analyze, and compute quantities for the levee and floodwall structures.

The dataset used for Lambertville, New Jersey was produced by the PAMAP Program in 2010 and consists of a raster digital elevation model with a horizontal ground resolution of 3.2 feet. The model was constructed from PAMAP LiDAR elevation points. PAMAP data are organized into blocks, which do not have gaps or overlaps, which represent 10,000 feet by 10,000 feet on the ground. The coordinate system for blocks in the northern half of the state is Pennsylvania State Plane North; blocks in the southern half of the state are in Pennsylvania State Plane South. Both coordinate block systems utilize the same datum reference (datum: NAD83, units: feet). A block name is formed by concatenating the first four digits of the State Plane northing and easting defining the block's northwest corner, the State identifier "PA", and the State Plane zone designator "N" or "S" (e.g. 45001210PAS).

The data set for Gibbstown, New Jersey was a raster file of elevation extracted from a larger classified data set and only includes points classified as Ground, Model Key-point (mass point), Bathymetric LiDAR Points, and Acoustic Bathymetry (bare earth) within the delineated geographic bounds. By positioning laser range finding with the use of 1 second GPS with 100 Hz inertial measurement unit corrections, Terrapoint's LIDAR instruments are able to make highly detailed geospatial elevation products of the ground, man-made structures and vegetation. These data were collected from March 29 through April 6, 2007 for Gloucester County, New Jersey. The project area covers 353 square miles. The LiDAR flight lines for this project were planned for a 50 percent acquisition overlap. The nominal resolution of this project without overlap is 1.25 meters. Four returns were recorded for each

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

pulse in addition to an intensity value. GPS Week Time, Intensity, flight line and number attributes were provided for each LiDAR data point. Data is provided as random points, in LAS v1.1 format.

More recent and comprehensive topographic survey will be required in order to develop plans and specifications. Due to the abundance of residential properties affected, it is recommended that an American Land Title Association (ALTA) Land Survey be performed in PED. This survey will provide existing physical features including topographic features, property boundary lines, easements, right-of-ways, structures, utilities, streets and railways, etc.

4 Geotechnical Investigation

4.1 General

This section presents general criteria based on limited subsurface investigations, analysis methods and assumptions for the geotechnical design of project features. Geotechnical design considerations for permanent structures are provided herein. The considerations consist of design of the structural foundations, earthen levees, and backfill.

4.2 Design Criteria

The following Engineer Manuals will be used in the geotechnical design of the projects.

EM 1110-1-1905, "Bearing Capacity of Soils" 10/30/1992

EM 1110-2-1906, "Laboratory Soils Testing" 10/31/1997

EM 1110-2-1913, "Design and Construction of Levees" 4/30/2000

EM 1110-2-2502, "Retaining and Flood Walls" 9/29/1989

4.3 Regional Geology

GIBBSTOWN

The proposed site location in Gibbstown consists of four geological units; the Quaternary Alluvium, The Unit 2 of the Quaternary Cape May Formation, the Cretaceous Magothy Formation, the Cretaceous Potomac Formation. A brief discussion of the formations is discussed herein:

1. Quaternary Alluvium. Beneath the modern salt marsh and estuarine environments of Salem and Gloucester Counties, geologic mapping data available from the New Jersey Geological Survey (NJGS) indicates that stream alluvium deposits may be present. Mapping data describes this alluvium as predominantly quartz sand and silt, with common intercalated deposits and lenses of gravel, peat, and less commonly silt/clay.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

2. Quaternary Cape May Formation, Unit 2. According to NJGS Geologic Map GMS 06-2, Unit 2 of the Quaternary Cape May Formation should be present in the project area in a pattern that fringes the present day creeks and tidal guts feeding into the Delaware estuary. In general, published maps place this unit below a maximum elevation of approximately 35 feet, where it forms a terrace and is generally found to pinch out up against older Coastal Plain deposits (Stanford, 2006). Published descriptions of the Cape May Formation describe it as a yellow to pale brown fine to medium sand with occasional beds of gravel, mud, and peat. Primarily quartz sand, accessory minerals such feldspar, mica, and the marine clay glauconite can occur in lesser amounts.

3. Cretaceous Magothy Formation. According to NJGS Geologic Map GMS 06-1, two Cretaceous-age geologic formations occur in the project area. These are the Magothy and Potomac (described below) Formations, and are found primarily in the subsurface, beneath the much younger, fluvial and marine deposits described above. The mapped patterns of these formations indicate that they subcrop more recent deposits along a northeast strike and are present in bands a few miles wide, where they dip to the east/southeast and become covered by progressively younger and younger geologic units. In general, the Magothy Formation is described as a gray (white to yellow where weathered) fine to very coarse quartz sand with comparatively thin beds of clay and silt are common.

4. Cretaceous Potomac Formation. In general, the Potomac Formation is the oldest of the Coastal Plain geologic formations in the region and overlies saprolite and/or weathered bedrock of the Piedmont Province to the north and west. NJGS Geologic Map GMS 06-1 describes the Potomac Formation as a white fine to very coarse quartz sand with gravel and varicolored, but commonly red, clay and silt beds that are more extensive than the sand beds. Both the muddy and sandy portions of the formation can contain lignite, and the unit is as much as 350 feet thick.

LAMBERTVILLE

The proposed site is located in the Passaic Formation. The preliminary borings for this site encountered silts, clays, and sands of varying composition, which are variable shades of brown and gray in color. Amounts of gravel and rock fragments were encountered within the soil layers. An alluvium strata consisting of sand and gravel was encountered in the borings next to the canal. The overburden soils are underlain by bedrock strata. The bedrock present at the site consists of weathered siltstone. The weathered siltstones are hard, light and medium shades of reddish gray and brown in color and contain occasional thin sandstone seams and iron-stained joints. The overburden soils generally classify as clay (CL), silt (ML), silty sand (SM), and silty gravel (GM) according to the Unified Soil Classification System. The liquid limits of these soils vary between NP and 33, and the plastic limits vary between NP and 10. The passing -200 sieve of these materials was ranging between 12% and 86%.

4.4 Seismological Evaluation

GIBBSTOWN

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

No seismic analysis has been performed on the site.

LAMBERTVILLE

A preliminary analysis performed during the Lambertville Subsurface Exploration by the subcontractor, Tetra Tech, yielded the following information:

Based on the results of the field and laboratory tests conducted for this investigation, review of the available geologic mapping, and site class definitions shown in Table 1613.5.2 from International Building Code (IBC 2006), it is our opinion that the subject site can be classified as Site Class C in the Very Dense Soil and Soft Rock category. This category is characterized by the following average soil/rock properties within the top 100 feet of the surface: Shear wave velocity between 1,200 to 2,500 feet per second, standard penetration resistance (N) > 50, and soil undrained shear strength > 2,000 pounds per square foot (psf).

4.5 Subsurface Investigations and In Situ Testing

GIBBSTOWN

Four exploratory borings were performed in 2013 along the planned alignment. These borings were completed using Standard Penetrating Test Methods to collect disturbed and undisturbed samples. Laboratory testing on selected samples included the performance of index testing, hydraulic conductivity testing, and triaxial compression strength testing. The number and types of tests are listed in Table 1: Gibbstown Soil Tests. Further information can be found in Attachments 1 and 2, Figures A1 and A2.

Table 1 : Gibbstown Soil Tests

| Minimum # of Undisturbed Samples Collected | Minimum # of Undisturbed Samples Lab Tested | Sieve Analysis | Atterberg Limits | Field Moisture Content | UU Triaxial Compression | Permeability |
|--|---|----------------|------------------|------------------------|-------------------------|--------------|
| 5 | 5 | 13 | 3 | 13 | 2 | 5 |

Subsurface conditions encountered at the boring locations are shown in the boring logs. The subsurface conditions observed across the site were generally consistent in stratigraphy, but highly variable in thickness and textural consistency. Beneath surficial fill deposits (where present), Duffield Associates' field program, geologic map review, review of topographic data, and experience from past studies in the area supports that shallow subsurface deposits beneath the area being considered for flood control improvements can be characterized by the following stratigraphic framework, in order of increasing age and depth below ground surface:

- The Quaternary Alluvium
- The Unit 2 of the Quaternary Cape May Formation

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

- The Cretaceous Magothy Formation
- The Cretaceous Potomac Formation

The Quaternary Alluvium stratum soils generally consisted of a loose to medium dense sand soils with an interlayered layer of fibrous organic soils. The underlying geologic formations were observed to consist primarily of coarse-grained loose to dense sands with several interlayered fine-grained medium to very stiff silty clays. Bedrock was not encountered in any of the borings and the maximum depth was 60 feet below ground surface.

LAMBERTVILLE

Four exploratory borings were performed in 2014 along the planned alignment. These borings were completed using Standard Penetrating Test Methods to collect disturbed and undisturbed samples. Laboratory testing on selected samples included the performance of index testing, hydraulic conductivity testing, and triaxial compression strength testing. The number and types of tests are listed in Table 2: Lambertville Soil Tests. Further information can be found in Attachments 3 and 4, Figures A3 and A4

Table 2 : Lambertville Soil Tests

| Minimum # of Undisturbed Samples Collected | Minimum # of Undisturbed Samples Lab Tested | Sieve Analysis | Atterberg Limits | Field Moisture Content | UU Triaxial Compression | Permeability | Unconfined Compression | Specific Gravity |
|--|---|----------------|------------------|------------------------|-------------------------|--------------|------------------------|------------------|
| 5 | 5 | 13 | 8 | 8 | 4 | 5 | 5 | 5 |

Subsurface conditions encountered at the boring locations are shown in the boring logs. Generally, in the borings drilled for this study, the site soils encountered consist of silts, clays, and sands of varying composition, which are variable shades of brown and gray in color. Amounts of gravel and rock fragments were encountered within the soil layers. An alluvium strata consisting of sand and gravel was encountered in the borings next to the canal. The overburden soils are underlain by bedrock strata. The bedrock present at the site consists of weathered siltstone. The weathered siltstones are hard, light and medium shades of reddish gray and brown in color and contain occasional thin sandstone seams and iron-stained joints. Observations made in the field of the soil materials retrieved from the borings, with the exception of the top few inches, the soils encountered in the borings drilled on the towpath, within the road, and open field appear to be of natural origin and no evidence of man-placed fill was noted. It should be appreciated that fill materials may not always be distinguishable from native soils, and may also be present within the site at locations other than the boring locations. The overburden soils generally classify as clay (CL), silt (ML), silty sand (SM), and silty gravel (GM) according to the Unified Soil Classification System. Depths from ground surface to bedrock ranged from 14 feet to 22 feet.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

4.6 Design

GIBBSTOWN

A preliminary design of the levee and floodwall was completed by URS Corporation. The designs of the levees and floodwalls reflect the results of a limited geotechnical study. In the Gibbstown area the borings indicate a layer of compressible soils near elevation 0 NAVD. Any levees exceeding 8 feet high in this area will likely require ground stabilization before and during construction. These treatments include surcharging the levee load and installing wick drains to accelerate soil compression, excavating unsuitable material and installing geogrids under the levees. With the exception of the relatively low walls at the northern project tieoff and the industrial ring structures, the floodwalls at Gibbstown are T-wall structures with a wide base to provide stability. These structures would be supported by 50 foot long steel piles with spacing of approximately 10 feet.

LAMBERTVILLE

A preliminary design of the levee and floodwall was completed by URS Corporation. In Lambertville the levee segments will utilize a design section with a 10 foot top width, a 10 foot wide impervious core extending to 6 feet below the levee and a 2.5 horizontal to 1 vertical side slope. The floodwalls are generally about 5 feet high with a maximum height of about 7 feet. Given the relatively low heights and the limited area for construction a cantilevered I-wall type structure was chosen. This structure consists of a sheetpile wall driven to bedrock at a depth of approximately 13 feet. The wall will include a concrete cap to ensure an impervious structure.

4.7 Potential Disposal Sites

No disposal sites for either project have been identified at this time.

5 Project Design

5.1 Description of the Selected Plan

LAMBERTVILLE

The proposed flood mitigation structure consists of a levee along Alexauken Creek and a floodwall adjacent to the D&R Canal. The levee is generally 10 to 12 feet high. The maximum height is 15 feet and the length is 516 feet. A 10 foot wide crest with 2.5H: 1V side slopes is proposed for the typical levee section. The top of the levee and floodwall is proposed at elevation +76.0 NAVD, pending optimization. The floodwall is 1,409 linear feet with a maximum height of 7 feet. The floodwall alignment is proposed to be approximately 15 feet from the waterline of the Canal in order to protect the Canal and provide sufficient space for temporary construction. This plan will require one property buy-out and demolition, and the construction of a 54 inch diameter gravity outlet in the area of Ely Creek. A preliminary alignment is shown below in Figure 5.1.1.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Figure 5.1.1: Lambertville



GIBBSTOWN

The proposed preliminary line of protection runs parallel to the Delaware River for approximately 4 miles, in the vicinity of Route 44 between Repaupo Station Road and Billingsport Road, in Gibbstown (Greenwich Township), Gloucester County, New Jersey. Refer to Figure 5.1.2 for the site location map and the preliminary alignment of the line of protection.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Figure 5.1.2: Tentatively Selected Plan (Alternative 1)



The tentatively selected plan is Alternative 1. This plan consists of a combination of levee and floodwall structures, flood gates, and ringwalls; the plan includes 13,788 feet of floodwall and 7,386 feet of levee, including 165 feet of closure gates. At the southernmost point, the line of protection begins with a levee segment along the south side of the railroad tracks adjacent to Route 44 (W. Broad St.). The typical height of the southwest levee segment varies from 1 to 12 feet. The levee transitions into a floodwall that circles the town in a clockwise manner. A floodwall was chosen for the center portion to lessen the footprint and avoid the need for more structure buyouts. The typical height of the floodwall varies from 10 to 14 feet. This portion of the floodwall includes one 115-foot railroad crossing gate and one 50-foot road crossing gate. The central floodwall ties into high ground near the center of town where North School Road meets Railroad Avenue. East of North School Road the ground elevation is above the project's design elevation. The line of protection continues as a levee on the north side of Railroad Street along the Northern face of the railroad tracks. The typical height of the levee in this section varies from 1 to 14 feet. The levee transitions back to a floodwall that continues in the northeast direction. The typical height of the floodwall in this section is from 14 feet down to 1 foot high. The design height of the levee/floodwall line of protection is proposed at elevation +12.0 feet NAVD88,

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

pending optimization. This alignment will require one property buyout along the alignment (building footprint shown in Figure 5.1.2) and 17 property buyouts in satellite locations depicted in Figure 5.1.3.

Figure 5.1.3: Gibbstown Buyout locations



In addition to the levee system within Alternative 1, the alternative includes ringwall structures that encompass three separate areas.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

The first area is located at 77 Asbury Road and is shown in Figure 5.1.4. This area includes a levee portion (represented as cyan), floodwall portion (represented as green), and one 42-foot gate and one 67-foot gate (both represented as red). The ringwall height would vary from approximately 7 to 10 feet.

Figure 5.1.4: 77 Asbury Road



The second area is located at 43 Asbury Station Road and is shown in Figure 5.1.5. This area includes a levee portion (represented as cyan), floodwall portion (represented as green), and one 48 foot gate (represented as red). The ringwall height would vary from approximately 6 to 9 feet.

Figure 5.1.5: 43 Asbury Station Road



APPENDIX A: ENGINEERING TECHNICAL APPENDIX

The third area is located at A line Road and is shown in Figure 5.1.6. This area also includes levee portion (represented as cyan), a floodwall portion (represented as green), and one 67-foot gate (represented as red). The ringwall height would vary from approximately 7 to 10 feet.

Figure 5.1.6: A line Road



5.2 Project Alternatives

GIBBSTOWN

Figure 5.2.1 shows Alternative 2, which follows the same alignment as Alternative 1, but replaces levee sections with floodwalls to avoid impacts to wetlands areas.

Figure 5.2.1: Gibbstown Alternative 2



APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Figure 5.2.2 shows Alternative 3, which also follows the same alignment as Alternative 1 and Alternative 2, but replaces fewer levee sections with floodwalls compared to Alternative 2 and was considered a balance between Alternative 1 and Alternative 2.

Figure 5.2.2: Gibbstown Alternative 3



5.3 Quantity Computations

LAMBERTVILLE

The levee is generally 10 to 12 feet high. The maximum height is 15 feet and the length is 516 feet. The levee typical section has a 10 foot top width and 2.5H: 1V side slopes. The key depth is 6 feet with a 1:1 trench side slope and 10 foot bottom width on the trench. The levee zonation calls for impervious fill for the 10 foot width of the key trench for the full height of the levee. The remainder of the material is common fill. Stripping depth was assumed to be 1 foot. A volume of 3,180 Cubic Yards of impervious fill and 8,862 Cubic Yards of common fill is used in the cost estimate for the levee.

The floodwall alignment is 1,409 feet long. The floodwall is generally five feet high with a maximum height of approximately seven feet. Given the relatively low heights and the limited area for construction, a steel sheet pile cantilevered concrete I-wall type structure

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

was chosen. This structure consists of a sheetpile wall driven to bedrock at an elevation of +53.0 feet NAVD. The quantity of sheet pile used in the cost estimate is 31,602 SF.

GIBBSTOWN

The proposed preliminary line of protection runs parallel to the Delaware River for approximately 4.0 miles. Alternative 1 consists of a total of 13,788 feet of floodwall and approximately 7,386 feet of levee including gates. The maximum levee height is 12 feet, pending optimization. A volume of 48,761 Cubic Yards of impervious fill and 140,239 Cubic Yards of common fill is used in the cost estimate for the levee.

The railroad crossing gate is proposed as 115 feet long, and the floodwall road crossing gate is proposed as 50 feet long. The total length of levee for the three proposed ringwalls is approximately 2,795 feet. The total length of floodwall for the three proposed ringwalls is approximately 2,620 feet. There are also two 67 foot gates, one 48 foot gate and one 42 foot gate included in the ringwall designs.

Alternative 2 consists of a total of 21,339 linear feet of floodwall, including gates. Alternative 3 consists of a total of 16,765 linear feet of floodwall and 4,409 linear feet of levee, not including gates. The ringwalls and gates are the same for all alternatives.

It is expected that the proposed full height floodwall is likely to be an inverted T (known as T-wall) concrete wall. The top elevation of the proposed T-wall is +12 feet NAVD, pending optimization, which is identical to the levee top elevation. The height of the wall from the top to the base slab is 14 feet, pending optimization. A 12 feet wide and 3 feet thick base slab is proposed. In addition, the width of the wall stem is considered to be 2 feet. Considering the existence of soft compressible organic soils, it is recommended that the proposed T-wall be supported on deep foundations such as driven piles.

5.4 Assumptions for Gibbstown and Lambertville Designs

LAMBERTVILLE

Bedrock was assumed to be at elevation +53.0 NAVD. The height of the main line of protection is estimated to be +76.0 feet NAVD. The unit costs of the items used in the cost estimates have been sourced from RS Means 2010. Typical sections of levee and floodwall are given in Figure 5.4.1 and Figure 5.4.3.

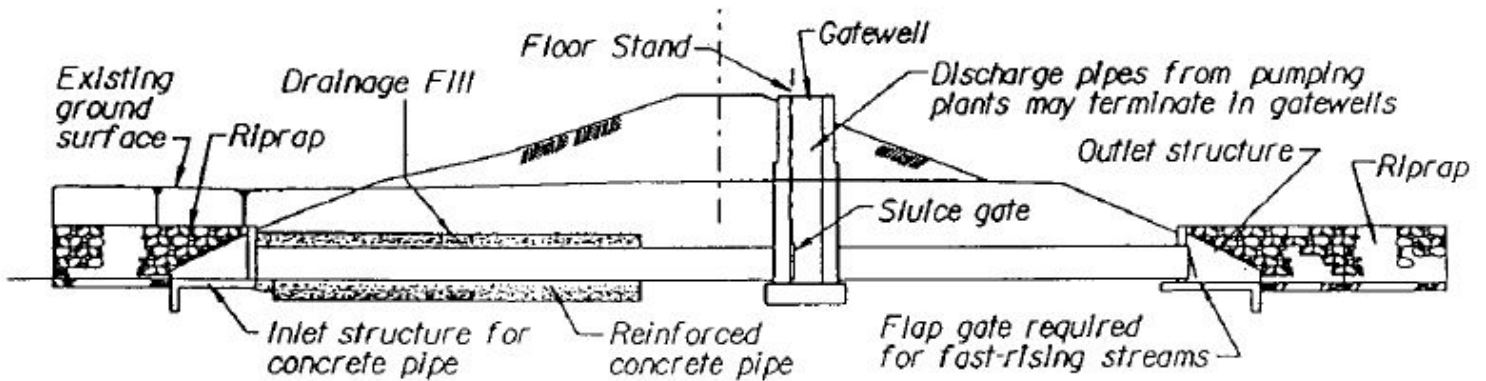
Closure gates/outlet structures are necessary to drain the interior runoff and are therefore included in the cost estimates. It is assumed five 24" Diameter flap and five 24" Diameter sluice gates are needed along with two 60" flap gates and two 60" sluice gates. The cost estimate also includes jacking a 54" pipe 225 linear feet under the D&R Canal to a proposed outlet structure. Associated costs are broken down in the cost estimate.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

GIBBSTOWN

Structure costs have been calculated for heights above grade ranging from zero feet at the tie-ins up to a maximum of 12 feet above grade. The unit costs of the items used in these estimates have been sourced from RS Means 2010. The height of the main line of protection levee is estimated to be +12.0 feet NAVD. Three feet of freeboard is included here as a placeholder until optimization is conducted and structure height is established. After optimization, inclusion of freeboard can be requested by the non-Federal sponsor. FEMA recommends 3' of free board in levee height in order to get the levee certified, but the addition will be considered the Locally Preferred Plan and funding apportioned accordingly. A typical section of Levee is as follows:

Figure 5.4.1: Typical Levee Section (Gibbstown and Lambertville)

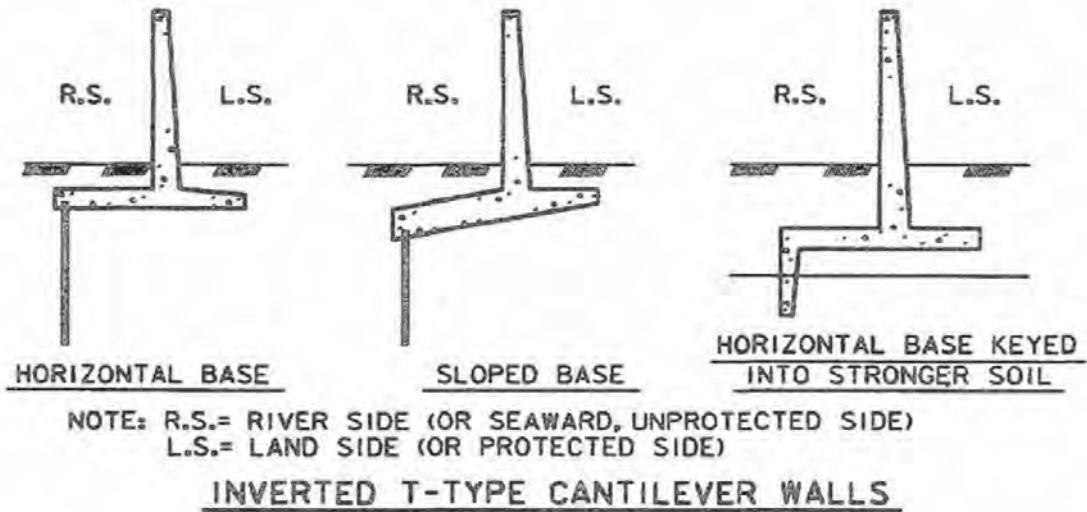


All design shall be compliant with EM 1110-2-1913, Design and Construction of Levees.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

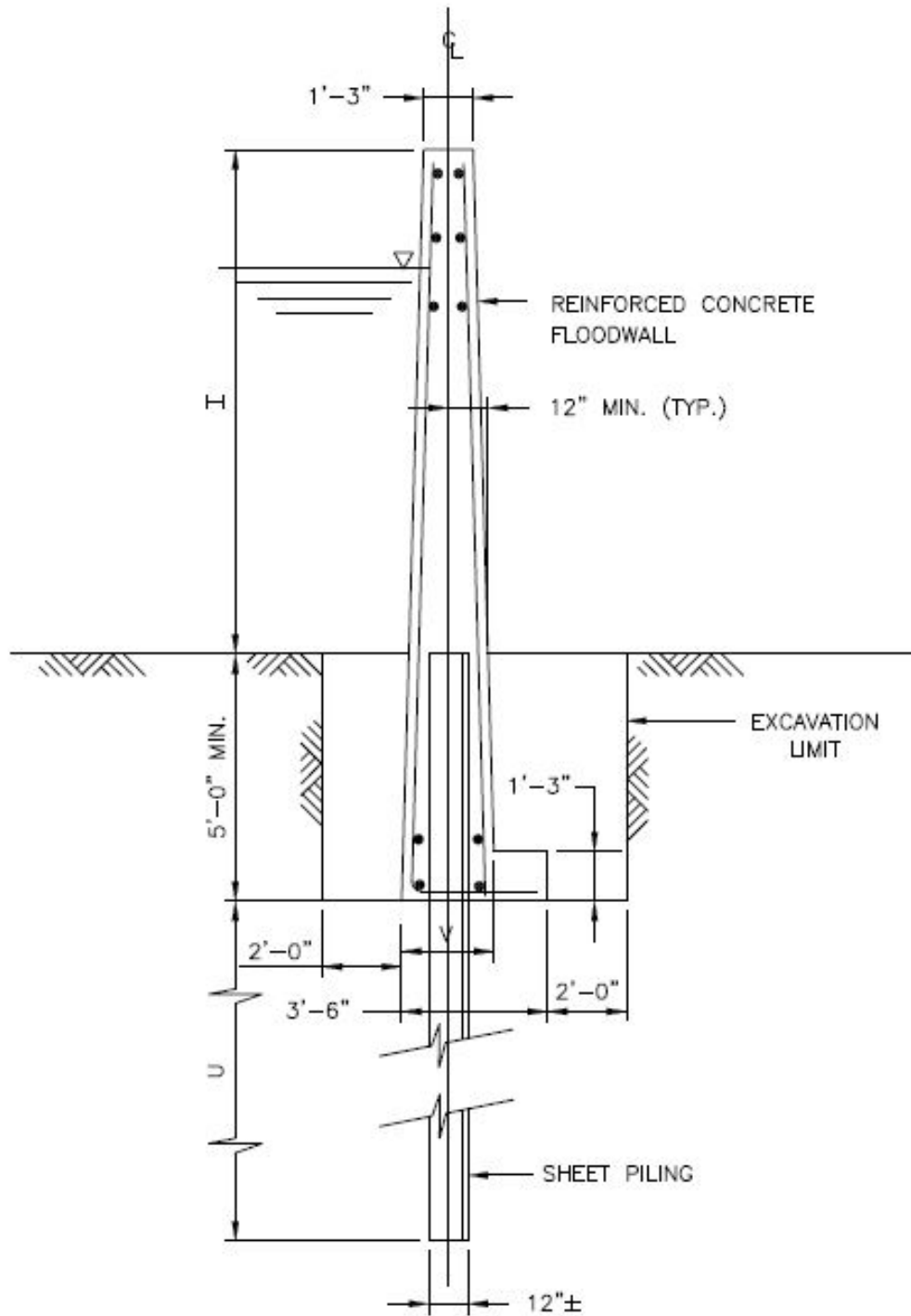
Inverted T-wall design is assumed for areas needing ring wall protection. A typical section of Inverted T-wall is as follows:

Figure 5.4.2: Inverted T-wall Section (Gibbstown)



All design shall be compliant with EM 1110-2-2502, Retaining and Floodwalls.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX



TYPICAL I-WALL DETAIL

All design shall be compliant with EM 1110-2-2502, Retaining and Floodwalls.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

5.4.1 Closure Gates

Closure gates/outlet structures are necessary to drain the interior runoff and are therefore included in the cost estimates. It is assumed fifty-four 24” Diameter flap and fifty-four 24” Diameter sluice gates are needed along the floodwall. Associated costs are broken down in the cost estimate.

5.4.2 Road/Rail Gates

Each ringwall would require at least one movable gate to allow traffic access. The railroad gate is also required to be movable for train access. As the floodwall also crosses Dry Ice Corp/A Line Road, another gate is needed in this location. The quantity used for the cost estimate was assumed to be 1,947 square feet of swing gates. The gate design is not optimized at this stage of design.

5.5 Relocations

Utilities located in the vicinity of the project were identified by using GIS files. For the selected plan sanitary sewer, potable water, gas, electric and telephone lines will have to be identified on the plans. There are no relocations identified at this time, however a lump sum value of approximately \$4 Million is included in the cost estimate for Utility Relocations.

5.6 Risk for Cost Overruns in Civil Design

5.6.1 Utilities

Utilities are always a challenge when constructing a project of this type. It is difficult to determine where underground utilities are located. Record files will be utilized in the design of this project, but it is quite common for utility lines to be present when not indicated on the drawings. This is especially true regarding abandoned utility lines. The depth of the utilities is also hard to predict, hence knowing whether or not a utility crossing the floodwall needs to be relocated is challenging. It is reasonable to believe that there are more utilities in the ground than what we will have record of.

5.6.2 Unknown Site Conditions

Unknown site conditions are always a potential risk on a project. The Gibbstown project area contains many locations where HTRW is being cleaned up. There is a possibility that more HTRW could be discovered during construction. Any differing site conditions could affect cost and schedule. Other possible unknown site conditions include utilities, rock formations, and artificial subsurface obstructions.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

5.6.3 Design Criteria and Standards

The following documents and standards, as a minimum, will be incorporated in the design of this flood risk management project.

- US Army Corps of Engineers, EM_1110-2-1913, “Design and Construction of Levees”, 2000.
- US Army Corps of Engineers, EM_1110-2-2502, “Retaining and Flood Walls”, 1989.
- “Roadside Design Guide” 4th Edition, 2011. American Association of State and Highway (AASHTO)
- “Manual on Uniform Traffic Control Devices (MUTCD)”, Federal Highway Administration
- International Building Code ®
- ASTM International Standards
- SpecsIntact will be utilized to develop the project specifications

5.6.4 Railroad Crossing

Coordination with the railroad has some inherit unknowns based on who owns the line, who operates on the line, and the individual entities that are involved with the design approval and coordination. The proposed railroad crossing gate spans 115 feet. If space permits, two smaller mechanical gates may be utilized instead of one large gate. The gate design shall be optimized through design and coordination with the Railroad Company in later stages.

5.6.5 Road Gates

There are several proposed road crossing gates of varying lengths from 42 feet to 67 feet. Each ringwall would require at least one movable gate to allow traffic access (and railroad access in the case of Dry Ice Corp/A Line Road). These have not been included in the ring levee cost estimates, but preliminary investigations suggest a cost of around \$1 million to \$1.3 million, depending on the width of the opening.

6 Construction Procedure and Water Control Plan

TBD

7 Initial Reservoir Filling and Surveillance Plan

N/A

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

8 Storm Emergency Plan

TBD

9 Construction Materials

TBD

10 Reservoir Clearing

N/A

11 Operations and Maintenance

Permanent easements are needed for the structure footprints, and temporary easements are needed for construction. Operation, Maintenance, Repair, Rehabilitation and Relocation (OMRR&R) costs include annual inspections and maintenance of the line of protection including gates and gate chambers, access ramps, and levee cover. The O&M costs also include annual inspections and maintenance of the interior drainage features and include the annualized cost of replacement of interior drainage appurtenant structures (e.g., gates, backflow valves, sluice gates, etc.) at the end of their useful project life of approximately 25 years. Annual OMRR&R costs are approximately \$198,000 for Gibbstown and \$30,000 and Lambertville.

12 Access Roads

The projects are located within the cities of Lambertville, NJ and Gibbstown, NJ and in most cases it will be feasible to use the existing public city streets for transportation of miscellaneous construction equipment and hauling of excavated material, debris and construction materials. Access roads and permanent easements are needed for levee inspection and maintenance. A maintenance path will need to be established, but no such area is defined at this time. The project site will have construction easements along the alignment of the floodwalls and levees. The easements will provide sufficient right of way for the sponsor to go back in the future and perform maintenance as required.

13 Corrosion Mitigation

Coatings and/or cathodic protection will be included in the design as required for materials which are installed in the soil.

14 Project Security

TBD

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

15 Cost Engineering Technical Support Document

SECTION 15 - COST ESTIMATE

Paragraph

Description

CONCEPT-LEVEL ALTERNATIVES INITIAL PROJECT CHARGES

- | | |
|---|---------------|
| 1 | General |
| 2 | Basis of Cost |

INCREMENTAL ALTERNATIVE PLAN DEVELOPMENT AND ASSESSMENT

- | | |
|----|---|
| 15 | Alternatives Considered |
| 16 | Lambertville Alternative Plans |
| 17 | Gibbstown Alternative Plans |
| 18 | Basis of Cost for Gibbstown Alternative Plans |

TENTATIVELY SELECTED PLANS

- | | |
|----|-------------------------------------|
| 20 | TSP Alternatives Considered |
| 21 | Lambertville TSP |
| 22 | Basis of Cost for Lambertville TSP |
| 28 | Annual Charges for Lambertville TSP |
| 31 | Gibbstown TSP |
| 32 | Basis of Cost for Gibbstown TSP |
| 38 | Annual Charges for Gibbstown TSP |

OPTIMIZATION OF SITE 5: LAMBERTVILLE, HUNTERDON CO., NJ

- | | |
|----|---------|
| 41 | General |
|----|---------|

OPTIMIZATION OF SITE 8: GIBBSTOWN (GREENWICH AND LOGAN TOWNSHIPS), GLOUCESTER CO, NJ

- | | |
|----|---------|
| 42 | General |
|----|---------|

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

LIST OF TABLES

| <u>No.</u> | <u>Description</u> |
|--------------------|--|
| 1 | Tentatively Selected Plan Costs - Site 5: Levee/Floodwall, Lambertville, NJ |
| 2 | Tentatively Selected Plan Costs - Site 8: Levee/Floodwall, Gibbstown, NJ |
| Site 1 thru Site 8 | Concept-Level Costs for Site 1 thru Site 8 |
| Alt 1 thru Alt 3 | Incremental Alternative Plan Costs for Site 8: Levee/Floodwall Analysis, Gibbstown (Greenwich and Logan Townships), NJ |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

SECTION 15 - COST ENGINEERING TECHNICAL SUPPORT DOCUMENT

CONCEPT-LEVEL ALTERNATIVES INITIAL PROJECT CHARGES

1. General: This section presents screening of parametric type cost estimates for concept-level initial construction resulting in total and annualized project costs for alternative flood risk management reduction plans for eleven sites. The eleven alternative sites include:

| <u>Site</u> | <u>Description</u> |
|-------------|---|
| 1 | Knowlton Township, Warren Co., NJ - 4,000 LF floodwall along Delaware River |
| 2a | Phillipsburg, Warren Co., NJ - 700 LF floodwall along Lopatcong Creek |
| 2b | Phillipsburg, Warren Co., NJ - 1,725 LF floodwall/ringwall at waste water treatment plant |
| 3 | Frenchtown, Hunterdon Co., NJ - 7,000 LF floodwall along bicycle path |
| 4 | Stockton, Hunterdon Co., NJ - Reinforce 5,400 LF of existing Delaware and Raritan Canal embankment |
| 5 | Lambertville, Hunterdon Co., NJ - 590 LF earthen levee at Alexauken Creek and 810 LF floodwall along D&R Canal embankment |
| 6 | Ewing Township, Mercer Co., NJ - 7,700 LF floodwall along Delaware River-side of Route 29 |
| 7a.1 | Trenton, Mercer Co., NJ (Delaware River Site - The Island and Glen Afton) - 7,280 LF floodwall along Delaware River |
| 7a.2 | Trenton, Mercer Co., NJ (Delaware River Site - The Island and Glen Afton) - 7,280 LF floodwall with removable sections along Delaware River |
| 7b.1 | Trenton, Mercer Co., NJ (Downtown) - Portable floodwalls for deployment in downtown area, with permanently installed foundation |
| 8 | Gibbstown (Greenwich and Logan Townships), Gloucester Co., NJ - 25,000 LF levee/floodwall between Delaware River and developed areas |

Typical levee features included a 2.5:1 side slope, an impervious core, 10-foot top width, and provide three feet of freeboard above the effective Base Flood Elevation (BFE) (100-yr event or 1% annual chance of exceedance) for the specific location. The freeboard allowance is a placeholder; a detailed study would be required to address design uncertainties and to ensure reliable performance of the risk management feature. Typical floodwall types were established based on height above grade. Floodwall types included concrete inverted cantilever T-walls w/ key, T-walls with pile supports, I-walls, and I-walls with sheeting. Although interior drainage features are required for any structural flood risk management component, no interior drainage analysis was conducted at this level of analysis. Therefore, a typical requirement of one 24-inch outlet per 400 feet of levee/floodwall was used for cost estimating purposes. Each 24-inch outlet included a manhole, flap gate, sluice gate, trash rack, excavation and backfill, and slope protection. The plan layouts of the concept-level plans are shown in the section of the Feasibility Study, Main Report describing the concept-level alternative sites.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

2. Basis of Cost: Cost estimates presented herein for the concept-level analysis are based on December 2010 price levels. The costs in the summary tables are rounded to the nearest \$1,000. The Concept-Level costs were developed in accordance with the construction procedures outlined herein. All initial construction costs presented in this paragraph are concept-level costs. The major assumptions include:

- a. Readily available, land-based construction equipment will do the work.
- b. There will be no severe weather events during construction.
- c. The project acquisition plan will be open bid (unrestricted) due to the size and cost of the nature of the work.
- d. Equipment standby costs are not included since work will take place 5 days per week, 8 hours per day.
- e. Construction work will be performed by an excavation/heavy construction contractor and the work for surveys and environmental restoration performed by a subcontractor.
- f. Mobilization and demobilization costs assume construction equipment located within 500 miles from the project site will perform the work.

3. A brief description of each alternative site follows:

- a. Site 1 - Knowlton Township, Warren Co., NJ: 4,000 LF floodwall along Delaware River: 4,000 LF floodwall, 9 feet above ground with tie-off levees perpendicular to the river and 9 interior drainage outlets. The wall would run along the rear part of residential properties located immediately on the Delaware River bank. Surrounding area is largely agricultural or wooded.
- b. Site 2a - Phillipsburg, Warren Co., NJ - 700 LF floodwall along Lopatcong Creek: 700 LF floodwall (concrete T-wall with pile support) with a top height approximately 15 feet above grade along Lopatcong Creek. The wall would extend along the right bank of Lopatcong Creek, in front of a mix of commercial, single-family residential, and apartment building properties.
- c. Site 2b - Phillipsburg, Warren Co., NJ - 1,725 LF floodwall/ringwall at waste water treatment plant 1,725 LF floodwall/ringwall (concrete T-wall with pile support) with a top height approximately 10 feet above grade surrounding the municipal wastewater treatment plant (WWTP). The ringwall would protect the WWTP facility, tying into high ground on the downstream side. Depending on site topography, the wall may fit entirely on the WWTP facility lot, or it may need to encroach for at least a portion of its length on the adjacent undeveloped wooded area/hillside.
- d. Site 3 - Frenchtown, Hunterdon Co., NJ - 7,000 LF floodwall along bicycle path: 7,000 LF floodwall (concrete inverted cantilever T-wall w/ key with sheetpile cutoff) with a top height 6 feet above grade along the existing bike path. The floodwall

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

- would extend along an existing municipally-owned bike path alignment although additional land along sides of the municipal ROW may be needed for inverted cantilever T-wall w/ key footings and construction access.
- e. Site 4 - Stockton, Hunterdon Co., NJ - Reinforce 5,400 LF of existing Delaware and Raritan Canal embankment: Reinforce 5,400 LF of the existing canal embankment which has an existing top height 9 feet above existing canal embankment. The canal bank requires reinforcement at various locations through this section. The embankment is owned by the public NJ Municipal Water Supply Authority. Reinforcement work is not likely to require easements on private property. Due to the embankment being part of the Delaware & Raritan Canal, additional mitigation may be needed to address the historic significance of the canal. Therefore, construction cost includes an estimated 25% increase over the base construction cost to address the mitigation (the required cost for this mitigation has not been established). The quantity of new material required has been reduced by 50% to account for the existing canal embankment material, which if suitable, would serve as part of the future line of protection (LOP).
 - f. **Site 5 - Lambertville, Hunterdon Co., NJ - 590 LF earthen levee at Alexauken Creek and 810 LF floodwall along D&R Canal embankment:** 590 LF earthen levee at Alexauken Creek (top height 12 feet above grade) and 810 LF floodwall along Delaware and Raritan Canal (top height 5 feet above grade). Levee would extend through the municipal park (baseball field) for much of its length, tying into the railroad embankment. Due to the levee location in the park and potential environmental or Green Acres impacts, mitigation is estimated as 10% of the project cost. The floodwall would run along eastern bank of Delaware and Raritan Canal. This site is recommended for further evaluation.
 - g. Site 6 - Ewing Township, Mercer Co., NJ - 7,700 LF floodwall along Delaware River-side of Route 29: 7,700 LF floodwall (concrete T-wall) with a top height 9 feet above grade constructed along Delaware River-side of Route 29 including levee tie-off to higher ground. There is no development on the river side of Route 29 in this area. A levee tie-off section, approximately 1,200 feet in length, would extend through a predominantly residential area and would likely avoid direct impacts to buildings.
 - h. Site 7a.1 - Trenton, Mercer Co., NJ (Delaware River Site - The Island and Glen Afton) - 7,280 LF floodwall along Delaware River: 7,280 LF floodwall (concrete T-wall with piles) with a top height 13 feet above grade. The foundation and floodwall would be constructed along the river side of Riverside Drive. This land is riverbank and likely to be publicly-owned. Two short tie-off sections of approximately 600' (northern tie-off) and 300' (southern tie-off) are required. The northern tie-off would be located on public ROW of existing roadway. The southern tie-off would go through public parkland (Stacy Park).
 - i. Site 7a.2 - Trenton, Mercer Co., NJ (Delaware River Site - The Island and Glen Afton) - 7,280 LF floodwall with removable sections along Delaware River: 7,280 LF

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

- floodwall (concrete T-wall, with removable sections) with a top height 13 feet above grade. The foundation and floodwall would be constructed along the river side of Riverside Drive. This land is riverbank and likely to be publicly-owned. Two short tie-off sections of approximately 600' (northern tie-off) and 300' (southern tie-off) are required. The northern tie-off would be located on public ROW of existing roadway. The southern tie-off would go through public parkland (Stacy Park). Approximately 40% of the structure will consist of removable panels that are inserted (when needed) into permanent foundations prior to flood events.
- j. Site 7b.1 - Trenton, Mercer Co., NJ (Downtown) - Portable floodwalls for deployment in downtown area, with permanently installed foundation: Floodwalls panels to be installed as needed. Top height is 6 feet above grade. A 150' section along US Route 1 and a second section 375' along NJ Route 29 and State-owned property. This cost estimate is based on a fixed, structural measure with an adjustment factor and is based on a permanently installed deployable flood barrier provided by *FloodBreak Inc.*
- k. **Site 8 - Gibbstown (Greenwich and Logan Townships), Gloucester Co., NJ – 21,400 LF levee/floodwall between Delaware River and developed areas:** 21,400 LF levee/floodwall; 65% (14,000 LF) of the structure would be floodwall (primarily concrete T-wall) and remainder of structure is levee (approximately 7,400 LF). Top height is 12 feet above grade and includes nonstructural protection for 20 buildings outside alignment, including a ringwall for several manufacturing facilities, at a cost of approximately \$13 million. The line of protection would extend through mixed wetland/upland areas and along the edge (but not through) primarily residential areas. Mitigation is estimated to be 15% of the project cost. The site is recommended for further evaluation.
4. Unit costs are based on MCACES estimates, actual costs and production rates from projects and construction of a similar nature, and cost estimating judgment based on engineering experience. The majority of unit costs were taken from recent projects estimated in MCACES (which include overhead and profit), or from *RS Means Building Construction Cost Data 2010 Edition*, and include contractor overhead, profit and bond of at least 30%.
5. Lump sum cost items were assigned a lump sum cost or were based on a project percentage to be used as a place holder until additional design information is obtained. As an example, the cost item “Maintenance of Traffic, Survey, and Access” was included at 2% of the basic construction cost to cover maintenance and protection of traffic and assorted items that may be required such as site preparation, site access, or contractor staging areas. Mobilization and demobilization costs of \$125,000 were included and are based on construction for similar projects.
- 6 Lands and damages costs have been included since the sponsor will be required to provide lands, easements and rights-of-way. The extent of the lands required for project implementation was estimated from typical project layouts (e.g., levee footprint plus required toe easements, typical construction easements, etc.). Most of the lands involved are either residential or park, open space, public, conservation, or wetlands.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

7. For screening purposes, park, open space, public, conservation, and wetlands, the underlying fee value was estimated at \$3,800 per acre. The perpetual easement for levee/floodwall and canal improvement does not add significantly to restrictions already imposed on these lands by environmental and zoning regulations, and by their topography. Thus, a 20% impact to the underlying fee value was selected, or \$670 per acre ($\$3,800 \times 20\% = \670).

8. The fee simple value of residential lands was estimated at \$7.15 per square foot or \$311,454 per acre. It was assumed that residential improvements on lands affected by the concept-level alignments would not be affected as the alignments are located at the rear of the properties. Thus, a similar 20% impact was applied to the underlying fee value, resulting in an easement cost of \$62,290 per acre ($\$311,454 \times 20\% = \$62,290$) for residential properties.

9. For both categories of land, real estate appraisal/survey costs were estimated at 9% of the real estate cost. The real estate cost estimates have an effective date of December, 2010.

10. Contingency allowances of 35% were assigned to the various cost items, real estate, engineering and design, and construction management and are based on construction for similar projects.

11. Mitigation costs were included based on the proximity of the concept-level alignments to rivers and wetland. Since no detailed environmental mitigation requirement was available, mitigation costs allowances of 5% of the levee and floodwall construction cost plus lands and damages, including contingency. For concept-level sites located near wetlands, parks, or potential Green Acres properties, the mitigation cost percentage of 15% was used.

12. Engineering and design costs of 12% of construction costs were used for screening purposes and includes the preparation of plans and specifications, as well as pre-construction monitoring and engineering support through project construction.

13. Construction management (S&A) costs to cover activities from pre-award requirements through final contract closeout effort were included as 10% of construction costs.

14. The costs for the eleven alternative sites as described in paragraph 1 for this concept-level screening phase of site selection are shown in Table Site 1 thru Table Site 8.

INCREMENTAL ALTERNATIVE PLAN DEVELOPMENT AND ASSESSMENT

15. Alternatives Considered: Since plans for Gibbstown and the Alexauken Creek area of Lambertville remained feasible, more detailed alternative plans for design were considered as a third phase of the plan selection process.

16. Lambertville Alternative Plans: There are no alternative locations for the Lambertville floodwall due to physical constraints associated with developed property on one side and the

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

historic Delaware and Raritan Canal on the other side. These impediments also leave no room for a levee. There are also not viable alternatives to the levee segment. Moving it closer to Alexauken Creek would cause hydraulic and environmental impacts. Replacing it with a floodwall would eliminate public access to the adjacent ball field. As a result, no alternative plans were created for the Lambertville site.

17. Gibbstown Alternative Plans: Based on items identified in the project Risk Register, interior drainage and mitigation requirements and more detailed topographic mapping and current aerial photography, the plan layout for Gibbstown was significantly revised. Three Alternative Plans were created: Alternative 1-Floodwall and Levee System (emphasis on levee); Alternative 2-Complete Floodwall System (emphasis on floodwall); and Alternative 3- Floodwall and Levee System (mix of levee and floodwall).

18. Basis of Cost for Gibbstown Alternative Plans: Cost estimate presented herein for the Gibbstown Alternative Plans analysis are based on May 2014 price levels. The Alternative Plans costs generally follow the assumptions and construction procedures outlined in the concept-level analysis.

19. The costs for the Gibbstown Alternative Plans as described in paragraph “Gibbstown Alternative Plans” for this third phase of site selection are shown in Tables Alt 1 thru Alt 3: Concept-Level Costs for Site 8: Levee/Floodwall Analysis, Gibbstown (Greenwich and Logan Townships), NJ.

TENTATIVELY SELECTED PLANS (TSP)

20. TSP Alternatives Considered: Alternative plans were developed in three phases for the plan selection process. In the first phase the concept-level alternative site plans were compared during the Phase 1 - Screening of Measures. During the Phase 2-First Added Assessment of Alternatives and Phase 3-Incremental Alternative Plan Development and Assessment, additional refinement of the two viable alternative sites took place. For more information on these plans, refer to the section of the Feasibility Study, Main Report describing the Tentatively Selected Plans (TSP). Based on an analysis of these annual costs with their associated benefits, Site 5: Lambertville, Hunterdon Co., NJ - 516 LF earthen levee at Alexauken Creek and 1,409 LF floodwall along D&R Canal embankment and Site 8: Gibbstown (Greenwich and Logan Townships), Gloucester Co., NJ – 13,788 LF floodwall and 7,386 LF earthen levee between Delaware River and developed areas were selected for the TSP phase optimization and selection.

21. Lambertville TSP: The TSP in the north end of the City of Lambertville includes approximately 516 LF of levee at Alexauken Creek and approximately 1,409 LF of I-wall type floodwall along the D&R Canal. Alexauken Creek lies upstream towards the city’s northern border and has a 15 square-mile drainage area. Nearing the confluence with the Delaware River, Alexauken Creek goes under a railroad bridge and is then carried under the D&R Canal aqueduct, approximately 300 feet before it meets the Delaware River.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

22. Basis of Cost for Lambertville TSP: Cost estimate presented herein for the Lambertville TSP analysis are based on May 2014 price levels. The TSP costs generally follow the construction procedures outlined in the concept-level analysis and include new or updated costs based on the following additional information.

23. Lump sum cost items were added based on updated site information as follows: “Levee/Floodwall Mitigation” in the amount of \$482,000 was added to cover mitigation requirements. “Maintenance of Traffic” in the amount of \$75,000 was added to cover costs for a traffic plan and a flag-person for maintenance and protection of traffic.

24. Lands and damages costs have been broken out in more detail based on information provided by NAB-RE.

25. Mitigation costs were updated as shown in item “06 Fish and Wildlife Facilities” and are based on refinement of TSP alignment. For more information on the mitigation costs used for the mitigation optimization, refer to the Section of the Feasibility Study, Main Report describing Line of Protection.

26. Interior drainage costs of \$902,000 were added as shown in item “15 Floodway Control-Diversion Structure” and are based on maximizing NED benefits. For more information on the interior drainage optimization, refer to the Section of the Feasibility Study, Main Report describing Interior Drainage.

27. The costs for the Lambertville TSP as described in paragraph 16 for this first phase of site selection are shown in Table 1.

28. Annual Charges for Lambertville TSP: The estimate of annual charges for the tentatively selected plan is based on an economic project life of 50 years and an interest rate of 3.5%. The annual charges include annualized first cost and interest during construction, post construction monitoring costs, and OMRR&R costs. It is noted that interest during construction was developed for the first cost of the project constructed over a 30-month period. For the Lambertville TSP, the total annualized cost is \$432,000.

29. OMRR&R costs for the TSP were estimated to be \$36,000 annually and covers inspections and maintenance of the gates, gate chambers, access ramps, levees, and interior drainage appurtenant structures.

30. Post construction monitoring costs include environmental monitoring over the 50-year project life. Total annualized monitoring costs are \$20,000 per year for the first 5 years after construction.

31. Gibbstown TSP: The TSP in Gibbstown consists of approximately 7,386 linear feet of levee and approximately 13,788 LF of floodwall forming the line of protection which generally follows the railway alignment along the north edge of town. The TSP also included

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

acquisition of 16 residential properties and one currently vacant commercial property and three ringwalls around commercial facilities.

32. Basis of Cost for Gibbstown TSP: Cost estimate presented herein for the Gibbstown TSP analysis are based on May 2014 price levels. The TSP costs generally follow the construction procedures outlined in the concept-level analysis and include new or updated costs based on the following additional information.

33. Lump sum cost items were added based on updated site information as follows: “Utility relocation” in the amount of \$3,000,000 was included as a place holder to account for pipe crossings, buried communication lines and overhead wires. “Levee/Floodwall Mitigation” in the amount of \$3,521,000 (excluding contingencies) was added to cover mitigation requirements. “Maintenance of Traffic” in the amount of \$1,000,000 was added to cover costs for a traffic plan and a flag-person for maintenance and protection of traffic.

34. Lands and damages costs have been broken out in more detail based on information provided by NAB-RE.

35. Mitigation costs were updated as shown in item “06 Fish and Wildlife Facilities” and are based on three alternative alignments that were considered for the Gibbstown line of protection. For more information on the mitigation costs used for the mitigation optimization, refer to the Section of the Feasibility Study, Main Report describing Line of Protection.

36. Interior drainage costs of \$12,572,000 were added as shown in item “15 Floodway Control-Diversion Structure” and are based on maximizing NED benefits. For more information on the interior drainage optimization, refer to the Section of the Feasibility Study, Main Report describing Interior Drainage.

37. The costs for the Gibbstown TSP as described in paragraph 26 for this first phase of site selection are shown in Table 2.

38 Annual Charges for Gibbstown TSP: The estimate of annual charges for the tentatively selected plan is based on an economic project life of 50 years and an interest rate of 3.5%. The annual charges include annualized first cost and interest during construction, post construction monitoring costs, and OMRR&R costs. It is noted that interest during construction was developed for the first cost of the project constructed over a 30-month period. For the Gibbstown TSP, the total annualized cost is \$8,286,000.

39. OMRR&R costs for the TSP were estimated to be \$198,000 annually and covers inspections and maintenance of the gates, gate chambers, access ramps, levees, and interior drainage appurtenant structures.

40. Post construction monitoring costs include environmental monitoring over the 50-year project life. Total annualized monitoring costs are \$20,000 per year for the first 5 years after construction.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

OPTIMIZATION OF SITE 5: LAMBERTVILLE, HUNTERDON CO., NJ

41. General: [\[to be provided by NAP\]](#)

OPTIMIZATION OF SITE 8: GIBBSTOWN (GREENWICH AND LOGAN TOWNSHIPS), GLOUCESTER CO., NJ

42. General: [\[to be provided by NAP\]](#)

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table 1: Tentatively Selected Plan Costs - Site 5: Levee/Floodwall, Lambertville, NJ

Price Level:

May-14

Location: Along Alexauken Creek (levee) and Delaware & Raritan Canal embankment (floodwall).
 Measure: 516 LF of earthen levee at Alexauken Creek (top height 14 feet above grade) and 1409 LF of floodwall along D&R Canal (top height 5 feet above grade). 1.118

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|----------------|---|----------|-------|--------------|------------------|-------------------------|--------------------|
| 01 | Lands and Damages | | | | \$288,052 | \$101,000 | \$389,000 |
| | Permanent Easement | 3.1 | Acres | \$62,290.00 | \$192,568 | \$67,000 | \$259,568 |
| | Temporary Easement | 0.9 | Acres | \$6,229.00 | \$5,405 | \$2,000 | \$7,405 |
| | Land assoc. with 54" pipe install | 1 | LS | \$62,290.00 | \$62,000 | \$22,000 | \$84,000 |
| | Survey and Appraisal | 1 | LS | 8% | \$28,078 | \$10,000 | \$38,078 |
| 06 | Fish and Wildlife Facilities | | | | | | |
| | Levee/Floodwall Mitigation | 1 | LS | \$482,000.00 | \$482,000 | \$169,000 | \$651,000 |
| 11 | Levees and Floodwalls | | | | \$3,216,000 | \$1,127,000 | \$4,343,000 |
| | Mobilization & Demobilization | 1 | LS | \$75,000.00 | \$75,000 | \$26,000 | \$101,000 |
| | Access Road Preparatory Work | 1925 | LF | \$80.00 | \$154,000 | \$54,000 | \$208,000 |
| | Contractor Staging Areas | 1 | EA | \$25,000.00 | \$25,000 | \$9,000 | \$34,000 |
| | Maintenance of Traffic | 1 | Job | \$75,000.00 | \$75,000 | \$26,000 | \$101,000 |
| | Floodwalls | | | | | | |
| | Concrete | 572 | CY | \$838.50 | \$480,000 | \$168,000 | \$648,000 |
| | Clearing & Grubbing | 2.25 | Acres | \$21,242.00 | \$48,000 | \$17,000 | \$65,000 |
| | Excavation | 1,979 | CY | \$12.18 | \$24,000 | \$8,000 | \$32,000 |
| | Common Fill | 2,007 | CY | \$30.19 | \$61,000 | \$21,000 | \$82,000 |
| | Care of Water | 9 | Days | \$1,185.08 | \$11,000 | \$4,000 | \$15,000 |
| | Stripping | 573 | CY | \$10.06 | \$6,000 | \$2,000 | \$8,000 |
| | Sheet Piling | 31,602 | SF | \$50.31 | \$1,590,000 | \$557,000 | \$2,147,000 |
| | 6" Topsoil & Seeding | 3,107 | SY | \$5.03 | \$16,000 | \$6,000 | \$22,000 |
| | Levee | | | | | | |
| | Clearing & Grubbing | 1.71 | Acres | \$21,242.00 | \$36,000 | \$13,000 | \$49,000 |
| | Excavation | 1,817 | CY | \$12.30 | \$22,000 | \$8,000 | \$30,000 |
| | Purchase Impervious Fill | 3,180 | CY | \$30.19 | \$96,000 | \$34,000 | \$130,000 |
| | Common Fill | 8,862 | CY | \$30.19 | \$267,000 | \$93,000 | \$360,000 |
| | Haul Fill - 5 miles | 12,641 | CY | \$12.69 | \$160,000 | \$56,000 | \$216,000 |
| | Backfill of material | 11,442 | CY | \$3.35 | \$38,000 | \$13,000 | \$51,000 |
| | Care of Water/dewatering | 4 | Days | \$1,185.08 | \$5,000 | \$2,000 | \$7,000 |
| | Stripping | 1,424 | CY | \$10.06 | \$14,000 | \$5,000 | \$19,000 |
| | 6" Topsoil & Seeding | 2,551 | SY | \$5.03 | \$13,000 | \$5,000 | \$18,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$902,000 | \$316,000 | \$1,218,000 |
| | Excavation for pipe | 335 | CY | \$12.30 | \$4,000 | \$1,400 | \$5,400 |
| | Backfill of material for pipe | 557 | CY | \$3.35 | \$1,900 | \$700 | \$2,600 |
| | Sheetpiling | 2,600 | SF | \$50.31 | \$131,000 | \$46,000 | \$177,000 |
| | Manhole Frame & Cover | 7 | EACH | \$967.07 | \$7,000 | \$2,000 | \$9,000 |
| | Concrete for inlet/outlet/MH | 136.5 | CY | \$463.97 | \$63,000 | \$22,000 | \$85,000 |
| | 24" RCP | 175 | LF | \$64.84 | \$11,000 | \$4,000 | \$15,000 |
| | 24" Dia. Flap Gate | 5 | EACH | \$4,052.75 | \$20,000 | \$7,000 | \$27,000 |
| | 24" Sluice Gate | 5 | EACH | \$18,558.80 | \$93,000 | \$33,000 | \$126,000 |
| | 24" x 24" Trash Rack | 5 | EACH | \$571.30 | \$3,000 | \$1,100 | \$4,100 |
| | 60" x 60" Sluice Gate | 2 | EACH | \$50,310.00 | \$101,000 | \$35,400 | \$136,400 |
| | 60" dia Flap gate | 2 | EACH | \$19,006.00 | \$38,000 | \$13,300 | \$51,300 |
| | Concrete for Chamber | 69 | CY | \$838.50 | \$58,000 | \$20,300 | \$78,300 |
| | Excavation for chamber | 117 | CY | \$12.30 | \$1,000 | \$400 | \$1,400 |
| | Jacking/Bore 54" pipe | 255 | LF | \$1,246.00 | \$318,000 | \$111,300 | \$429,300 |
| | 54" Inlet Structure | 1 | EACH | \$23,003.00 | \$23,000 | \$8,100 | \$31,100 |
| | 54" Outlet structure | 1 | EACH | \$23,003.00 | \$23,000 | \$8,100 | \$31,100 |
| | 60" x 60" Trash rack | 2 | EACH | \$3,194.00 | \$6,000 | \$2,100 | \$8,100 |
| 19 | Buildings and Grounds | | | | \$437,100 | \$153,000 | \$590,000 |
| | One buyout | 1.0 | LS | \$437,100.00 | \$437,100 | \$153,000 | \$590,100 |
| 30 | Planning, Engineering, and Design | | Job | 12% | \$816,000 | \$122,000 | \$938,000 |
| 31 | Construction Management | | Job | 10% | \$680,000 | \$102,000 | \$782,000 |
| | | | | | | Total First Cost | \$8,911,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

| Table 2: Tentatively Selected Plan Costs for Site 8: Levee/Floodwall, Gibbstown, NJ | | | | | | | |
|--|---|----------|-------|------------------------------|---------------------|---------------------|----------------------|
| (Greenwich and Logan Townships, NJ) | | | | | | | |
| Location: | Between Delaware River and developed areas. | | | Price Level: May 2014 | | | |
| Measure: | 21339 LF levee and floodwall excluding the ring levees, ring walls and their entrances; 64.6% (13,788) of the structure would be floodwall (concrete T-wall and I-S wall with piles) and 7,386 LF of levee. Ring walls and levees are not included in this length Top height is 12 feet NAVD88. Includes nonstructural protection for 17 buildings outside LOP and 3 manufacturing facilities | | | | | | |
| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
| 01 | Lands and Damages | | | | \$5,182,000 | \$1,814,000 | \$6,996,000 |
| | Permanent Easement | 62.5 | Acres | \$62,500.00 | \$3,905,000 | \$ 1,367,000 | \$5,272,000 |
| | Temporary Easement | 12.3 | Acres | \$62,500.00 | \$772,000 | \$ 270,000 | \$1,042,000 |
| | Survey and Appraisal | | LS | 8% | \$505,000 | \$ 177,000 | \$682,000 |
| 02 | Utility relocation | 1 | LS | \$3,000,000.00 | \$3,000,000 | \$ 1,050,000 | \$4,050,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 3,521,000 | \$ 1,232,000 | \$ 4,753,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$3,521,000.00 | \$ 3,521,000 | \$ 1,232,000 | \$ 4,753,000 |
| 11 | Levees and Floodwalls | | | | \$84,875,000 | \$29,708,000 | \$114,583,000 |
| | Mob & Demob | 1 | LS | \$75,000.00 | \$75,000 | \$ 26,000 | \$101,000 |
| | Temporary Access Road | 19,100 | LF | \$80.00 | \$1,528,000 | \$ 535,000 | \$2,063,000 |
| | Contractor Staging Areas | 3 | EA | \$25,000.00 | \$75,000 | \$ 26,000 | \$101,000 |
| | Maintenance of Traffic | 1 | LS | \$1,000,000.00 | \$ 1,000,000 | \$ 350,000 | \$ 1,350,000 |
| | Ring Levee | | | | \$5,740,000 | \$2,009,000 | \$7,749,000 |
| | Clearing & Grubbing | 10.3 | Acres | \$21,242.00 | \$220,000 | \$ 77,000 | \$ 297,000 |
| | Excavation | 16,269 | CY | \$12.30 | \$200,000 | \$ 70,000 | \$ 270,000 |
| | Purchase Impervious Fill | 20,944 | CY | \$30.19 | \$632,000 | \$ 221,000 | \$ 853,000 |
| | Purchase Common Fill | 66,026 | CY | \$30.19 | \$1,993,000 | \$ 698,000 | \$ 2,691,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 85,343 | CY | \$12.69 | \$1,083,000 | \$ 379,000 | \$ 1,462,000 |
| | Haul and Disposal | 14,642 | CY | \$12.69 | \$186,000 | \$ 65,000 | \$ 251,000 |
| | Dump Charges (25% of material) | 5,683 | Tons | \$81.87 | \$465,000 | \$ 163,000 | \$ 628,000 |
| | Dump Charges (75% of material) | 17,049 | Tons | \$24.58 | \$419,000 | \$ 147,000 | \$ 566,000 |
| | Backfill of material | 88,597 | CY | \$3.35 | \$297,000 | \$ 104,000 | \$ 401,000 |
| | Dewatering | 39 | Days | \$1,185.08 | \$46,000 | \$ 16,000 | \$ 62,000 |
| | Stripping of Topsoil | 9,437 | CY | \$10.06 | \$95,000 | \$ 33,000 | \$ 128,000 |
| | 6" Topsoil & Seeding | 20,741 | SY | \$5.03 | \$104,000 | \$ 36,000 | \$ 140,000 |
| | Ring Walls (Non Structural) | | | | \$2,429,000 | \$852,000 | \$3,281,000 |
| | Concrete in place | 2,063 | CY | \$838.50 | \$1,730,000 | \$ 606,000 | \$ 2,336,000 |
| | Clearing & Grubbing | 4.3 | Acres | \$21,242.00 | \$92,000 | \$ 32,000 | \$ 124,000 |
| | Excavation | 4,840 | CY | \$12.30 | \$60,000 | \$ 21,000 | \$ 81,000 |
| | Purchase Common Fill | 3,389 | CY | \$30.19 | \$102,000 | \$ 36,000 | \$ 138,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 3,389 | CY | \$12.69 | \$43,000 | \$ 15,000 | \$ 58,000 |
| | Haul and Disposal | 4,356 | CY | \$12.69 | \$55,000 | \$ 19,000 | \$ 74,000 |
| | Dewatering | 25 | Days | \$1,185.08 | \$30,000 | \$ 11,000 | \$ 41,000 |
| | Dump Charges (25% of material) | 1,691 | TON | \$81.87 | \$138,000 | \$ 48,000 | \$ 186,000 |
| | Dump Charges (75% of material) | 5,072 | TON | \$24.58 | \$125,000 | \$ 44,000 | \$ 169,000 |
| | Backfill of material | 3,873 | CY | \$3.35 | \$13,000 | \$ 5,000 | \$ 18,000 |
| | Stripping of Topsoil | 1,023 | CY | \$10.06 | \$10,000 | \$ 4,000 | \$ 14,000 |
| | 6" Topsoil & Seeding | 6,138 | SY | \$5.03 | \$31,000 | \$ 11,000 | \$ 42,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

| Table 2: Tentatively Selected Plan Costs for Site 8: Levee/Floodwall, Gibbstown, NJ | | | | | | | |
|---|--|-----------|-------|--------------|---------------------|---------------------|----------------------|
| (Greenwich and Logan Townships, NJ) | | | | | | | |
| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
| | Levees | | | | \$20,000,000 | \$ 7,001,000 | \$ 27,001,000 |
| | Clearing & Grubbing | 35.8 | Acres | \$21,242.00 | \$ 760,000 | \$ 266,000 | \$ 1,026,000 |
| | Excavation | 60,985 | CY | \$12.30 | \$ 750,000 | \$ 263,000 | \$ 1,013,000 |
| | Purchase Impervious Fill | 48,761 | CY | \$30.19 | \$ 1,472,000 | \$ 515,000 | \$ 1,987,000 |
| | Purchase Common Fill | 140,239 | CY | \$30.19 | \$ 4,233,000 | \$ 1,482,000 | \$ 5,715,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 189,000 | CY | \$12.69 | \$ 2,398,000 | \$ 839,000 | \$ 3,237,000 |
| | Backfill of material | 195,098 | CY | \$3.35 | \$ 654,000 | \$ 229,000 | \$ 883,000 |
| | Care of Water/dewatering | 89 | Days | \$1,185.08 | \$ 105,000 | \$ 37,000 | \$ 142,000 |
| | Stripping of Topsoil | 21,861 | CY | \$10.06 | \$ 220,000 | \$ 77,000 | \$ 297,000 |
| | 6" Topsoil & Seeding | 48,930 | SY | \$5.03 | \$ 246,000 | \$ 86,000 | \$ 332,000 |
| | Geotextile | 173,079 | SY | \$4.47 | \$ 774,000 | \$ 271,000 | \$ 1,045,000 |
| | Vertical (wick) Drains | 2,880,057 | LF | \$1.50 | \$ 4,315,000 | \$ 1,510,000 | \$ 5,825,000 |
| | Haul and Dispose | 54,887 | CY | \$12.69 | \$ 696,000 | \$ 244,000 | \$ 940,000 |
| | Dump Charges (25% of material) | 21,303 | TONS | \$81.87 | \$ 1,744,000 | \$ 610,000 | \$ 2,354,000 |
| | Dump Charges (75% of material) | 63,908 | TONS | \$24.58 | \$ 1,571,000 | \$ 550,000 | \$ 2,121,000 |
| | Levee Surcharge Fill Volume | 5,022 | CY | \$12.30 | \$ 62,000 | \$ 22,000 | \$ 84,000 |
| | Floodwalls | | | | \$54,028,000 | \$18,909,000 | \$72,937,000 |
| | Concrete in place | 32,045 | CY | \$838.50 | \$26,870,000 | \$ 9,405,000 | \$ 36,275,000 |
| | Clearing & Grubbing | 34.7 | Acres | \$21,242.00 | \$738,000 | \$ 258,000 | \$ 996,000 |
| | Excavation | 96,548 | CY | \$12.30 | \$1,187,000 | \$ 415,000 | \$ 1,602,000 |
| | Purchase Common Fill | 60,798 | CY | \$33.54 | \$2,039,000 | \$ 714,000 | \$ 2,753,000 |
| | Dewatering | 345 | Days | \$1,185.08 | \$409,000 | \$ 143,000 | \$ 552,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 51,143 | CY | \$12.69 | \$649,000 | \$ 227,000 | \$ 876,000 |
| | Haul and Disposal | 86,893 | CY | \$12.69 | \$1,103,000 | \$ 386,000 | \$ 1,489,000 |
| | Stripping of Topsoil | 19,864 | CY | \$10.06 | \$200,000 | \$ 70,000 | \$ 270,000 |
| | Piles | 164,729 | LF | \$83.85 | \$13,812,000 | \$ 4,834,000 | \$ 18,646,000 |
| | Sheet Piling | 14,100 | SF | \$60.60 | \$854,000 | \$ 299,000 | \$ 1,153,000 |
| | Toe Drain Filter | 979 | CY | \$32.48 | \$32,000 | \$ 11,000 | \$ 43,000 |
| | Dump Charges (25% of material) | 33,725 | TONS | \$81.87 | \$2,761,000 | \$ 966,000 | \$ 3,727,000 |
| | Dump Charges (75% of material) | 101,176 | TONS | \$24.58 | \$2,486,000 | \$ 870,000 | \$ 3,356,000 |
| | Backfill of material | 70,453 | CY | \$3.35 | \$236,000 | \$ 83,000 | \$ 319,000 |
| | Toe Drain 6" Perf. Pipe | 13,168 | LF | \$3.91 | \$52,000 | \$ 18,000 | \$ 70,000 |
| | 6" Topsoil & Seeding | 119,184 | SY | \$5.03 | \$600,000 | \$ 210,000 | \$ 810,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 9,312,000 | \$ 3,260,000 | \$ 12,572,000 |
| | Excavation | 5,578 | CY | \$12.30 | \$ 69,000 | \$ 24,000 | \$ 93,000 |
| | Backfill of material for pipe | 3,953 | CY | \$3.35 | \$ 13,000 | \$ 5,000 | \$ 18,000 |
| | Manhole Frame & Cover | 59 | EACH | \$967.07 | \$ 57,000 | \$ 20,000 | \$ 77,000 |
| | Concrete for Sluice Gates | 1,714 | CY | \$838.50 | \$ 1,437,000 | \$ 503,000 | \$ 1,940,000 |
| | Concrete for inlet/outlet/MH | 1,151 | CY | \$463.97 | \$ 534,000 | \$ 187,000 | \$ 721,000 |
| | 24" RCP | 2,065 | LF | \$64.84 | \$ 134,000 | \$ 47,000 | \$ 181,000 |
| | 24" Dia. Flap Gate | 59 | EACH | \$4,052.75 | \$ 239,000 | \$ 84,000 | \$ 323,000 |
| | 24" Sluice Gate | 59 | EACH | \$18,558.80 | \$ 1,095,000 | \$ 383,000 | \$ 1,478,000 |
| | 24" x 24" Trash Rack | 59 | EACH | \$571.30 | \$ 34,000 | \$ 12,000 | \$ 46,000 |
| | 10' x 6' Sluice Gate | 12 | EACH | \$111,800.00 | \$ 1,342,000 | \$ 470,000 | \$ 1,812,000 |
| | 10'x6' Flap Gate | 12 | EACH | \$39,130.00 | \$ 470,000 | \$ 165,000 | \$ 635,000 |
| | Piles | 9,750 | LF | \$83.85 | \$ 818,000 | \$ 286,000 | \$ 1,104,000 |
| | Dewatering | 360 | DAYS | \$1,677.00 | \$ 604,000 | \$ 211,000 | \$ 815,000 |
| | Haul and Disposal | 1,625 | CY | \$12.69 | \$ 21,000 | \$ 7,000 | \$ 28,000 |
| | Allowance for electrical | 3 | EACH | \$300,000.00 | \$ 900,000 | \$ 315,000 | \$ 1,215,000 |
| | Swing Gates | 1,947 | SF | \$793.78 | \$ 1,545,000 | \$ 541,000 | \$ 2,086,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

| Table 2: Tentatively Selected Plan Costs for Site 8: Levee/Floodwall, Gibbstown, NJ | | | | | | | |
|---|--|----------|-----|----------------|----------------------|---------------------|-----------------------|
| (Greenwich and Logan Townships, NJ) | | | | | | | |
| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
| 19 | Buildings & Grounds | | | | \$ 3,308,560 | \$ 1,159,000 | \$ 4,467,560 |
| | Voluntary Acquisition (approx. 17) | 1 | LS | \$2,485,000.00 | \$ 2,485,000 | \$ 870,000 | \$ 3,355,000 |
| | Abatement | 1 | LS | \$170,000.00 | \$ 170,000 | \$ 60,000 | \$ 230,000 |
| | Demolition | 1 | LS | \$331,000.00 | \$ 331,000 | \$ 116,000 | \$ 447,000 |
| | Survey and Appraisal | | LS | 8% | \$322,560 | \$ 113,000 | \$435,560 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 16,365,000 | \$ 2,455,000 | \$ 18,820,000 |
| 31 | Construction Management | 1 | Job | 10% | \$ 13,638,000 | \$ 2,046,000 | \$ 15,684,000 |
| Total First Cost | | | | | | | \$ 181,926,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 1 Concept-Level Costs for Site 1: Floodwall, Knowlton, NJ (The Island/Glen Afton)

Location: Knowlton Township, NJ, running along the bank of the Delaware River.

Measure: 4,000 LF floodwall, tie-off levees perpendicular to the river, 9 interior drainage outlets.
Top height 9 feet above ground.

Price Level:

Dec-10

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|-------------------------|---|----------|------|---------------|------------------|--------------|----------------------|
| 01 | Lands and Damages | 1 | LS | \$ 461,569 | \$ 462,000 | \$ 116,000 | \$ 578,000 |
| 06 | Fish and Wildlife Facilities | | | | \$506,000 | \$ 177,000 | \$ 683,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 506,400 | \$ 506,000 | \$ 177,000 | \$ 683,000 |
| 11 | Levees and Floodwalls | | | | \$ 10,128,000 | \$ 3,545,000 | \$ 13,673,000 |
| | Floodwalls | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Maint. of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 203,000 | \$ 71,000 | \$ 274,000 |
| | Concrete | 10,378 | CY | \$ 750.00 | \$ 7,783,000 | \$ 2,724,000 | \$ 10,507,000 |
| | Excavation | 29,524 | CY | \$ 16.52 | \$ 488,000 | \$ 171,000 | \$ 659,000 |
| | Common Fill | 21,111 | CY | \$ 27.00 | \$ 570,000 | \$ 200,000 | \$ 770,000 |
| | Care of Water | 106 | Days | \$ 1,060.00 | \$ 112,000 | \$ 39,000 | \$ 151,000 |
| | Stripping | 5,531 | CY | \$ 9.00 | \$ 50,000 | \$ 18,000 | \$ 68,000 |
| | Toe Drain Filter | 243 | CY | \$ 29.05 | \$ 7,000 | \$ 2,000 | \$ 9,000 |
| | 6" Perf. Pipe | 3,200 | FT | \$ 3.50 | \$ 11,000 | \$ 4,000 | \$ 15,000 |
| | Topsoil & Seeding | 15,948 | SY | \$ 3.25 | \$ 52,000 | \$ 18,000 | \$ 70,000 |
| | Tieoff Levees | 1 | LS | \$ 726,855.67 | \$ 726,856 | \$ 254,000 | \$ 980,856 |
| 15 | Floodway Control-Diversion Structure | | | | \$373,000 | \$ 131,000 | \$ 504,000 |
| | Excavation for pipe | 603 | CY | \$10.89 | \$7,000 | \$ 2,000 | \$ 9,000 |
| | Backfill of material for pipe | 603 | CY | \$2.94 | \$2,000 | \$ 1,000 | \$ 3,000 |
| | Manhole Frame & Cover | 9 | EACH | \$665.00 | \$6,000 | \$ 2,000 | \$ 8,000 |
| | Concrete for inlet/outlet/MH | 176 | CY | \$750.00 | \$132,000 | \$ 46,000 | \$ 178,000 |
| | 24" RCP | 315 | LF | \$49.50 | \$16,000 | \$ 6,000 | \$ 22,000 |
| | 24" DIA. Flap Gate | 9 | EACH | \$11,100 | \$100,000 | \$ 35,000 | \$ 135,000 |
| | 24" Sluice Gate | 9 | EACH | \$10,700 | \$96,000 | \$ 34,000 | \$ 130,000 |
| | 24" x 24" Trash Rack | 9 | EACH | \$511 | \$5,000 | \$ 2,000 | \$ 7,000 |
| | Riprap | 2 | CY | \$90.00 | \$0 | \$ - | \$ - |
| | Excavation for Channel | 800 | CY | \$10.89 | \$9,000 | \$ 3,000 | \$ 12,000 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$1,783,000 | \$ 267,000 | \$ 2,050,000 |
| 31 | Construction Management | 1 | Job | 10% | \$1,486,000 | \$ 223,000 | \$ 1,709,000 |
| Total First Cost | | | | | | | \$ 19,197,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 2a: Concept Level Costs for Site 2a: Floodwall, Phillipsburg, NJ

Location: Along Lopatcong Creek

Measure: 700 LF floodwall (concrete T-wall). Top height approximately 15 feet above grade.

Price Level:

Dec-10

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|----------------|---|----------|------|-------------|------------------|-------------------------|---------------------|
| 01 | Lands and Damages | 1 | LS | \$ 52,323 | \$ 52,000 | \$ 13,000 | \$ 65,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 199,000 | \$ 70,000 | \$ 269,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 199,050 | \$ 199,000 | \$ 70,000 | \$ 269,000 |
| 11 | Levees and Floodwalls | | | | \$ 3,981,000 | \$ 1,393,000 | \$ 5,374,000 |
| | Floodwalls | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Maint. Of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 76,000 | \$ 27,000 | \$ 103,000 |
| | Concrete | 4,384 | CY | \$ 750.00 | \$ 3,288,000 | \$ 1,151,000 | \$ 4,439,000 |
| | Excavation | 11,670 | CY | \$ 16.52 | \$ 193,000 | \$ 68,000 | \$ 261,000 |
| | Common Fill | 8,104 | CY | \$ 27.00 | \$ 219,000 | \$ 77,000 | \$ 296,000 |
| | Care of Water | 41 | Days | \$ 1,060.00 | \$ 43,000 | \$ 15,000 | \$ 58,000 |
| | Stripping | 1,777 | CY | \$ 9.00 | \$ 16,000 | \$ 6,000 | \$ 22,000 |
| | Toe Drain Filter | 53 | CY | \$ 29.05 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| | 6" Perf. Pipe | 700 | FT | \$ 3.50 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| | Topsoil & Seeding | 5,189 | SY | \$ 3.25 | \$ 17,000 | \$ 6,000 | \$ 23,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 35,000 | \$ 12,000 | \$ 47,000 |
| | Excavation for pipe | 67 | CY | \$10.89 | \$ 1,000 | \$ 350 | \$ 1,000 |
| | Backfill of material for pipe | 67 | CY | \$2.94 | \$ 200 | \$ 70 | \$ 300 |
| | Manhole Frame & Cover | 1 | EACH | \$665 | \$ 1,000 | \$ 350 | \$ 1,000 |
| | Concrete for inlet/outlet/MH | 20 | CY | \$400 | \$ 8,000 | \$ 2,800 | \$ 11,000 |
| | 24" RCP | 35 | LF | \$50 | \$ 2,000 | \$ 700 | \$ 3,000 |
| | 24" Dia. Flap Gate | 1 | EACH | \$11,100 | \$ 11,000 | \$ 3,850 | \$ 15,000 |
| | 24" Sluice Gate | 1 | EACH | \$10,700 | \$ 11,000 | \$ 3,850 | \$ 15,000 |
| | 24" x 24" Trash Rack | 1 | EACH | \$511 | \$ 1,000 | \$ 350 | \$ 1,000 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 683,000 | \$ 102,000 | \$ 785,000 |
| 31 | Construction Management | 1 | Job | 10% | \$ 569,000 | \$ 85,000 | \$ 654,000 |
| | | | | | | Total First Cost | \$ 7,194,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 2b: Concept Level Costs for Site 2b: Floodwall, Phillipsburg, NJ

Location: Municipal Waste Water Treatment Plant (WWTP).

Measure: 1,725 LF floodwall/ringwall (concrete T-wall) surrounding municipal WWTP. Top height approximately 10 feet above grade.

Price Level: Dec 10

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|----------------|---|----------|------|-------------|------------------|-------------------------|----------------------|
| 01 | Lands and Damages | 1 | LS | \$1,615 | \$ 1,615 | \$ 400 | \$ 2,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 370,000 | \$ 130,000 | \$ 500,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 369,650 | \$ 370,000 | \$ 130,000 | \$ 500,000 |
| 11 | Levees and Floodwalls | | | | \$ 7,393,000 | \$ 2,588,000 | \$ 9,981,000 |
| | Floodwalls | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Maint. of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 145,000 | \$ 51,000 | \$ 196,000 |
| | Concrete | 8,211 | CY | \$ 750.00 | \$ 6,158,000 | \$ 2,155,000 | \$ 8,313,000 |
| | Excavation | 22,537 | CY | \$ 16.52 | \$ 372,000 | \$ 130,000 | \$ 502,000 |
| | Common Fill | 15,865 | CY | \$ 27.00 | \$ 428,000 | \$ 150,000 | \$ 578,000 |
| | Care of Water | 80 | Days | \$ 1,060.00 | \$ 85,000 | \$ 30,000 | \$ 115,000 |
| | Stripping | 3,782 | CY | \$ 9.00 | \$ 34,000 | \$ 12,000 | \$ 46,000 |
| | Toe Drain | 131 | CY | \$ 29.05 | \$ 4,000 | \$ 1,000 | \$ 5,000 |
| | 6" Perf. Pipe | 1,725 | LF | \$ 3.50 | \$ 6,000 | \$ 2,000 | \$ 8,000 |
| | Topsoil & Seeding | 10,999 | SY | \$ 3.25 | \$ 36,000 | \$ 13,000 | \$ 49,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 134,000 | \$ 46,000 | \$ 180,000 |
| | Excavation for pipe | 268 | CY | \$10.89 | \$ 3,000 | \$ 1,000 | \$ 4,000 |
| | Backfill of material for pipe | 268 | CY | \$2.94 | \$ 1,000 | \$ 400 | \$ 1,400 |
| | Manhole Frame & Cover | 4 | EACH | \$665 | \$ 3,000 | \$ 1,000 | \$ 4,000 |
| | Concrete for inlet/outlet/MH | 78 | CY | \$400 | \$ 31,000 | \$ 11,000 | \$ 42,000 |
| | 24" RCP | 140 | LF | \$50 | \$ 7,000 | \$ 2,000 | \$ 9,000 |
| | 24" Dia. Flap Gate | 4 | EACH | \$11,100 | \$ 44,000 | \$ 15,000 | \$ 59,000 |
| | 24" Sluice Gate | 4 | EACH | \$10,700 | \$ 43,000 | \$ 15,000 | \$ 58,000 |
| | 24" x 24" Trash Rack | 4 | EACH | \$511 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| 30 | Planning, Engineering, and Design | | Job | 12% | \$ 1,220,000 | \$ 183,000 | \$ 1,403,000 |
| 31 | Construction Management | | Job | 10% | \$ 1,016,000 | \$ 152,000 | \$ 1,168,000 |
| | | | | | | | |
| | | | | | | Total First Cost | \$ 13,234,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 4: Concept-Level Costs for Site 4: Levee Reinforcement, Stockton, NJ

Price Level: Dec 10

Location: Along Delaware and Raritan Canal embankment.

Measure: Reinforce 5,400 LF of the existing D&R Canal embankment. Top height 9 feet above embankment.

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|----------------|---|----------|-------|------------|------------------|-------------------------|--------------------|
| 01 | Lands and Damages | 1 | LS | | \$12,000 | \$ 3,000 | \$15,000 |
| 11 | Levees and Floodwalls ⁽¹⁾ | | | | \$ 3,680,000 | \$ 2,062,000 | \$ 5,742,000 |
| | Levees | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Maint. of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 143,000 | \$ 50,000 | \$ 193,000 |
| | Clearing & Grubbing | 20 | Acres | \$19,000 | \$ 389,000 | \$ 136,000 | \$ 525,000 |
| | Excavation | 6,400 | CY | \$10.89 | \$ 70,000 | \$ 25,000 | \$ 95,000 |
| | Purchase Impervious Fill | 19,500 | CY | \$27.00 | \$ 527,000 | \$ 184,000 | \$ 711,000 |
| | Purchase Common Fill (Assume 67% reuse of excavated material) | 101,306 | CY | \$27.00 | \$ 2,735,000 | \$ 957,000 | \$ 3,692,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 120,806 | CY | \$11.35 | \$ 1,371,000 | \$ 480,000 | \$ 1,851,000 |
| | Backfill of material | 113,200 | CY | \$2.94 | \$ 333,000 | \$ 117,000 | \$ 450,000 |
| | Care of Water/dewatering | 45 | Days | \$1,060.00 | \$ 48,000 | \$ 17,000 | \$ 65,000 |
| | Stripping of Topsoil | 9,500 | CY | \$9.00 | \$ 86,000 | \$ 30,000 | \$ 116,000 |
| | Topsoil & Seed | 19,040 | SY | \$3.25 | \$ 62,000 | \$ 22,000 | \$ 84,000 |
| | Mitigation-Historic Significance | 1 | LS | 25% | \$ 1,472,000 | - | \$ 1,472,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 65,000 | \$ 22,000 | \$ 87,000 |
| | Excavation for pipe | 134 | CY | \$ 10.89 | \$ 1,000 | \$ 400 | \$ 1,400 |
| | Backfill of material for pipe | 134 | CY | \$ 2.94 | \$ 400 | \$ 100 | \$ 500 |
| | Manhole Frame & Cover | 2 | EACH | \$ 665 | \$ 1,000 | - | \$ 1,000 |
| | Concrete for inlet/outlet/MH | 39 | CY | \$ 400 | \$ 16,000 | \$ 6,000 | \$ 22,000 |
| | 24" RCP | 70 | LF | \$ 49.50 | \$ 3,000 | \$ 1,000 | \$ 4,000 |
| | 24" DIA. Flap Gate | 2 | EACH | \$ 11,100 | \$ 22,000 | \$ 8,000 | \$ 30,000 |
| | 24" Sluice Gate | 2 | EACH | \$ 10,700 | \$ 21,000 | \$ 7,000 | \$ 28,000 |
| | 24"X24" Trash Rack | 2 | EACH | \$ 511.00 | \$ 1,000 | - | \$ 1,000 |
| 30 | Planning, Engineering, and Design | | Job | 12% | \$ 699,000 | \$ 105,000 | \$ 804,000 |
| 31 | Construction Management | | Job | 10% | \$ 583,000 | \$ 87,000 | \$ 670,000 |
| | | | | | | Total First Cost | \$7,318,000 |

(1) Reflects -50% adjustment factor for existing canal embankment

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 5: Concept-Level Costs for Site 5: Levee/Floodwall, Lambertville, NJ

Price Level:

Dec-10

Location: Along Alexauken Creek (levee) and Delaware & Raritan Canal embankment (floodwall).

Measure: 590 LF of earthen levee at Alexauken Creek (top height 12 feet above grade) and 810 LF of floodwall along D&R Canal. Top height 5 feet above grade.

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|----------------|---|----------|-------|------------|------------------|-------------------------|---------------------|
| 01 | Lands and Damages | 1 | LS | \$167,000 | \$167,000 | \$ 42,000 | \$ 209,000 |
| 06 | Fish and Wildlife Facilities | | | | | | |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 310,000 | \$310,000 | \$ 47,000 | \$ 357,000 |
| 11 | Levees and Floodwalls | | | | \$ 2,064,000 | \$ 723,000 | \$ 2,787,000 |
| | Floodwalls | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Concrete | 1,530 | CY | \$ 750 | \$ 1,147,000 | \$ 401,000 | \$ 1,548,000 |
| | Excavation | 4,877 | CY | \$ 10.89 | \$ 53,000 | \$ 19,000 | \$ 72,000 |
| | Common Fill | 3,574 | CY | \$ 27.00 | \$ 97,000 | \$ 34,000 | \$ 131,000 |
| | Care of Water | 18 | Days | \$ 1,060 | \$ 19,000 | \$ 7,000 | \$ 26,000 |
| | Stripping | 1,099 | CY | \$ 9.00 | \$ 10,000 | \$ 4,000 | \$ 14,000 |
| | Length of Piles | 17,978 | LF | \$ 10.00 | \$ 180,000 | \$ 63,000 | \$ 243,000 |
| | Toe Drain Filter | 62 | CY | \$ 29.05 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| | 6" Perf. Pipe | 809 | LF | \$ 3.50 | \$ 3,000 | \$ 1,000 | \$ 4,000 |
| | Topsoil & Seeding | 3,133 | SY | \$ 3.25 | \$ 10,000 | \$ 4,000 | \$ 14,000 |
| | Levees | | | | | | |
| | Maint. of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 41,000 | \$ 14,000 | \$ 55,000 |
| | Clearing & Grubbing | 1.70 | Acres | \$ 19,000 | \$ 32,000 | \$ 11,000 | \$ 43,000 |
| | Excavation | 1,375 | CY | \$ 10.89 | \$ 15,000 | \$ 5,000 | \$ 20,000 |
| | Purchase Impervious Fill | 2,578 | CY | \$ 27.00 | \$ 70,000 | \$ 25,000 | \$ 95,000 |
| | Common Fill | 4,787 | CY | \$ 27.00 | \$ 129,000 | \$ 45,000 | \$ 174,000 |
| | Haul Fill - 5 miles | 7,365 | CY | \$ 11.35 | \$ 84,000 | \$ 29,000 | \$ 113,000 |
| | Backfill of material | 8,286 | CY | \$ 2.94 | \$ 24,000 | \$ 8,000 | \$ 32,000 |
| | Care of Water/dewatering | 3 | Days | \$ 1,060 | \$ 3,000 | \$ 1,000 | \$ 4,000 |
| | Stripping | 1,235 | CY | \$ 9.00 | \$ 11,000 | \$ 4,000 | \$ 15,000 |
| | Topsoil & Seed | 2,789 | SY | \$ 3.25 | \$ 9,000 | \$ 3,000 | \$ 12,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 134,000 | \$ 46,000 | \$ 180,000 |
| | Excavation for pipe | 268 | CY | \$ 10.89 | \$ 3,000 | \$ 1,000 | \$ 4,000 |
| | Backfill of material for pipe | 268 | CY | \$ 2.94 | \$ 1,000 | \$ 400 | \$ 1,400 |
| | Manhole Frame & Cover | 4 | EACH | \$ 665 | \$ 3,000 | \$ 1,000 | \$ 4,000 |
| | Concrete for inlet/outlet/MH | 78 | CY | \$ 400 | \$ 31,000 | \$ 11,000 | \$ 42,000 |
| | 24" RCP | 140 | LF | \$ 50 | \$ 7,000 | \$ 2,000 | \$ 9,000 |
| | 24" Dia. Flap Gate | 4 | EACH | \$ 11,100 | \$ 44,000 | \$ 15,000 | \$ 59,000 |
| | 24" Sluice Gate | 4 | EACH | \$ 10,700 | \$ 43,000 | \$ 15,000 | \$ 58,000 |
| | 24" x 24" Trash Rack | 4 | EACH | \$ 511 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| 30 | Planning, Engineering, and Design | | Job | 12% | \$ 424,000 | \$ 64,000 | \$ 488,000 |
| 31 | Construction Management | | Job | 10% | \$ 353,000 | \$ 53,000 | \$ 406,000 |
| | | | | | | | |
| | | | | | | Total First Cost | \$ 4,427,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 6 Concept-Level Costs for Site 6: Floodwall, Ewing Township, NJ
Location: Delaware River-side of Route 29.
Measure: 7,700 LF Floodwall (concrete T-wall). Top height 9 feet above grade.

Price Level: Dec-10

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|-------------------------|---|----------|------|--------------|------------------|--------------|----------------------|
| 01 | Lands and Damages | 1 | LS | \$ 136,000 | \$ 136,000 | \$ 34,000 | \$ 170,000 |
| 06 | Fish and Wildlife Facilities | | | | | | |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 823,550 | \$ 823,550 | \$ 288,000 | \$ 1,112,000 |
| 11 | Levees and Floodwalls | | | | \$ 16,471,000 | \$ 5,766,000 | \$ 22,237,000 |
| | Floodwalls | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Maint. Of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 333,000 | \$ 117,000 | \$ 450,000 |
| | Concrete | 17,437 | CY | \$750.00 | \$ 13,078,000 | \$ 4,577,000 | \$ 17,655,000 |
| | Excavation | 51,048 | CY | \$16.52 | \$ 843,000 | \$ 295,000 | \$ 1,138,000 |
| | Common Fill | 36,780 | CY | \$27.00 | \$ 993,000 | \$ 348,000 | \$ 1,341,000 |
| | Care of Water | 184 | Days | \$1,060.00 | \$ 195,000 | \$ 68,000 | \$ 263,000 |
| | Stripping | 10,111 | CY | \$9.00 | \$ 91,000 | \$ 32,000 | \$ 123,000 |
| | Toe Drain Filter | 479 | CY | \$29.05 | \$ 14,000 | \$ 5,000 | \$ 19,000 |
| | 6" Perf. Pipe | 6,300 | FT | \$3.50 | \$ 22,000 | \$ 8,000 | \$ 30,000 |
| | Topsoil & Seeding | 29,065 | SY | \$3.25 | \$ 94,000 | \$ 33,000 | \$ 127,000 |
| | Tieoff Levee | 1 | LS | \$683,000.00 | \$ 683,000 | \$ 239,000 | \$ 922,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 645,000 | \$ 227,000 | \$ 872,300 |
| | Excavation for pipe | 1273 | CY | \$10.89 | \$ 14,000 | \$ 5,000 | \$ 19,000 |
| | Backfill of material for pipe | 1273 | CY | \$2.94 | \$ 4,000 | \$ 1,000 | \$ 5,000 |
| | Manhole Frame & Cover | 19 | EACH | \$665 | \$ 13,000 | \$ 5,000 | \$ 18,000 |
| | Concrete for inlet/outlet/MH | 370.5 | CY | \$400 | \$ 148,000 | \$ 52,000 | \$ 200,000 |
| | 24" RCP | 665 | LF | \$49.50 | \$ 33,000 | \$ 12,000 | \$ 45,000 |
| | 24" Dia. Flap Gate | 19 | EACH | \$11,100 | \$ 211,000 | \$ 74,000 | \$ 285,000 |
| | 24" Sluice Gate | 19 | EACH | \$10,700 | \$ 203,000 | \$ 71,000 | \$ 274,000 |
| | 24" x 24" Trash Rack | 19 | EACH | \$511 | \$ 10,000 | \$ 4,000 | \$ 14,000 |
| | Riprap | 2 | CY | \$90 | \$ 200 | \$ 100 | \$ 300 |
| | Excavation for Channel | 800 | CY | \$10.89 | \$ 9,000 | \$ 3,000 | \$ 12,000 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 2,907,000 | \$ 436,000 | \$ 3,343,000 |
| 31 | Construction Management | 1 | Job | 10% | \$ 2,422,000 | \$ 363,000 | \$ 2,785,000 |
| Total First Cost | | | | | | | \$ 30,519,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 7a.1: Concept-Level Costs for Site 7a.1: Floodwall, Trenton, NJ (The Island/Glen Afton)

Location: Glen Afton/The Island neighborhoods along bank of Delaware River.

Measure: 7,280 LF Floodwall (concrete T-wall with piles). Top height 13 feet above ground.

Price Level:

Dec-10

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|-------------------------|---|----------|------|--------------|------------------|---------------|----------------------|
| 01 | Lands and Damages | 1 | LS | \$8,000 | \$ 8,000 | \$ 2,000 | \$ 10,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 1,652,000 | \$ 578,000 | \$ 2,230,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 1,651,750 | \$ 1,652,000 | \$ 578,000 | \$ 2,230,000 |
| 11 | Levees and Floodwalls | | | | \$ 33,035,000 | \$ 11,563,000 | \$ 44,598,000 |
| | Mobilization & Demobilization | 1 | Job | 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Maint. Of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 653,000 | \$ 229,000 | \$ 882,000 |
| | Concrete | 27,249 | CY | \$750 | \$ 20,437,000 | \$ 7,153,000 | \$ 27,590,000 |
| | Excavation | 75,766 | CY | \$16.52 | \$ 1,252,000 | \$ 438,000 | \$ 1,690,000 |
| | Common Fill | 53,795 | CY | \$27.00 | \$ 1,452,000 | \$ 508,000 | \$ 1,960,000 |
| | Care of Water | 269 | Days | \$1,060 | \$ 285,000 | \$ 100,000 | \$ 385,000 |
| | Stripping | 13,481 | CY | \$9.00 | \$ 121,000 | \$ 42,000 | \$ 163,000 |
| (1) | Length of Piles | 388,267 | LF | \$22.00 | \$ 8,542,000 | \$ 2,990,000 | \$ 11,532,000 |
| | Toe Drain Filter | 554 | CY | \$29.05 | \$ 16,000 | \$ 6,000 | \$ 22,000 |
| | 6" Perf. Pipe | 7,280 | FT | \$3.50 | \$ 25,000 | \$ 9,000 | \$ 34,000 |
| | Topsoil & Seeding | 38,978 | SY | \$3.25 | \$ 127,000 | \$ 44,000 | \$ 171,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 368,000 | \$ 129,000 | \$ 509,000 |
| | Excavation for pipe | 737 | CY | \$10.89 | \$ 8,000 | \$ 3,000 | \$ 11,000 |
| | Backfill of material for pipe | 737 | CY | \$2.94 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| | Manhole Frame & Cover | 11 | EACH | \$665 | \$ 7,000 | \$ 2,000 | \$ 9,000 |
| | Concrete for inlet/outlet/MH | 214.5 | CY | \$400 | \$ 86,000 | \$ 30,000 | \$ 116,000 |
| | 24" RCP | 385 | LF | \$49.50 | \$ 19,000 | \$ 7,000 | \$ 26,000 |
| | 24" Dia. Flap Gate | 11 | EACH | \$11,100 | \$ 122,000 | \$ 43,000 | \$ 165,000 |
| | 24" Sluice Gate | 11 | EACH | \$10,700 | \$ 118,000 | \$ 41,000 | \$ 159,000 |
| | 24" x 24" Trash Rack | 11 | EACH | \$511 | \$ 6,000 | \$ 2,000 | \$ 8,000 |
| | Riprap | 2 | CY | \$90.00 | \$ 200 | \$ 100 | \$ 300 |
| | Excavation for Channel | 800 | CY | \$10.89 | \$ 9,000 | \$ 3,000 | \$ 12,000 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 5,680,000 | \$ 852,000 | \$ 6,532,000 |
| 31 | Construction Management | 1 | Job | 10% | \$ 4,734,000 | \$ 710,000 | \$ 5,444,000 |
| Total First Cost | | | | | | | \$ 59,323,000 |

(1) Assumption is made that there is a 33% chance piles will be needed. Pile quantity adjusted to 1/3 of original quantity.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 7b.1 Concept-Level Costs for Site 7b.1: Portable Floodwall, Trenton (Downtown), NJ

Location: Downtown Trenton (two sections). 150 LF section along Route 1 and 375 LF section along NJ Route 29.

Measure: 525 LF removable floodwall.

Price Level: Dec-10

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|----------------|---|----------|------|------------|------------------|-------------------------|---------------------|
| 01 | Lands and Damages | 1 | LS | \$ 603 | \$ 600 | \$ 150 | \$ 750 |
| 06 | Fish and Wildlife Facilities | | | | \$ 67,000 | \$ 23,000 | \$ 90,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 66,825 | \$ 67,000 | \$ 23,000 | \$ 90,000 |
| 11 | Levees and Floodwalls ⁽¹⁾ | | | | \$ 1,336,500 | \$ 468,000 | \$ 1,804,500 |
| | Floodwalls | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$ 125,000 | \$ 44,000 | \$ 169,000 |
| | Maint. Of Traffic, Access Roads, and Survey | 1 | Job | 2% | \$ 16,000 | \$ 6,000 | \$ 22,000 |
| | Concrete | 430.73 | CY | \$ 750 | \$ 323,000 | \$ 113,000 | \$ 436,000 |
| | Excavation | 1250.00 | CY | \$ 16.52 | \$ 21,000 | \$ 7,000 | \$ 28,000 |
| | Common Fill | 1260.42 | CY | \$ 27.00 | \$ 34,000 | \$ 12,000 | \$ 46,000 |
| | Care of Water | 7.00 | Days | \$ 1,060 | \$ 7,000 | \$ 2,000 | \$ 9,000 |
| | Stripping | 250.00 | CY | \$ 9.00 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| | Sheet Piling | 7950.00 | SF | \$ 45.00 | \$ 358,000 | \$ 125,000 | \$ 483,000 |
| | Topsoil & Seeding | 1403.54 | SY | \$ 3.25 | \$ 5,000 | \$ 2,000 | \$ 7,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 44,400 | \$ 16,400 | \$ 60,800 |
| | Excavation for pipe | 67 | CY | \$ 10.89 | \$ 1,000 | \$ 400 | \$ 1,400 |
| | Backfill of material for pipe | 67 | CY | \$ 2.94 | \$ 200 | \$ 100 | \$ 300 |
| | Manhole Frame & Cover | 1 | EACH | \$ 665.00 | \$ 1,000 | \$ 400 | \$ 1,400 |
| | Concrete for inlet/outlet/MH | 19.5 | CY | \$ 400.00 | \$ 8,000 | \$ 3,000 | \$ 11,000 |
| | 24" RCP | 35 | LF | \$ 49.50 | \$ 2,000 | \$ 1,000 | \$ 3,000 |
| | 24" Dia. Flap Gate | 1 | EACH | \$ 11,100 | \$ 11,000 | \$ 4,000 | \$ 15,000 |
| | 24" Sluice Gate | 1 | EACH | \$ 10,700 | \$ 11,000 | \$ 4,000 | \$ 15,000 |
| | 24" x 24" Trash Rack | 1 | EACH | \$ 511 | \$ 1,000 | \$ 400 | \$ 1,400 |
| | Riprap | 2 | CY | \$ 90.00 | \$ 200 | \$ 100 | \$ 300 |
| | Excavation for Channel | 800 | CY | \$ 10.89 | \$ 9,000 | \$ 3,000 | \$ 12,000 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 235,000 | \$ 35,000 | \$ 270,000 |
| 31 | Construction Management | 1 | Job | 10% | \$ 196,000 | \$ 29,000 | \$ 225,000 |
| | | | | | | | |
| | | | | | | Total First Cost | \$ 2,451,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX

Table Site 8: Concept-Level Costs for Site 8: Levee/Floodwall, Gibbstown (Greenwich and Logan Townships), NJ

Location: Between Delaware River and developed areas.

Measure: 25,000 LF levee/floodwall; 40% (9,900 LF) of the structure would be floodwall (concrete T-wall with piles). Top height is 9 feet above grade. Includes nonstructural protection for 20 buildings outside LOP and manufacturing facility (approximately \$5 million total).

Price Level: Dec 10

| ACCOUNT NUMBER | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL COST |
|-------------------------|---|----------|-------|--------------|------------------|---------------|----------------------|
| 01 | Lands and Damages | 1 | LS | \$27,000 | \$27,000 | \$ 7,000 | \$ 34,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 5,493,000 | \$ 1,923,000 | \$ 7,416,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$ 5,182,350 | \$ 5,182,000 | \$ 1,814,000 | \$ 6,996,000 |
| | Interior Drainage Mitigation | 1 | LS | \$ 311,000 | \$ 311,000 | \$ 109,000 | \$ 420,000 |
| 11 | Levees and Floodwalls | | | | \$ 34,549,000 | \$ 12,092,000 | \$ 47,394,000 |
| | Floodwalls | | | | | | |
| | Mobilization & Demobilization | 1 | Job | \$ 125,000 | \$125,000 | \$ 44,000 | \$ 169,000 |
| | Maintenance of Traffic, Access Roads and Survey (floodwall) | 1 | Job | 2% | \$527,000 | \$ 184,000 | \$ 711,000 |
| | Concrete | 27,417 | CY | \$750.00 | \$20,563,000 | \$ 7,197,000 | \$ 27,760,000 |
| | Excavation | 80,267 | CY | \$ 16.52 | \$1,326,000 | \$ 464,000 | \$ 1,790,000 |
| | Common Fill | 57,831 | CY | \$ 27.00 | \$1,561,000 | \$ 546,000 | \$ 2,107,000 |
| | Dewatering | 289 | Days | \$1,060.00 | \$307,000 | \$ 107,000 | \$ 414,000 |
| | Stripping | 15,899 | CY | \$ 9.00 | \$143,000 | \$ 50,000 | \$ 193,000 |
| | ⁽¹⁾ Piles | 102,729 | LF | \$ 22.00 | \$2,260,000 | \$ 791,000 | \$ 3,051,000 |
| | Toe Drain Filter | 753 | CY | \$ 29.05 | \$22,000 | \$ 8,000 | \$ 30,000 |
| | Toe Drain 6" Perf. Pipe | 9,906 | LF | \$ 3.50 | \$35,000 | \$ 12,000 | \$ 47,000 |
| | Topsoil & Seeding | 45,701 | SY | \$ 3.25 | \$149,000 | \$ 52,000 | \$ 201,000 |
| | Levees | | | | | | |
| | Maintenance of Traffic, Access Roads and Survey (levee) | 1 | Job | 2% | \$ 148,000 | \$ 52,000 | \$ 200,000 |
| | Clearing & Grubbing | 42 | Acres | \$ 19,000 | \$ 791,000 | \$ 277,000 | \$ 1,068,000 |
| | Excavation | 35,835 | CY | \$ 10.89 | \$ 390,000 | \$ 137,000 | \$ 527,000 |
| | Purchase Impervious Fill | 58,792 | CY | \$ 27.00 | \$ 1,587,000 | \$ 555,000 | \$ 2,142,000 |
| | Purchase Common Fill (Assume 67% reuse of excavated material) | 76,498 | CY | \$ 27.00 | \$ 2,065,000 | \$ 723,000 | \$ 2,788,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 135,290 | CY | \$ 11.35 | \$ 1,536,000 | \$ 538,000 | \$ 2,074,000 |
| | Backfill of material | 159,299 | CY | \$ 2.94 | \$ 468,000 | \$ 164,000 | \$ 632,000 |
| | Care of Water/dewatering | 75 | Days | \$ 1,060 | \$ 80,000 | \$ 28,000 | \$ 108,000 |
| | Stripping of Topsoil | 27,996 | CY | \$ 9.00 | \$ 252,000 | \$ 88,000 | \$ 340,000 |
| | Topsoil & Seed | 65,903 | SY | \$ 3.25 | \$ 214,000 | \$ 75,000 | \$ 289,000 |
| | Gate across Railroad | 315 | SF | \$1,771.00 | \$ 558,000 | \$ 195,000 | \$ 753,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 2,072,000 | \$ 724,000 | \$ 2,796,000 |
| | Excavation for pipe | 4,154 | CY | \$ 10.89 | \$ 45,000 | \$ 16,000 | \$ 61,000 |
| | Backfill of material for pipe | 4,154 | CY | \$ 2.94 | \$ 12,000 | \$ 4,000 | \$ 16,000 |
| | Manhole Frame & Cover | 62 | EACH | \$ 665 | \$ 41,000 | \$ 14,000 | \$ 55,000 |
| | Concrete for inlet/outlet/MH | 1,209 | CY | \$ 400 | \$ 484,000 | \$ 169,000 | \$ 653,000 |
| | 24" RCP | 2,170 | LF | \$ 49.50 | \$ 107,000 | \$ 37,000 | \$ 144,000 |
| | 24" Dia. Flap Gate | 62 | EACH | \$ 11,100 | \$ 688,000 | \$ 241,000 | \$ 929,000 |
| | 24" Sluice Gate | 62 | EACH | \$ 10,700 | \$ 663,000 | \$ 232,000 | \$ 895,000 |
| | 24" x 24" Trash Rack | 62 | EACH | \$ 511 | \$ 32,000 | \$ 11,000 | \$ 43,000 |
| 19 | Buildings & Grounds | | | | \$ 3,675,000 | \$ 1,287,000 | \$ 4,962,000 |
| | Nonstructural Treatments (approx. 20) | 20 | Each | \$ 150,000 | \$ 3,000,000 | \$ 1,050,000 | \$ 4,050,000 |
| | Ringwall at Manufacturing Facility | 1 | Each | \$ 650,000 | \$ 650,000 | \$ 228,000 | \$ 878,000 |
| | Mobilization & Demobilization | 1 | LS | \$ 25,000 | \$ 25,000 | \$ 9,000 | \$ 34,000 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 7,508,000 | \$ 1,126,000 | \$ 8,634,000 |
| 31 | Construction Management | 1 | Job | 10% | \$ 6,257,000 | \$ 939,000 | \$ 7,196,000 |
| Total First Cost | | | | | | | \$ 78,432,000 |

⁽¹⁾ Assumption is made that piles will be required for 1/3 of floodwall section, due to possible presence of relict drainage channels. Sensitivity testing indicates that if piles are needed for all of floodwall section, overall construction cost of measure will increase approximately 15%.

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| Table Alt #1: Incremental Alternative Plan Costs for Site 8: Levee/Floodwall, Gibbstown, NJ | | | | | | | |
|--|---|----------|-------|------------------------------|---------------------|---------------------|----------------------|
| (Greenwich and Logan Townships, NJ) | | | | | | | |
| Location: | Between Delaware River and developed areas. | | | Price Level: May 2014 | | | |
| Measure: | 21339 LF levee and floodwall excluding the ring levees, ring walls and their entrances; 64.6% (13,788) of the structure would be floodwall (concrete T-wall and I-S wall with piles) and 7,386 LF of levee. Ring walls and levees are not included in this length Top height is 12 feet NAVD88. Includes nonstructural protection for 17 buildings outside LOP and 3 manufacturing facilities | | | | | | |
| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
| 01 | Lands and Damages | | | | \$5,182,000 | \$1,814,000 | \$6,996,000 |
| | Permanent Easement | 62.5 | Acres | \$62,500.00 | \$3,905,000 | \$ 1,367,000 | \$5,272,000 |
| | Temporary Easement | 12.3 | Acres | \$62,500.00 | \$772,000 | \$ 270,000 | \$1,042,000 |
| | Survey and Appraisal | | LS | 8% | \$505,000 | \$ 177,000 | \$682,000 |
| 02 | Utility relocation | 1 | LS | \$3,000,000.00 | \$3,000,000 | \$ 1,050,000 | \$4,050,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 3,521,000 | \$ 1,232,000 | \$ 4,753,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$3,521,000.00 | \$ 3,521,000 | \$ 1,232,000 | \$ 4,753,000 |
| 11 | Levees and Floodwalls | | | | \$84,875,000 | \$29,708,000 | \$114,583,000 |
| | Mob & Demob | 1 | LS | \$75,000.00 | \$75,000 | \$ 26,000 | \$101,000 |
| | Temporary Access Road | 19,100 | LF | \$80.00 | \$1,528,000 | \$ 535,000 | \$2,063,000 |
| | Contractor Staging Areas | 3 | EA | \$25,000.00 | \$75,000 | \$ 26,000 | \$101,000 |
| | Maintenance of Traffic | 1 | LS | \$1,000,000.00 | \$ 1,000,000 | \$ 350,000 | \$ 1,350,000 |
| | Ring Levee | | | | \$5,740,000 | \$2,009,000 | \$7,749,000 |
| | Clearing & Grubbing | 10.3 | Acres | \$21,242.00 | \$220,000 | \$ 77,000 | \$ 297,000 |
| | Excavation | 16,269 | CY | \$12.30 | \$200,000 | \$ 70,000 | \$ 270,000 |
| | Purchase Impervious Fill | 20,944 | CY | \$30.19 | \$632,000 | \$ 221,000 | \$ 853,000 |
| | Purchase Common Fill | 66,026 | CY | \$30.19 | \$1,993,000 | \$ 698,000 | \$ 2,691,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 85,343 | CY | \$12.69 | \$1,083,000 | \$ 379,000 | \$ 1,462,000 |
| | Haul and Disposal | 14,642 | CY | \$12.69 | \$186,000 | \$ 65,000 | \$ 251,000 |
| | Dump Charges (25% of material) | 5,683 | Tons | \$81.87 | \$465,000 | \$ 163,000 | \$ 628,000 |
| | Dump Charges (75% of material) | 17,049 | Tons | \$24.58 | \$419,000 | \$ 147,000 | \$ 566,000 |
| | Backfill of material | 88,597 | CY | \$3.35 | \$297,000 | \$ 104,000 | \$ 401,000 |
| | Dewatering | 39 | Days | \$1,185.08 | \$46,000 | \$ 16,000 | \$ 62,000 |
| | Stripping of Topsoil | 9,437 | CY | \$10.06 | \$95,000 | \$ 33,000 | \$ 128,000 |
| | 6" Topsoil & Seeding | 20,741 | SY | \$5.03 | \$104,000 | \$ 36,000 | \$ 140,000 |
| | Ring Walls (Non Structural) | | | | \$2,429,000 | \$852,000 | \$3,281,000 |
| | Concrete in place | 2,063 | CY | \$838.50 | \$1,730,000 | \$ 606,000 | \$ 2,336,000 |
| | Clearing & Grubbing | 4.3 | Acres | \$21,242.00 | \$92,000 | \$ 32,000 | \$ 124,000 |
| | Excavation | 4,840 | CY | \$12.30 | \$60,000 | \$ 21,000 | \$ 81,000 |
| | Purchase Common Fill | 3,389 | CY | \$30.19 | \$102,000 | \$ 36,000 | \$ 138,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 3,389 | CY | \$12.69 | \$43,000 | \$ 15,000 | \$ 58,000 |
| | Haul and Disposal | 4,356 | CY | \$12.69 | \$55,000 | \$ 19,000 | \$ 74,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
|--------------|--|-----------|-------|-------------|---------------------|---------------------|----------------------|
| | Dewatering | 25 | Days | \$1,185.08 | \$30,000 | \$ 11,000 | \$ 41,000 |
| | Dump Charges (25% of material) | 1,691 | TON | \$81.87 | \$138,000 | \$ 48,000 | \$ 186,000 |
| | Dump Charges (75% of material) | 5,072 | TON | \$24.58 | \$125,000 | \$ 44,000 | \$ 169,000 |
| | Backfill of material | 3,873 | CY | \$3.35 | \$13,000 | \$ 5,000 | \$ 18,000 |
| | Stripping of Topsoil | 1,023 | CY | \$10.06 | \$10,000 | \$ 4,000 | \$ 14,000 |
| | 6" Topsoil & Seeding | 6,138 | SY | \$5.03 | \$31,000 | \$ 11,000 | \$ 42,000 |
| | Levees | | | | \$20,000,000 | \$ 7,001,000 | \$ 27,001,000 |
| | Clearing & Grubbing | 35.8 | Acres | \$21,242.00 | \$ 760,000 | \$ 266,000 | \$ 1,026,000 |
| | Excavation | 60,985 | CY | \$12.30 | \$ 750,000 | \$ 263,000 | \$ 1,013,000 |
| | Purchase Impervious Fill | 48,761 | CY | \$30.19 | \$ 1,472,000 | \$ 515,000 | \$ 1,987,000 |
| | Purchase Common Fill | 140,239 | CY | \$30.19 | \$ 4,233,000 | \$ 1,482,000 | \$ 5,715,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 189,000 | CY | \$12.69 | \$ 2,398,000 | \$ 839,000 | \$ 3,237,000 |
| | Backfill of material | 195,098 | CY | \$3.35 | \$ 654,000 | \$ 229,000 | \$ 883,000 |
| | Care of Water/dewatering | 89 | Days | \$1,185.08 | \$ 105,000 | \$ 37,000 | \$ 142,000 |
| | Stripping of Topsoil | 21,861 | CY | \$10.06 | \$ 220,000 | \$ 77,000 | \$ 297,000 |
| | 6" Topsoil & Seeding | 48,930 | SY | \$5.03 | \$ 246,000 | \$ 86,000 | \$ 332,000 |
| | Geotextile | 173,079 | SY | \$4.47 | \$ 774,000 | \$ 271,000 | \$ 1,045,000 |
| | Vertical (wick) Drains | 2,880,057 | LF | \$1.50 | \$ 4,315,000 | \$ 1,510,000 | \$ 5,825,000 |
| | Haul and Dispose | 54,887 | CY | \$12.69 | \$ 696,000 | \$ 244,000 | \$ 940,000 |
| | Dump Charges (25% of material) | 21,303 | TONS | \$81.87 | \$ 1,744,000 | \$ 610,000 | \$ 2,354,000 |
| | Dump Charges (75% of material) | 63,908 | TONS | \$24.58 | \$ 1,571,000 | \$ 550,000 | \$ 2,121,000 |
| | Levee Surcharge Fill Volume | 5,022 | CY | \$12.30 | \$ 62,000 | \$ 22,000 | \$ 84,000 |
| | Floodwalls | | | | \$54,028,000 | \$18,909,000 | \$72,937,000 |
| | Concrete in place | 32,045 | CY | \$838.50 | \$26,870,000 | \$ 9,405,000 | \$ 36,275,000 |
| | Clearing & Grubbing | 34.7 | Acres | \$21,242.00 | \$738,000 | \$ 258,000 | \$ 996,000 |
| | Excavation | 96,548 | CY | \$12.30 | \$1,187,000 | \$ 415,000 | \$ 1,602,000 |
| | Purchase Common Fill | 60,798 | CY | \$33.54 | \$2,039,000 | \$ 714,000 | \$ 2,753,000 |
| | Dewatering | 345 | Days | \$1,185.08 | \$409,000 | \$ 143,000 | \$ 552,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 51,143 | CY | \$12.69 | \$649,000 | \$ 227,000 | \$ 876,000 |
| | Haul and Disposal | 86,893 | CY | \$12.69 | \$1,103,000 | \$ 386,000 | \$ 1,489,000 |
| | Stripping of Topsoil | 19,864 | CY | \$10.06 | \$200,000 | \$ 70,000 | \$ 270,000 |
| | Piles | 164,729 | LF | \$83.85 | \$13,812,000 | \$ 4,834,000 | \$ 18,646,000 |
| | Sheet Piling | 14,100 | SF | \$60.60 | \$854,000 | \$ 299,000 | \$ 1,153,000 |
| | Toe Drain Filter | 979 | CY | \$32.48 | \$32,000 | \$ 11,000 | \$ 43,000 |
| | Dump Charges (25% of material) | 33,725 | TONS | \$81.87 | \$2,761,000 | \$ 966,000 | \$ 3,727,000 |
| | Dump Charges (75% of material) | 101,176 | TONS | \$24.58 | \$2,486,000 | \$ 870,000 | \$ 3,356,000 |
| | Backfill of material | 70,453 | CY | \$3.35 | \$236,000 | \$ 83,000 | \$ 319,000 |
| | Toe Drain 6" Perf. Pipe | 13,168 | LF | \$3.91 | \$52,000 | \$ 18,000 | \$ 70,000 |
| | 6" Topsoil & Seeding | 119,184 | SY | \$5.03 | \$600,000 | \$ 210,000 | \$ 810,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
|-------------------------|---|----------|------|----------------|----------------------|---------------------|-----------------------|
| 15 | Floodway Control-Diversion Structure | | | | \$ 9,312,000 | \$ 3,260,000 | \$ 12,572,000 |
| | Excavation | 5,578 | CY | \$12.30 | \$ 69,000 | \$ 24,000 | \$ 93,000 |
| | Backfill of material for pipe | 3,953 | CY | \$3.35 | \$ 13,000 | \$ 5,000 | \$ 18,000 |
| | Manhole Frame & Cover | 59 | EACH | \$967.07 | \$ 57,000 | \$ 20,000 | \$ 77,000 |
| | Concrete for Sluice Gates | 1,714 | CY | \$838.50 | \$ 1,437,000 | \$ 503,000 | \$ 1,940,000 |
| | Concrete for inlet/outlet/MH | 1,151 | CY | \$463.97 | \$ 534,000 | \$ 187,000 | \$ 721,000 |
| | 24" RCP | 2,065 | LF | \$64.84 | \$ 134,000 | \$ 47,000 | \$ 181,000 |
| | 24" Dia. Flap Gate | 59 | EACH | \$4,052.75 | \$ 239,000 | \$ 84,000 | \$ 323,000 |
| | 24" Sluice Gate | 59 | EACH | \$18,558.80 | \$ 1,095,000 | \$ 383,000 | \$ 1,478,000 |
| | 24" x 24" Trash Rack | 59 | EACH | \$571.30 | \$ 34,000 | \$ 12,000 | \$ 46,000 |
| | 10' x 6' Sluice Gate | 12 | EACH | \$111,800.00 | \$ 1,342,000 | \$ 470,000 | \$ 1,812,000 |
| | 10'x6' Flap Gate | 12 | EACH | \$39,130.00 | \$ 470,000 | \$ 165,000 | \$ 635,000 |
| | Piles | 9,750 | LF | \$83.85 | \$ 818,000 | \$ 286,000 | \$ 1,104,000 |
| | Dewatering | 360 | DAYS | \$1,677.00 | \$ 604,000 | \$ 211,000 | \$ 815,000 |
| | Haul and Disposal | 1,625 | CY | \$12.69 | \$ 21,000 | \$ 7,000 | \$ 28,000 |
| | Allowance for electrical | 3 | EACH | \$300,000.00 | \$ 900,000 | \$ 315,000 | \$ 1,215,000 |
| | Swing Gates | 1,947 | SF | \$793.78 | \$ 1,545,000 | \$ 541,000 | \$ 2,086,000 |
| | | | | | | | |
| 19 | Buildings & Grounds | | | | \$ 3,308,560 | \$ 1,159,000 | \$ 4,467,560 |
| | Voluntary Acquisition (approx. 17) | 1 | LS | \$2,485,000.00 | \$ 2,485,000 | \$ 870,000 | \$ 3,355,000 |
| | Abatement | 1 | LS | \$170,000.00 | \$ 170,000 | \$ 60,000 | \$ 230,000 |
| | Demolition | 1 | LS | \$331,000.00 | \$ 331,000 | \$ 116,000 | \$ 447,000 |
| | Survey and Appraisal | | LS | 8% | \$322,560 | \$ 113,000 | \$435,560 |
| | | | | | | | |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 16,365,000 | \$ 2,455,000 | \$ 18,820,000 |
| | | | | | | | |
| 31 | Construction Management | 1 | Job | 10% | \$ 13,638,000 | \$ 2,046,000 | \$ 15,684,000 |
| | | | | | | | |
| Total First Cost | | | | | | | \$ 181,926,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| Table Alt #2: Incremental Alternative Plan Costs for Site 8: Floodwall, Gibbstown, NJ | | | | | | | |
|--|---|----------|-------|------------------------------|----------------------|---------------------|----------------------|
| (Greenwich and Logan Townships) | | | | | | | |
| Location: | Between Delaware River and developed areas | | | Price Level: May 2014 | | | |
| Measure: | 21,339 LF of floodwall (100% floodwall),excluding the ring levees, ring walls and their entrances. Ring walls are not included in this let | | | | | | |
| | Top height is 12 feet NAVD88. | | | | | | |
| | Includes nonstructural protection for 17 buildings outside LOP and 3 manufacturing facilities | | | | | | |
| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
| 01 | Lands and Damages | | | | \$4,787,000 | \$1,675,000 | \$6,462,000 |
| | Permanent Easement | 56.8 | Acres | \$62,500.00 | \$3,548,000 | \$1,242,000 | \$4,790,000 |
| | Temporary Easement | 12.3 | Acres | \$62,500.00 | \$772,000 | \$270,000 | \$1,042,000 |
| | Survey and Appraisal | | | 8.00% | \$467,000 | \$163,000 | \$630,000 |
| 02 | Utility relocation | 1 | LS | \$3,000,000.00 | \$3,000,000 | \$1,050,000 | \$4,050,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 2,700,000 | \$945,000 | \$ 3,645,000 |
| | Floodwall Mitigation | 1 | LS | \$2,699,750.00 | \$ 2,700,000 | \$945,000 | \$ 3,645,000 |
| 11 | Levees and Floodwalls | | | | \$101,341,000 | \$35,474,000 | \$136,815,000 |
| | Mob & Demob | 1 | LS | \$75,000.00 | \$75,000 | \$26,000 | \$101,000 |
| | Tempoary Access Road | 20,850 | LF | \$80.00 | \$1,668,000 | \$584,000 | \$2,252,000 |
| | Contractor Staging Areas | 3 | EA | \$25,000.00 | \$75,000 | \$26,000 | \$101,000 |
| | Maintenance of Traffic | 1 | LS | \$1,000,000.00 | \$ 1,000,000 | \$350,000 | \$ 1,350,000 |
| | Ring Levee | | | | \$5,740,000 | \$2,009,000 | \$7,749,000 |
| | Clearing & Grubbing | 10.3 | Acres | \$21,242.00 | \$220,000 | \$77,000 | \$ 297,000 |
| | Excavation | 16,269 | CY | \$12.30 | \$200,000 | \$70,000 | \$ 270,000 |
| | Purchase Impervious Fill | 20,944 | CY | \$30.19 | \$632,000 | \$221,000 | \$ 853,000 |
| | Purchase Common Fill | 66,026 | CY | \$30.19 | \$1,993,000 | \$698,000 | \$ 2,691,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 85,343 | CY | \$12.69 | \$1,083,000 | \$379,000 | \$ 1,462,000 |
| | Haul and Disposal | 14,642 | CY | \$12.69 | \$186,000 | \$65,000 | \$ 251,000 |
| | Backfill of material | 88,597 | CY | \$3.35 | \$297,000 | \$104,000 | \$ 401,000 |
| | Dump Charges (25% of material) | 5,683 | CY | \$81.87 | \$465,000 | \$163,000 | \$ 628,000 |
| | Dump Charges (75% of material) | 17,049 | CY | \$24.58 | \$419,000 | \$147,000 | \$ 566,000 |
| | Care of Water/dewatering | 39 | Days | \$1,185.08 | \$46,000 | \$16,000 | \$ 62,000 |
| | Stripping of Topsoil | 9,437 | CY | \$10.06 | \$95,000 | \$33,000 | \$ 128,000 |
| | 6" Topsoil & Seeding | 20,741 | SY | \$5.03 | \$104,000 | \$36,000 | \$ 140,000 |
| | Ring Walls (Non Structural) | | | | \$2,501,000 | \$878,000 | \$3,379,000 |
| | Concrete in place | 2,063 | CY | \$838.50 | \$1,730,000 | \$606,000 | \$ 2,336,000 |
| | Clearing & Grubbing | 4.3 | Acres | \$21,242.00 | \$92,000 | \$32,000 | \$ 124,000 |
| | Excavation | 4,840 | CY | \$12.30 | \$60,000 | \$21,000 | \$ 81,000 |
| | Purchase Common Fill | 3,389 | CY | \$30.19 | \$102,000 | \$36,000 | \$ 138,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 3,389 | CY | \$12.69 | \$43,000 | \$15,000 | \$ 58,000 |
| | Dewatering | 25 | Days | \$1,185.08 | \$30,000 | \$11,000 | \$ 41,000 |
| | Backfill of material | 2,905 | CY | \$3.35 | \$10,000 | \$4,000 | \$ 14,000 |
| | Stripping of Topsoil | 1,023 | CY | \$10.06 | \$10,000 | \$4,000 | \$ 14,000 |

Delaware River Basin Comprehensive Flood Risk Management Interim Feasibility Study and Integrated EA for New Jersey

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
|--------------|--|----------|-------|--------------|---------------------|---------------------|----------------------|
| | Haul and Disposal | 5,379 | CY | \$12.69 | \$68,000 | \$24,000 | \$ 92,000 |
| | Dump Charges (25% of material) | 2,088 | Tons | \$81.87 | \$171,000 | \$60,000 | \$ 231,000 |
| | Dump Charges (75% of material) | 6,263 | Tons | \$24.58 | \$154,000 | \$54,000 | \$ 208,000 |
| | 6" Topsoil & Seeding | 6,138 | SY | \$5.03 | \$31,000 | \$11,000 | \$ 42,000 |
| | Floodwalls | | | | \$90,282,000 | \$31,601,000 | \$121,883,000 |
| | Concrete in place | 54,214 | CY | \$838.50 | \$45,459,000 | \$15,911,000 | \$ 61,370,000 |
| | Clearing & Grubbing | 54.4 | Acres | \$21,242.00 | \$1,157,000 | \$405,000 | \$ 1,562,000 |
| | Excavation | 160,696 | CY | \$12.30 | \$1,976,000 | \$692,000 | \$ 2,668,000 |
| | Purchase Common fill | 100,105 | CY | \$33.54 | \$3,358,000 | \$1,175,000 | \$ 4,533,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 100,105 | CY | \$12.69 | \$1,270,000 | \$445,000 | \$ 1,715,000 |
| | Dewatering | 574 | Days | \$1,185.08 | \$680,000 | \$238,000 | \$ 918,000 |
| | Haul and Disposal | 144,626 | CY | \$12.69 | \$1,835,000 | \$642,000 | \$ 2,477,000 |
| | Backfill of material | 116,175 | CY | \$3.35 | \$390,000 | \$137,000 | \$ 527,000 |
| | Stripping of Topsoil | 32,324 | CY | \$10.06 | \$325,000 | \$114,000 | \$ 439,000 |
| | Piles | 279,157 | LF | \$83.85 | \$23,407,000 | \$8,192,000 | \$ 31,599,000 |
| | Sheet Piles | 9,600 | SF | \$60.60 | \$582,000 | \$204,000 | \$ 786,000 |
| | Dump Charges (25% of material) | 56,133 | Tons | \$81.87 | \$4,595,000 | \$1,608,000 | \$ 6,203,000 |
| | Dump Charges (75% of material) | 168,399 | Tons | \$24.58 | \$4,139,000 | \$1,449,000 | \$ 5,588,000 |
| | Toe Drain Filter | 1,579 | CY | \$32.48 | \$51,000 | \$18,000 | \$ 69,000 |
| | Toe Drain 6" Perf. Pipe | 21,054 | LF | \$3.91 | \$82,000 | \$29,000 | \$ 111,000 |
| | 6" Topsoil & Seeding | 193,946 | SY | \$5.03 | \$976,000 | \$342,000 | \$ 1,318,000 |
| 15 | Floodway Control-Diversion Structure | | | | \$ 9,312,000 | \$3,260,000 | \$ 12,572,000 |
| | Excavation | 5,578 | CY | \$12.30 | \$ 69,000 | \$24,000 | \$ 93,000 |
| | Backfill of material for pipe | 3,953 | CY | \$3.35 | \$ 13,000 | \$5,000 | \$ 18,000 |
| | Manhole Frame & Cover | 59 | EACH | \$967.07 | \$ 57,000 | \$20,000 | \$ 77,000 |
| | Concrete for sluice gate | 1,714 | CY | \$838.50 | \$ 1,437,000 | \$503,000 | \$ 1,940,000 |
| | Concrete for inlet/outlet/MH | 1,151 | CY | \$463.97 | \$ 534,000 | \$187,000 | \$ 721,000 |
| | 24" RCP | 2,065 | LF | \$64.84 | \$ 134,000 | \$47,000 | \$ 181,000 |
| | 24" Dia. Flap Gate | 59 | EACH | \$4,052.75 | \$ 239,000 | \$84,000 | \$ 323,000 |
| | 24" Sluice Gate | 59 | EACH | \$18,558.80 | \$ 1,095,000 | \$383,000 | \$ 1,478,000 |
| | 24" x 24" Trash Rack | 59 | EACH | \$571.30 | \$ 34,000 | \$12,000 | \$ 46,000 |
| | 10' x 6' Sluice Gate | 12 | EACH | \$111,800.00 | \$ 1,342,000 | \$470,000 | \$ 1,812,000 |
| | 10'x6' Flap Gate | 12 | EACH | \$39,130.00 | \$ 470,000 | \$165,000 | \$ 635,000 |
| | Piles | 9,750 | LF | \$83.85 | \$ 818,000 | \$286,000 | \$ 1,104,000 |
| | Dewatering | 360 | DAYS | \$1,677.00 | \$ 604,000 | \$211,000 | \$ 815,000 |
| | Haul and Disposal | 1,625 | CY | \$12.69 | \$ 21,000 | \$7,000 | \$ 28,000 |
| | Allowance for electrical | 3 | EACH | \$300,000.00 | \$ 900,000 | \$315,000 | \$ 1,215,000 |
| | Swing Gates | 1,947 | SF | \$793.78 | \$ 1,545,000 | \$541,000 | \$ 2,086,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
|-------------------------|--|----------|-----|----------------|----------------------|--------------------|-----------------------|
| 19 | Buildings & Grounds | | | | \$ 3,308,560 | \$1,159,000 | \$ 4,467,560 |
| | Voluntary Acquisition (approx. 17) | 1 | LS | \$2,485,000.00 | \$ 2,485,000 | \$870,000 | \$ 3,355,000 |
| | Abatement | 1 | LS | \$170,000.00 | \$ 170,000 | \$60,000 | \$ 230,000 |
| | Demolition | 1 | LS | \$331,000.00 | \$ 331,000 | \$116,000 | \$ 447,000 |
| | Survey and Appraisal | | | 8.00% | \$322,560 | \$113,000 | \$435,560 |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 18,900,000 | \$2,835,000 | \$ 21,735,000 |
| 31 | Construction Management | 1 | Job | 10% | \$ 15,750,000 | \$2,363,000 | \$ 18,113,000 |
| Total First Cost | | | | | | | \$ 207,860,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| Table Alt #3: Incremental Alternative Plan Costs for Site 8: Levee/Floodwall, Gibbstown, NJ | | | | | | | |
|--|--|----------|-------|------------------------------|---------------------|---------------------|----------------------|
| (Greenwich and Logan Townships) | | | | | | | |
| Location: | Between Delaware River and developed areas | | | Price Level: May 2014 | | | |
| Measure: | 21,339 LF levee and floodwall, excluding the ring levees, ring walls and their entrances; 78.6% (16,765 LF) of the structure would be floodwall (concrete T-wall and I-S wall with piles). The ring walls and levees are not included. | | | | | | |
| | Top height is 12 feet NAVD88. | | | | | | |
| | Includes nonstructural protection for 17 buildings outside LOP and 3 manufacturing facilities | | | | | | |
| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
| 01 | Lands and Damages | | | | \$4,810,000 | \$1,683,000 | \$6,493,000 |
| | Permanent Easement | 57.1 | Acres | \$62,500.00 | \$3,569,000 | \$1,249,000 | \$4,818,000 |
| | Temporary Easement | 12.3 | Acres | \$62,500.00 | \$772,000 | \$270,000 | \$1,042,000 |
| | Survey and Appraisal | | | \$0.08 | \$469,000 | \$164,000 | \$633,000 |
| 02 | Relocations | | | | | | |
| | Utility relocations | 1 | LS | \$3,000,000.00 | \$3,000,000 | \$1,050,000 | \$4,050,000 |
| 06 | Fish and Wildlife Facilities | | | | \$ 2,971,000 | \$1,040,000 | \$4,011,000 |
| | Levee/Floodwall Mitigation | 1 | LS | \$2,971,000.00 | \$ 2,971,000 | \$1,040,000 | \$4,011,000 |
| 11 | Levees and Floodwalls | | | | \$91,009,000 | \$31,855,000 | \$122,864,000 |
| | Mob & Demob | | | \$75,000.00 | \$75,000 | \$26,000 | \$101,000 |
| | Temporary Access Roads | 19,390 | LF | \$80.00 | \$1,551,000 | \$543,000 | \$2,094,000 |
| | Contractor Staging Areas | 3 | EA | \$25,000.00 | \$75,000 | \$26,000 | \$101,000 |
| | Maintenance of Traffic | 1 | LS | \$1,000,000.00 | \$1,000,000 | \$350,000 | \$1,350,000 |
| | Ring Levee | | | | \$5,740,000 | \$2,009,000 | \$7,749,000 |
| | Clearing & Grubbing | 10.3 | Acres | \$21,242.00 | \$220,000 | \$77,000 | \$297,000 |
| | Excavation | 16,269 | CY | \$12.30 | \$200,000 | \$70,000 | \$270,000 |
| | Purchase Impervious Fill | 20,944 | CY | \$30.19 | \$632,000 | \$221,000 | \$853,000 |
| | Purchase Common Fill | 66,026 | CY | \$30.19 | \$1,993,000 | \$698,000 | \$2,691,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 85,343 | CY | \$12.69 | \$1,083,000 | \$379,000 | \$1,462,000 |
| | Haul and Disposal | 14,642 | CY | \$12.69 | \$186,000 | \$65,000 | \$251,000 |
| | Dump Charges (25% of material) | 5,683 | Tons | \$81.87 | \$465,000 | \$163,000 | \$628,000 |
| | Dump Charges (75% of material) | 17,049 | Tons | \$24.58 | \$419,000 | \$147,000 | \$566,000 |
| | Backfill of material | 88,597 | CY | \$3.35 | \$297,000 | \$104,000 | \$401,000 |
| | Dewatering | 39 | Days | \$1,185.08 | \$46,000 | \$16,000 | \$62,000 |
| | Stripping of Topsoil | 9,437 | CY | \$10.06 | \$95,000 | \$33,000 | \$128,000 |
| | Topsoil (6") & Seeding | 20,741 | SY | \$5.03 | \$104,000 | \$36,000 | \$140,000 |
| | Ring Walls (Non Structural) | | | | \$3,644,000 | \$1,277,000 | \$4,921,000 |
| | Concrete in place | 2,063 | CY | \$838.50 | \$1,730,000 | \$606,000 | \$2,336,000 |
| | Clearing & Grubbing | 4.3 | Acres | \$21,242.00 | \$92,000 | \$32,000 | \$124,000 |
| | Excavation | 4,840 | CY | \$12.30 | \$60,000 | \$21,000 | \$81,000 |
| | Purchase Common Fill | 3,389 | CY | \$30.19 | \$102,000 | \$36,000 | \$138,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
|--------------|--|-----------|-------|-------------|---------------------|---------------------|---------------------|
| | Haul Fill - 5 miles (impervious & purchased common fill) | 76,711 | CY | \$12.69 | \$973,000 | \$341,000 | \$1,314,000 |
| | Dewatering | 25 | Days | \$1,185.08 | \$30,000 | \$11,000 | \$41,000 |
| | Stripping of Topsoil | 1,023 | CY | \$10.06 | \$10,000 | \$4,000 | \$14,000 |
| | Haul and Disposal | 4,356 | CY | \$12.69 | \$55,000 | \$19,000 | \$74,000 |
| | Backfill of material | 88,942 | CY | \$3.35 | \$298,000 | \$104,000 | \$402,000 |
| | Dump Charges (25% of material) | 1,691 | Tons | \$81.87 | \$138,000 | \$48,000 | \$186,000 |
| | Dump Charges (75% of material) | 5,072 | Tons | \$24.58 | \$125,000 | \$44,000 | \$169,000 |
| | Topsoil (6") & Seeding | 6,138 | SY | \$5.03 | \$31,000 | \$11,000 | \$42,000 |
| | | | | | | | |
| | Levees | | | | \$9,053,000 | \$3,168,000 | \$12,221,000 |
| | Clearing & Grubbing | 22.5 | Acres | \$21,242.00 | \$478,000 | \$167,000 | \$645,000 |
| | Excavation | 21,869 | CY | \$12.30 | \$269,000 | \$94,000 | \$363,000 |
| | Purchase Impervious Fill | 16,184 | CY | \$30.19 | \$489,000 | \$171,000 | \$660,000 |
| | Purchase Common Fill | 44,948 | CY | \$30.19 | \$1,357,000 | \$475,000 | \$1,832,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 58,945 | CY | \$12.69 | \$748,000 | \$262,000 | \$1,010,000 |
| | Backfill of material | 63,319 | CY | \$3.35 | \$212,000 | \$74,000 | \$286,000 |
| | Dewatering | 29 | Days | \$1,185.08 | \$34,000 | \$12,000 | \$46,000 |
| | Stripping of Topsoil | 8,225 | CY | \$10.06 | \$83,000 | \$29,000 | \$112,000 |
| | Topsoil (6") & Seeding | 40,887 | LF | \$5.03 | \$206,000 | \$72,000 | \$278,000 |
| | Geotextile | 109,017 | SY | \$4.47 | \$488,000 | \$171,000 | \$659,000 |
| | Vertical (wick) Drains | 2,037,907 | LF | \$1.50 | \$3,053,000 | \$1,069,000 | \$4,122,000 |
| | Haul and Dispose | 21,869 | CY | \$12.69 | \$278,000 | \$97,000 | \$375,000 |
| | Dump Charges (25% of material) | 8,488 | TONS | \$81.87 | \$695,000 | \$243,000 | \$938,000 |
| | Dump Charges (75% of material) | 25,464 | TONS | \$24.58 | \$626,000 | \$219,000 | \$845,000 |
| | Levee Surcharge Fill Volume | 2,998 | CY | \$12.30 | \$37,000 | \$13,000 | \$50,000 |
| | | | | | | | |
| | Floodwalls | | | | \$69,871,000 | \$24,456,000 | \$94,327,000 |
| | Concrete in place | 40,978 | CY | \$838.50 | \$34,360,000 | \$12,026,000 | \$46,386,000 |
| | Clearing & Grubbing | 42.6 | Acres | \$21,242.00 | \$905,000 | \$317,000 | \$1,222,000 |
| | Excavation | 122,309 | CY | \$12.30 | \$1,504,000 | \$526,000 | \$2,030,000 |
| | Purchase Common Fill | 76,711 | CY | \$33.54 | \$2,573,000 | \$901,000 | \$3,474,000 |
| | Haul Fill - 5 miles (impervious & purchased common fill) | 76,711 | CY | \$12.69 | \$973,000 | \$341,000 | \$1,314,000 |
| | Dewatering | 438 | Days | \$1,185.08 | \$519,000 | \$182,000 | \$701,000 |
| | Stripping of Topsoil | 24,824 | CY | \$10.06 | \$250,000 | \$88,000 | \$338,000 |
| | Piles | 230,281 | LF | \$83.85 | \$19,309,000 | \$6,758,000 | \$26,067,000 |
| | Sheet Piling | 11,478 | SF | \$60.60 | \$695,000 | \$243,000 | \$938,000 |
| | Haul and Disposal | 110,078 | CY | \$12.69 | \$1,397,000 | \$489,000 | \$1,886,000 |
| | Backfill of material | 88,942 | CY | \$3.35 | \$298,000 | \$104,000 | \$402,000 |
| | Dump Charges (25% of material) | 42,724 | Tons | \$81.87 | \$3,498,000 | \$1,224,000 | \$4,722,000 |
| | Dump Charges (75% of material) | 128,172 | Tons | \$24.58 | \$3,150,000 | \$1,103,000 | \$4,253,000 |
| | Toe Drain Filter | 922 | CY | \$32.48 | \$30,000 | \$11,000 | \$41,000 |
| | Toe Drain 6" Perf. Pipe | 12,127 | LF | \$3.91 | \$47,000 | \$16,000 | \$63,000 |
| | Topsoil (6") & Seeding | 72,248 | SY | \$5.03 | \$363,000 | \$127,000 | \$490,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| ACCOUNT CODE | DESCRIPTION OF ITEM | QUANTITY | UOM | UNIT PRICE | ESTIMATED AMOUNT | CONTINGENCY | TOTAL |
|-------------------------|---|----------|------|----------------|----------------------|--------------------|----------------------|
| 15 | Floodway Control-Diversion Structure | | | | \$7,767,000 | \$2,719,000 | \$12,572,000 |
| | Excavation | 5,578 | CY | \$12.30 | \$ 69,000 | \$24,000 | \$93,000 |
| | Backfill of material for pipe | 3,953 | CY | \$3.35 | \$ 13,000 | \$5,000 | \$18,000 |
| | Manhole Frame & Cover | 59 | EACH | \$967.07 | \$ 57,000 | \$20,000 | \$77,000 |
| | Concrete for sluice gates | 1,714 | CY | \$838.50 | \$ 1,437,000 | \$503,000 | \$1,940,000 |
| | Concrete for inlet/outlet/MH | 1,151 | CY | \$463.97 | \$ 534,000 | \$187,000 | \$721,000 |
| | 24" RCP | 2,065 | LF | \$64.84 | \$ 134,000 | \$47,000 | \$181,000 |
| | 24" Dia. Flap Gate | 59 | EACH | \$4,052.75 | \$ 239,000 | \$84,000 | \$323,000 |
| | 24" Sluice Gate | 59 | EACH | \$18,558.80 | \$ 1,095,000 | \$383,000 | \$1,478,000 |
| | 24" x 24" Trash Rack | 59 | EACH | \$571.30 | \$ 34,000 | \$12,000 | \$46,000 |
| | 10' x 6' Sluice Gate | 12 | EACH | \$111,800.00 | \$ 1,342,000 | \$470,000 | \$1,812,000 |
| | 10'x6' Flap Gate | 12 | EACH | \$39,130.00 | \$ 470,000 | \$165,000 | \$635,000 |
| | Piles | 9,750 | LF | \$83.85 | \$ 818,000 | \$286,000 | \$1,104,000 |
| | Dewatering | 360 | DAYS | \$1,677.00 | \$ 604,000 | \$211,000 | \$815,000 |
| | Haul and Disposal | 1,625 | CY | \$12.69 | \$ 21,000 | \$7,000 | \$28,000 |
| | Allowance for electrical | 3 | EACH | \$300,000.00 | \$ 900,000 | \$315,000 | \$1,215,000 |
| | Swing Gates | 1,947 | SF | \$793.78 | \$ 1,545,000 | \$541,000 | \$2,086,000 |
| | | | | | | | |
| 19 | Buildings & Grounds | | | | \$ 3,309,000 | \$1,159,000 | \$4,468,000 |
| | Voluntary Acquisition (approx. 17) | 1 | LS | \$2,485,000.00 | \$ 2,485,000 | \$870,000 | \$3,355,000 |
| | Abatement | 1 | LS | \$170,000.00 | \$ 170,000 | \$60,000 | \$230,000 |
| | Demolition | 1 | LS | \$331,000.00 | \$ 331,000 | \$116,000 | \$447,000 |
| | Survey and Appraisal | | LS | 8% | \$323,000 | \$113,000 | \$436,000 |
| | | | | | | | |
| 30 | Planning, Engineering, and Design | 1 | Job | 12% | \$ 17,270,000 | \$2,591,000 | \$19,861,000 |
| | | | | | | | |
| 31 | Construction Management | 1 | Job | 10% | \$ 14,392,000 | \$2,159,000 | \$16,551,000 |
| | | | | | | | |
| Total First Cost | | | | | | | \$190,870,000 |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

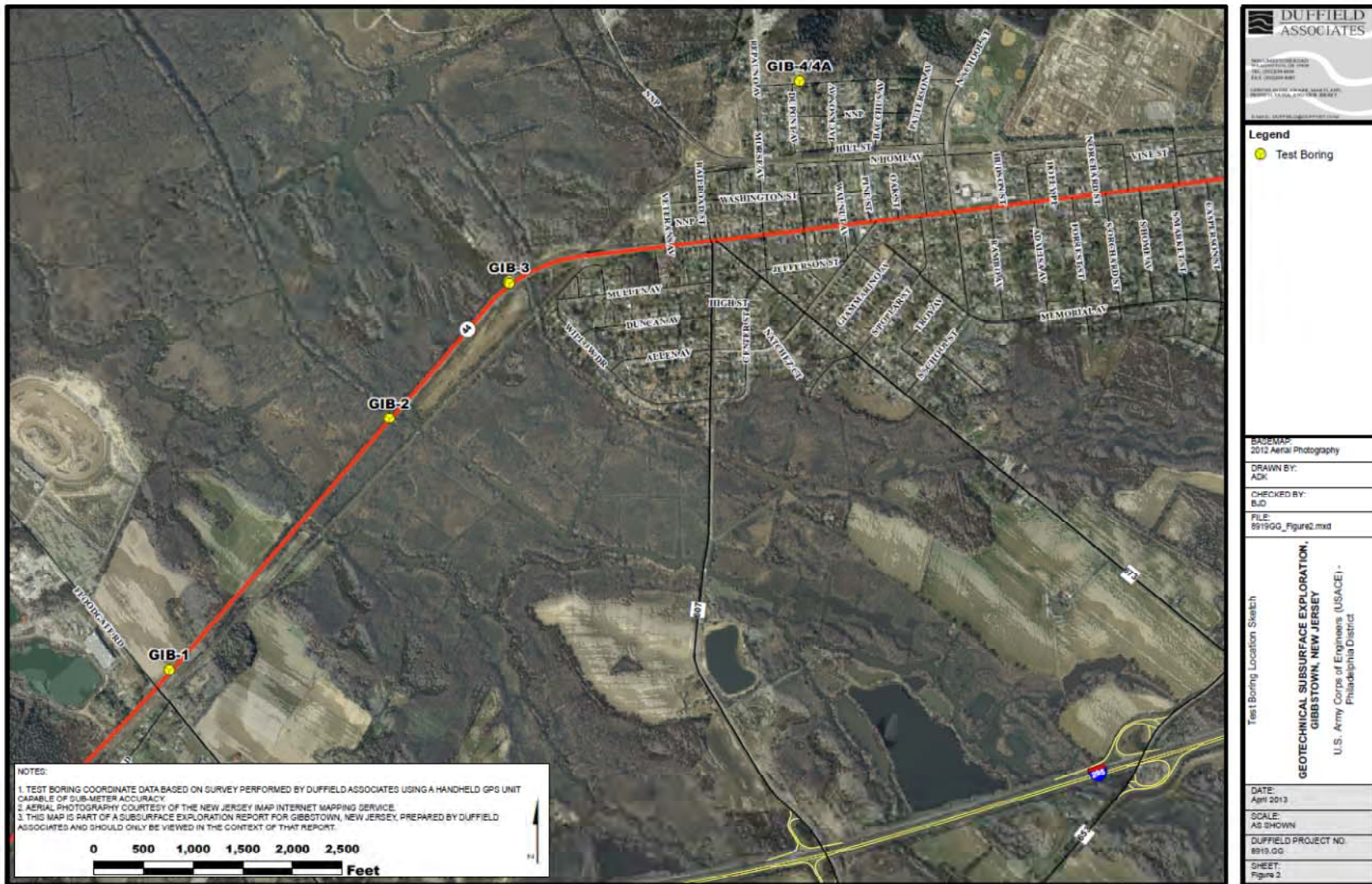


Figure A1: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Location Sketch

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| DUFFIELD ASSOCIATES Consultants in the Geosciences | | TEST BORING GIB-1 (Page 1 of 1) | | | | | | | | |
|--|--------------------|--|--|--|--------------------------------------|--|--------------------------------------|--|---------|-------------|
| Geotechnical Subsurface Exploration - Gibbstown, New Jersey Project No. 8919.GG USACE Contract No. W912BU-11-D-0005 Task Order 0007 | | Date Started : January 17, 2013 Date Completed : January 17, 2013 Logged by : ADK Weather : Cloudy, 30s Driller/Agency : A. Leavy/Granese Drilling, Inc. | Drilling Equipment : Truck-mounted Getco StrataStar 15 Drilling Methods : 3.25" H.S.A. Surface Elevation : 8.5 feet NAVD 88 Northing : 357,685 NUSPFT NAD83 Easting : 263,609 NUSPFT NAD83 | | | | | | | |
| Depth in feet | Surf. Elev. 8.5 ft | GRAPHIC | USCS | DESCRIPTION | SAMPLES | Sample Number | Blows per 6 inches or Fluid Pressure | Recovery (ft) | Remarks | WATER LEVEL |
| | | | | | | | | | | |
| 0 | 8.0 | | SM | TOPSOIL AND ROOT MATERIAL Very pale brown fine SAND, little medium sand, trace coarse sand, trace silt, trace pebbles (sl. laminated/bedded appearance) (damp) SAME (very pale brown to brown color) (trace to little silt) (wet) | 1A 1B | 3-3-4-3 | 1.0 | Apparent top of Cape May Formation, Unit 2. | | |
| 5 | 3.6 | | SC | SAME (trace silt) (wet) Reddish yellow fine SAND, little silt, trace to little medium sand, trace to little clay, trace coarse sand (common faint light brown mottles) (saturated to wet) SAME (saturated) | 3A 3B | 2-2-2-3 2-1-1-1 | 0.8 1.8 | | | |
| 10 | -1.5 | | SP-SM | SHELBY TUBE ST-1: 8.0' - 10.0' - SHELBY TUBE Very pale brown fine SAND, trace medium to coarse sand, trace very coarse sand, trace pebbles, trace to no silt (few reddish yellow coarse sand lenses) (saturated) | ST-1 | 1-1-1-1 | 0.9 | | | |
| 15 | -4.4 | | SM SC | Light brownish gray very fine SAND and SILT/CLAY (common distinct fine reddish yellow mottles) (wet) Reddish yellow coarse to medium SAND, little very coarse sand, trace to no silt (trace thin lenses with some silt/clay) (saturated) | 5 6A 6B 6C | 3-3-3-5 5-7-7-14 | 1.4 1.5 | Driller washed out augers with drilling mud. | | |
| 20 | -10.0 | | SM SC | Light gray fine SAND, trace medium to coarse sand, trace to no silt (few clay stringers) (few yellow to reddish yellow lenses) (saturated) Very pale brown fine SAND, some silt, trace clay, trace medium sand (many to common distinct reddish yellow mottles) (wet to saturated) | 7 8 9A 9B | 10-10-10-12 10-8-7-6 3-2-2-6 | 1.2 1.6 1.2 | Apparent top of Magothy Formation. | | |
| 25 | -13.5 | | CL | Greenish gray SILT/CLAY, little to some very fine sand (little to some organic material/lignite) (micaceous) (wet) SAME (few light gray fine sand lenses) (wet to moist) | 10A 10B | 3-3-3-4 | 1.3 | | | |
| 30 | -21.5 | | CL | Dark brown to dark grayish brown CLAY/SILT, trace fine sand (sl. micaceous) (little organic material) (moist to wet) Gray fine SAND, little to some silt, trace medium to coarse sand (some to little lignite) (saturated to wet) Dark brown CLAY/SILT, trace fine sand (little to some lignite) (sl. hydrogen sulfide odor) (wet to moist) SAME (micaceous) (wet to damp with depth) SAME (wet to saturated with depth) Very dark brown PEAT (saturated) Dark brown CLAY/SILT, trace very fine sand (some lignite) (micaceous) (wet to saturated) | 11A 11B 12 13A 13B 14 | 2-2-2-4 3-4-6-5 5-6-7-8 7-7-7-9 | 1.2 1.1 1.6 1.8 | | | |
| <p>NOTES:</p> <ol style="list-style-type: none"> 1. Test boring terminated at 30 feet +/- below existing ground surface (b.e.g.s.). 2. Saturation encountered at approximately 5 feet b.e.g.s. 3. Borehole backfilled with bentonite-amended portland cement upon completion. 4. Soil descriptions performed in general accordance with ASTM D 2488, the Practice for Description and Identification of Soils (Visual-Manual Procedure). 5. Standard, split-barrel sampling performed in general accordance with the Method for Penetrative Test and Split-Barrel Sampling (ASTM D 1586). 6. Location data based on GPS survey performed by Duffield Associates. 7. Elevation estimated by Duffield Associates using 2010 LIDAR data. | | | | | | | | | | |

| DUFFIELD ASSOCIATES Consultants in the Geosciences | | TEST BORING GIB-2 (Page 1 of 1) | | | | | | | | |
|--|--------------------|---|--|--|---------|---------------|--------------------------------------|-------------------|---|-------------|
| Geotechnical Subsurface Exploration - Gibbstown, New Jersey Project No. 8919.GG USACE Contract No. W912BU-11-D-0005 Task Order 0007 | | Date Started : January 21, 2013 Date Completed : January 21, 2013 Logged by : ADK Weather : P Sunny, 30s Driller/Agency : A. Leavy/Granese Drilling, Inc. | Drilling Equipment : Truck-mounted Getco StrataStar 15 Drilling Methods : 3.25" H.S.A. Surface Elevation : 9.8 feet NAVD 88 Northing : 360,206 NUSPFT NAD83 Easting : 265,816 NUSPFT NAD83 | | | | | | | |
| Depth in feet | Surf. Elev. 9.8 ft | GRAPHIC | USCS | DESCRIPTION | SAMPLES | Sample Number | Blows per 6 inches or Fluid Pressure | Recovery (ft) | Remarks | WATER LEVEL |
| | | | | | | | | | | |
| 0 | 8.8 | | | ASPHALT (2+ layers) APPARENT FILL [yellow fine to medium sand, little coarse sand, trace fine gravel, little to trace silt (damp)] SAME (damp to moist) | | 1 2 | 6-9 9-5-5-5 | 0.8 1.4 | | |
| 5 | | | | SAME (mostly fine sand) (moist) SAME (moist) SAME (wet by 8.5' +/-) | | 3 4 5 | 5-3-4-5 4-3-3-3 2-2-3-3 | 1.0 1.6 1.5 | | |
| 10 | -2.2 | | SM | SAME (change in shoe to light brownish gray color) (wet) Light brownish gray to grayish brown fine SAND, trace coarse sand, trace silt (trace organic material) (few heavy mineral laminations) (saturated) | | 6 7 | 1-1-3-2 4-4-4-4 | 1.4 1.4 | Apparent top of stream alluvium. | |
| 15 | -4.2 | | SP-SM | SAME (trace to no silt) (trace to little pebble quartz) (wet with saturated lenses) SAME (very pale brown with brownish gray lenses) (weakly stratified) (wet) | | 8 9 | 2-3-4-3 2-5-4-3 | 1.9 1.7 | Driller reports wet on rods at 17' +/- b.e.g.s. | |
| 20 | -8.2 -8.5 | | CL OL | Dark gray to black CLAY/SILT, little fine to coarse sand (some slag/metal flakes) (el. odor) (saturated) Dark brown PEAT (moist) | | 10A 10B | 6-7-9-9 | 1.8 | | |
| 25 | -12.2 | | SP-SM | SHELBY TUBE ST-1: 20.0' - 22.0' - SHELBY TUBE Pale brown to light greenish gray (with depth) fine SAND, little to trace medium sand, trace coarse sand, trace to no silt (trace roots) (mod. well-sorted) (saturated) | ST-1 | 11 | 3-4-5-7 | 1.7 | | |
| 30 | -14.2 | | SP-SM | SAME (1-1.5' thick fining upward sequences from fine to coarse, sub-rounded quartz gravel to fine sand and clay/silt lens cap) (saturated) | | 12 | 4-5-5-3 | 1.7 | | |
| | -18.2 | | SP-SM | SAME (saturated) | | 13 | 7-13-12-16 | 1.7 | | |
| | -20.2 | | SP-SM | Greenish gray fine SAND, little to trace medium to coarse sand, trace fine gravel, trace to no silt (mod. well-sorted) (trace organic material) (trace clay/silt clasts) (sl. glauconitic) (saturated) | | 14 | 1-1-4-5 | 1.4 | | |
| <p>NOTES:</p> <ol style="list-style-type: none"> 1. Test boring terminated at 30 feet +/- below existing ground surface (b.e.g.s.). 2. Saturation encountered at approximately 12 feet b.e.g.s. 3. Borehole backfilled with bentonite-amended portland cement and capped with asphalt cold patch upon completion. 4. Soil descriptions performed in general accordance with ASTM D 2488, the Practice for Description and Identification of Soils (Visual-Manual Procedure). 5. Standard, split-barrel sampling performed in general accordance with the Method for Penetrative Test and Split-Barrel Sampling (ASTM D 1586). 6. Location data based on GPS survey performed by Duffield Associates. 7. Elevation estimated by Duffield Associates using 2010 LIDAR data. | | | | | | | | | | |

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

| DUFFIELD ASSOCIATES Consultants in the Geosciences | | TEST BORING GIB-3 (Page 1 of 2) | | | | | | | | |
|---|--------------------|---|--|--|---------|---------------|--------------------------------------|---------------|------------------------------------|-------------|
| Geotechnical Subsurface Exploration - Gibbstown, New Jersey Project No. 8919.GG USACE Contract No. W912BJ-11-D-0005 Task Order 0007 | | Date Started: January 18, 2013 Date Completed: January 18, 2013 Logged by: ADK Weather: Sunny, 30s Driller/Agency: A. Levy/Granose Drilling, Inc. | Drilling Equipment: Truck-mounted Getco StrataStar 16 Drilling Methods: 3.25" H.S.A. Surface Elevation: 9.2 feet NAVD 88 Nothing: 381.570 NUSPFT NAD83 Easting: 267.025 NUSPFT NAD83 | | | | | | | |
| Depth in feet | Surf. Elev. 9.2 ft | GRAPHIC | USCS | DESCRIPTION | SAMPLES | Sample Number | Blows per 6 inches or Fluid Pressure | Recovery (ft) | Remarks | WATER LEVEL |
| | | | | | | | | | | |
| 0 | 8.7 | | | TOPSOIL AND ROOT MATERIAL | | 1A | 3-5-5-4 | 1.5 | | |
| | | | | APPARENT FILL [yellow to yellowish brown fine sand, some silt, trace clay, trace fine to medium gravel (little organic material) (moist to wet)] | | 1B | | | | |
| | | | | SAME (moist to wet) | | 2A | 4-4-5-8 | 1.4 | | |
| | | | | SAME (greenish gray color) (little silt) (moist) | | 2B | | | | |
| | | | | SAME (pale yellow and greenish gray) (sl. glauconitic) (moist to wet) | | 3 | 10-13-16-11 | 1.5 | | |
| | | | | SAME (trace silt) (wet) | | 4 | 13-14-22-34 | 1.4 | | |
| | | | | APPARENT FILL [black coal slag, mostly fine sand size (@9.3' +/- lens of apparent oyster shells) (wet)] | | 5 | 44-34-35-10 | 1.5 | | |
| | | | SC | Grayish brown fine SAND, some to and silt, little medium sand, little to trace clay (few laminations of organic material) (wet) | | 6 | 7-8-4-7 | 1.1 | Apparent top of stream alluvium. | |
| | | | | Light gray to pale yellow fine SAND, trace medium sand, trace to no silt (sl. glauconitic) (saturated) | | 7 | 4-4-5-5 | 1.1 | | |
| | | | SP-SM | SAME (fine to very fine sand, trace to no silt) (well-sorted) (saturated) | | 8 | 4-4-4-4 | 1.4 | | |
| | | | | SAME (change in shoe to granular sand stringer over greenish gray clay/silt lens) (saturated) | | 9 | 7-6-3-5 | 1.5 | | |
| | | | SC | Greenish gray, olive yellow and brownish yellow fine SAND, trace silt (glauconitic) (many gray-greenish gray clay/silt lenses) (saturated) | | 10 | 2-2-9-9 | 1.2 | Apparent top of Magothy Formation. | |
| | | | | SAME (thinly-bedded) (trace lignite and mica in clay/silt lenses) (saturated) | | 11 | 4-4-3-3 | 0.9 | | |
| | | | | SAME (saturated) | | 12A | 2-2-3-2 | 1.4 | | |
| | | | CL | Gray CLAY/SILT, trace fine sand (micaceous) (trace organic material) (medium plasticity) (wet to saturated) | | 12B | | | | |
| | | | | SAME (saturated) | | 13A | 8-5-14-12 | 1.9 | | |
| | | | | Gray fine to medium SAND, trace to little coarse sand, trace very coarse to granular sand, trace to no silt (sl. glauconitic) (common thin lenses of greenish gray very fine to fine silty sand) (saturated) | | 13B | | | | |
| | | | SP-SM | SAME (finer than above: mostly fine sand) (saturated) | | 14 | 5-10-11-14 | 1.3 | | |
| | | | | SAME (mostly medium to fine sand, trace to no silt) (sl. micaceous) (saturated) | | 15 | 2-5-9-12 | 1.7 | | |
| | | | | SAME (trace gray clay stringers) (trace fine quartz gravel) | | | | | | |

NOTES:
 1. Test boring terminated at 60 feet +/- below existing ground surface (b.e.g.s.).
 2. Saturation encountered at approximately 12 feet b.e.g.s.
 3. Borehole backfilled with bentonite-amended portland cement upon completion.
 4. Soil descriptions performed in general accordance with ASTM D 2488, the Practice for Description and Identification of Soils (Visual-Manual Procedure).
 5. Standard, split-barrel sampling performed in general accordance with the Method for Penetrative Test and Split-Barrel Sampling (ASTM D 1586).
 6. Location data based on GPS survey performed by Duffield Associates.
 7. Elevation estimated by Duffield Associates using 2010 LIDAR data.

Figure A2: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

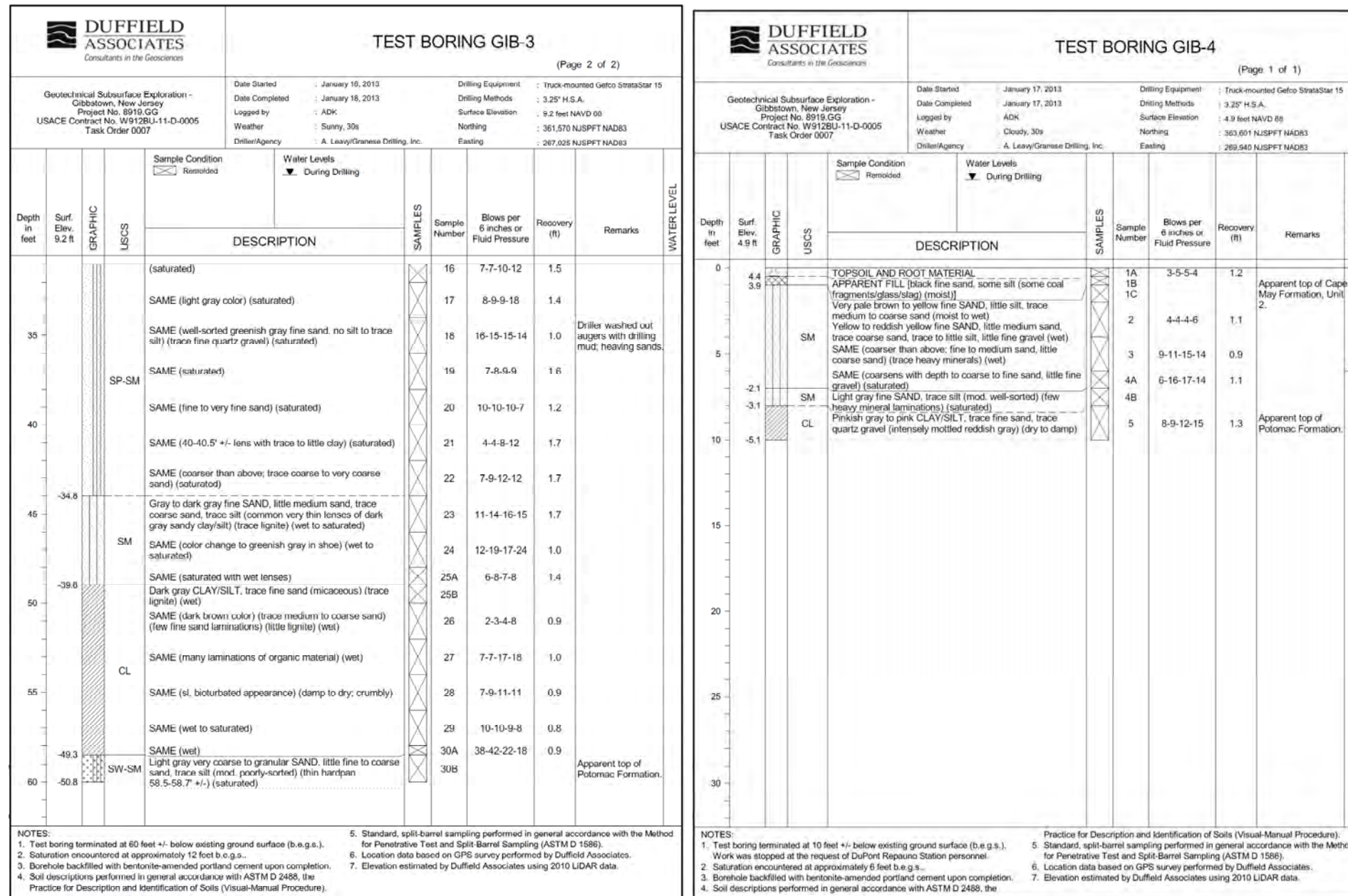


Figure A2 con't: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

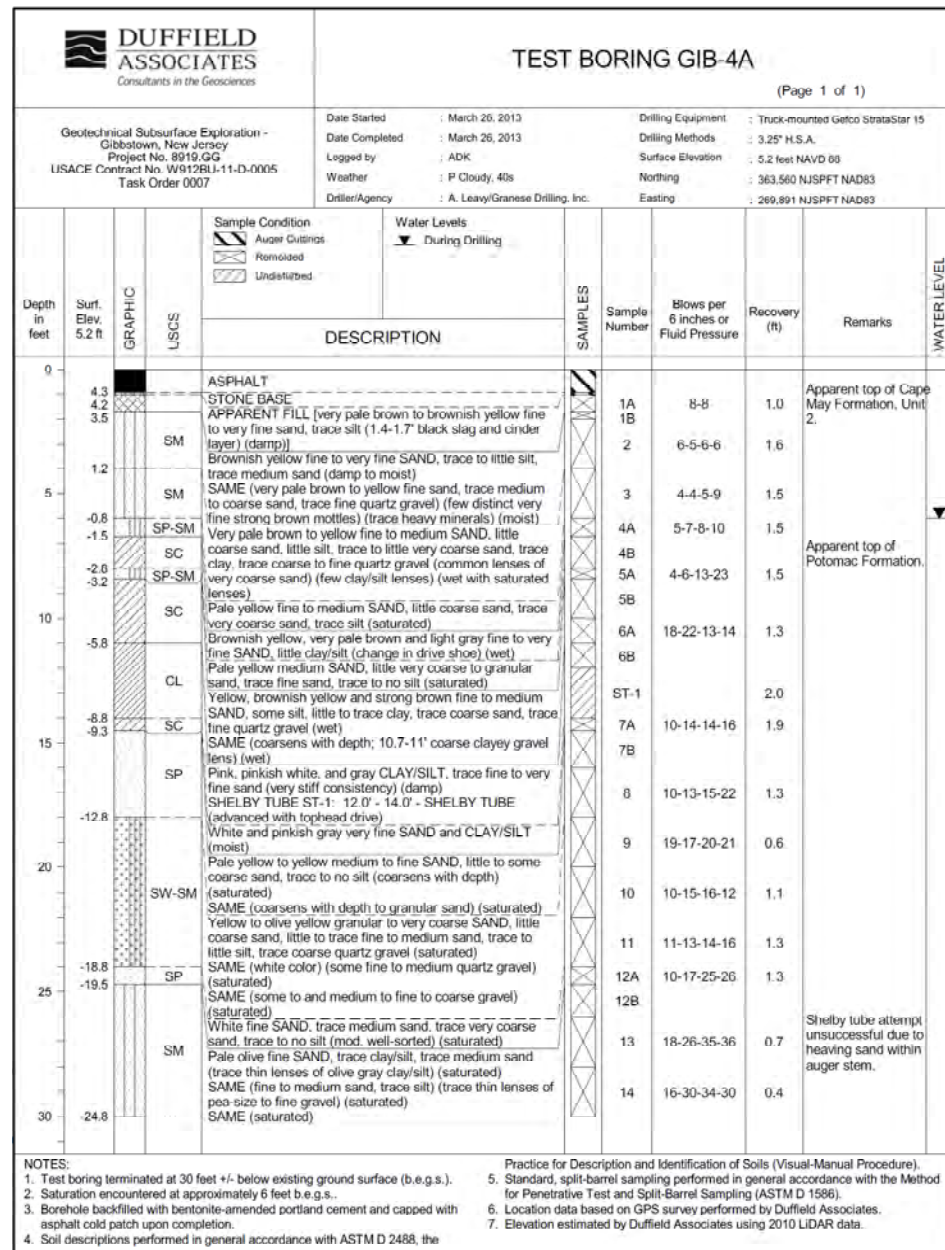


Figure A2 con't: Geotechnical Subsurface Exploration, Gibbstown, New Jersey – Test Boring Logs

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

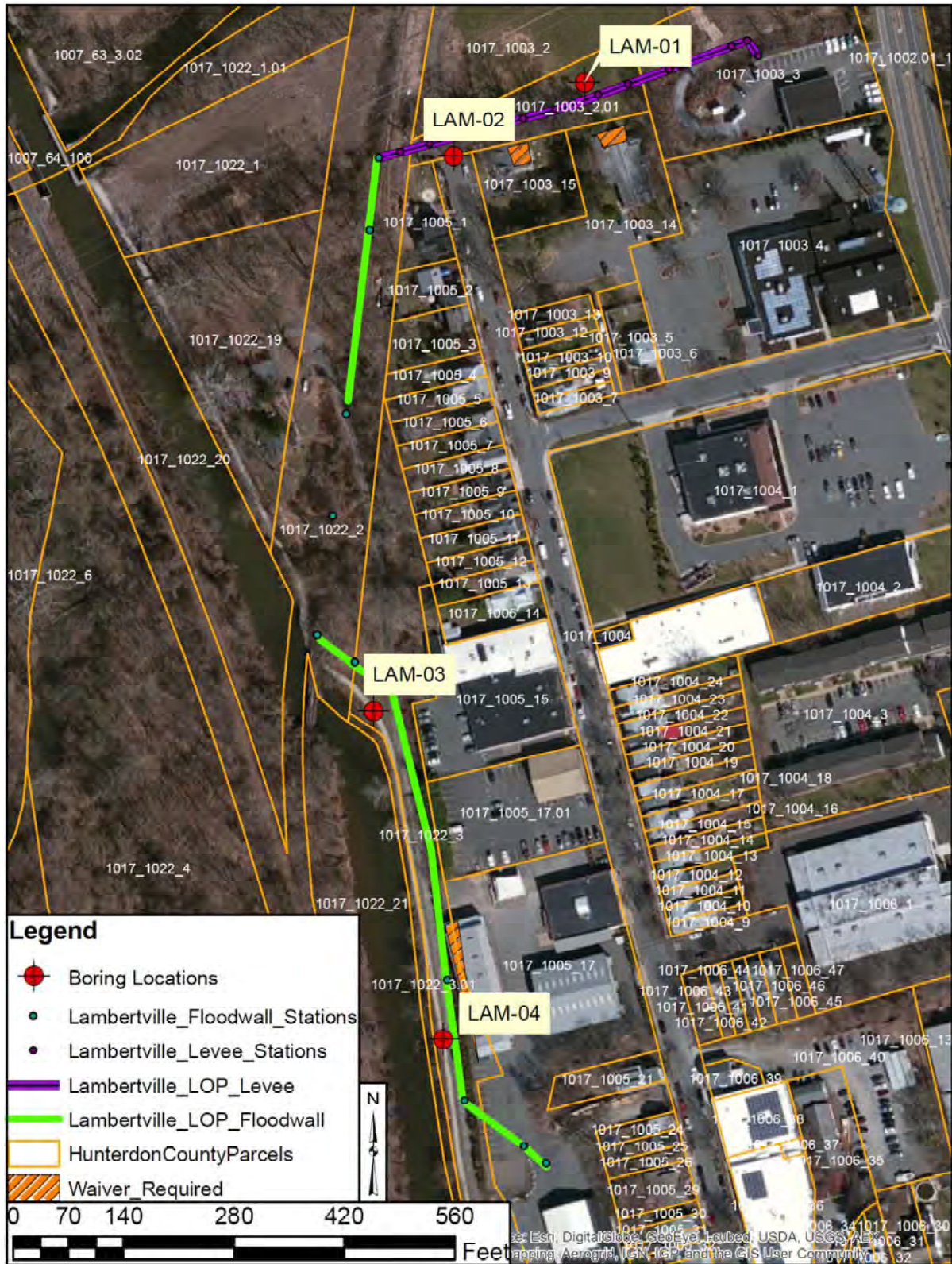


Figure A3: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Location Sketch

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

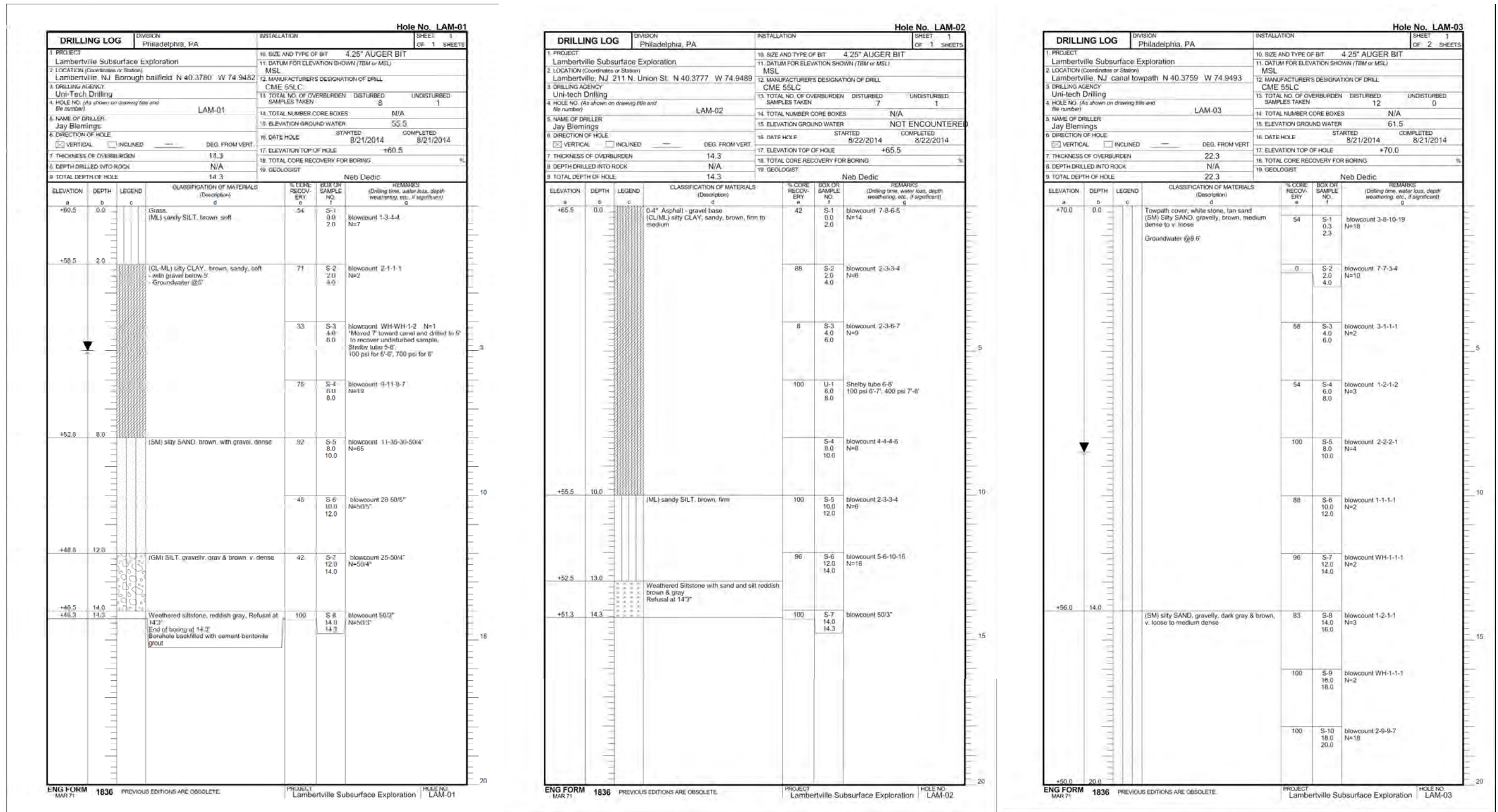


Figure A4: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

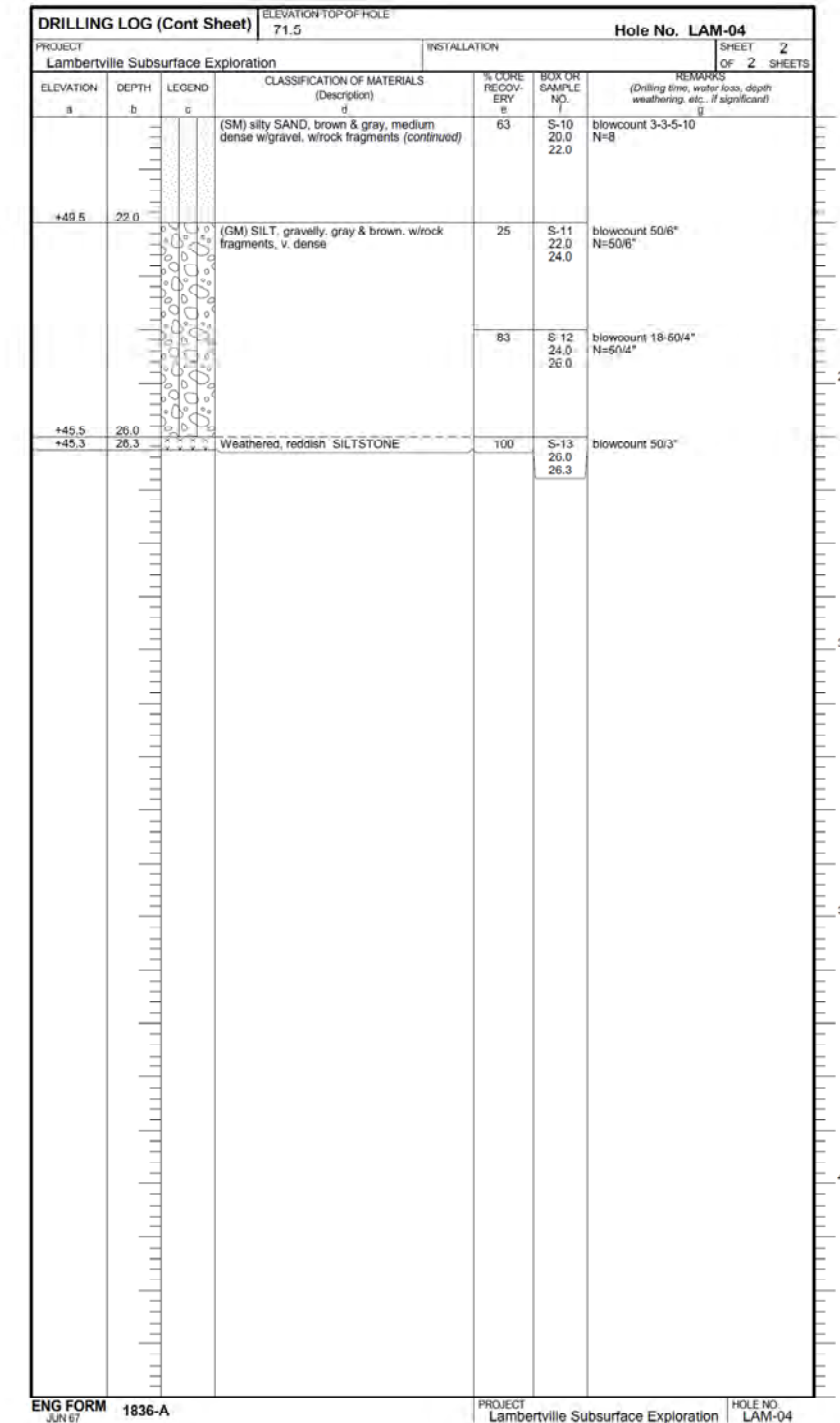
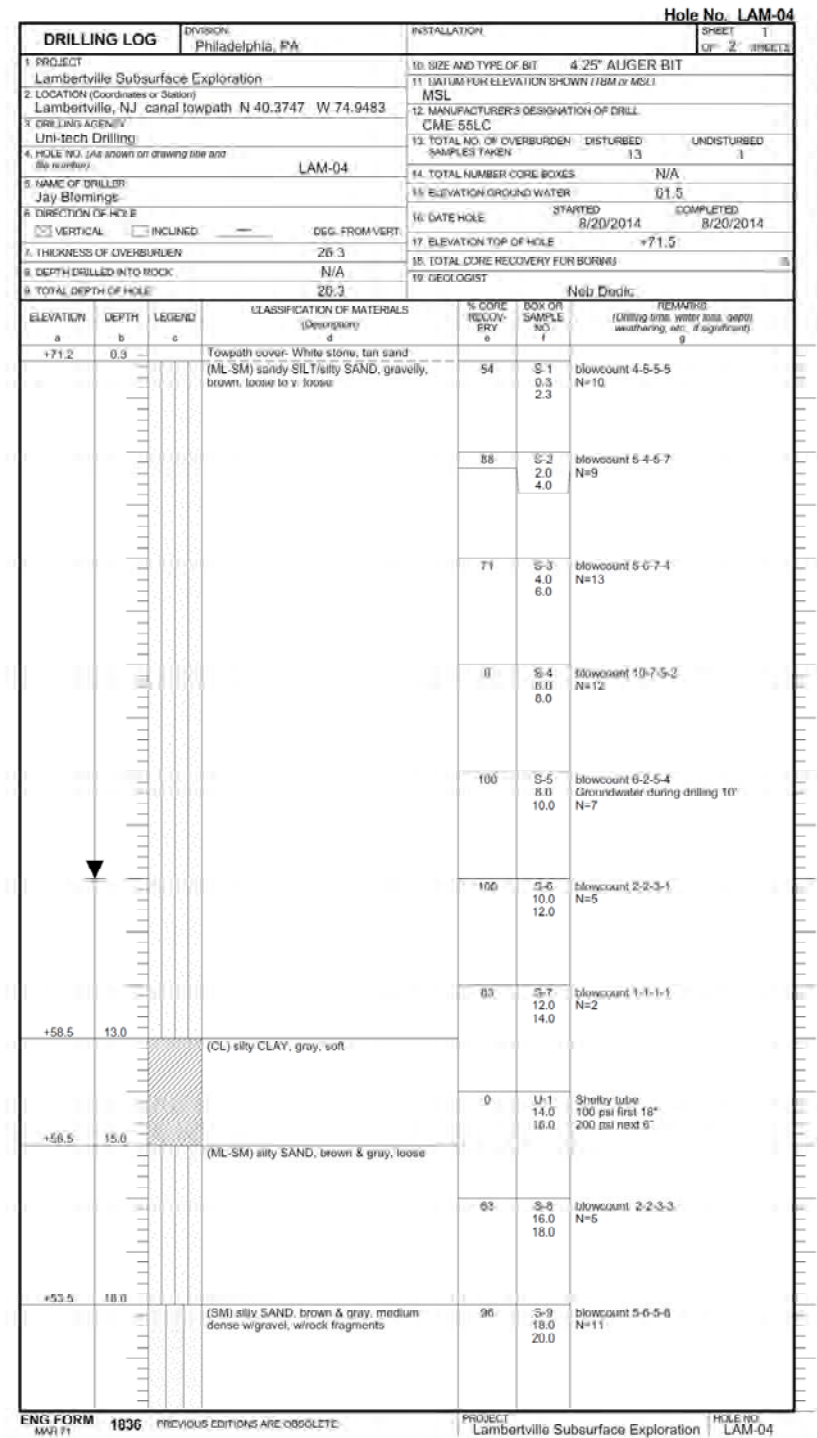
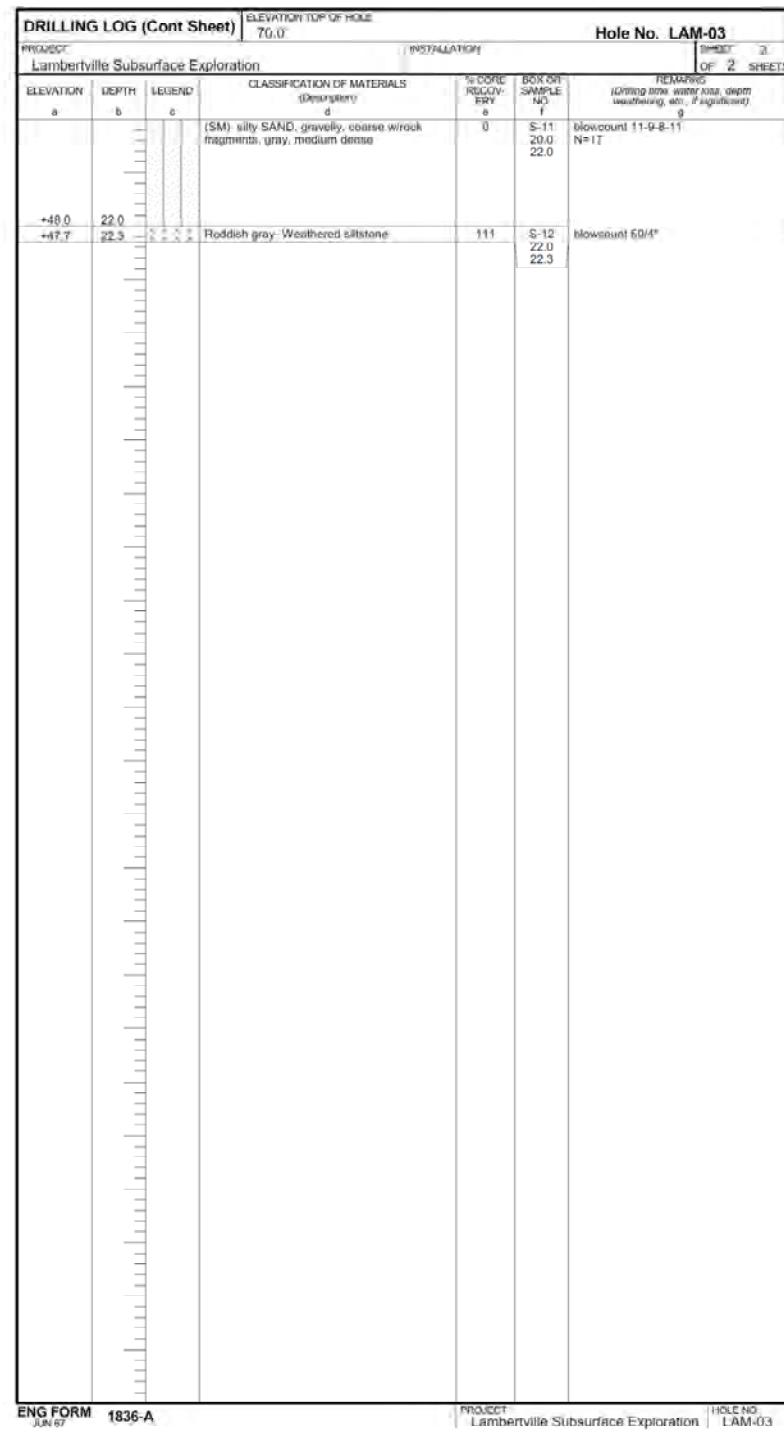


Figure A4 con't: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs

APPENDIX A: ENGINEERING TECHNICAL APPENDIX - ATTACHMENTS

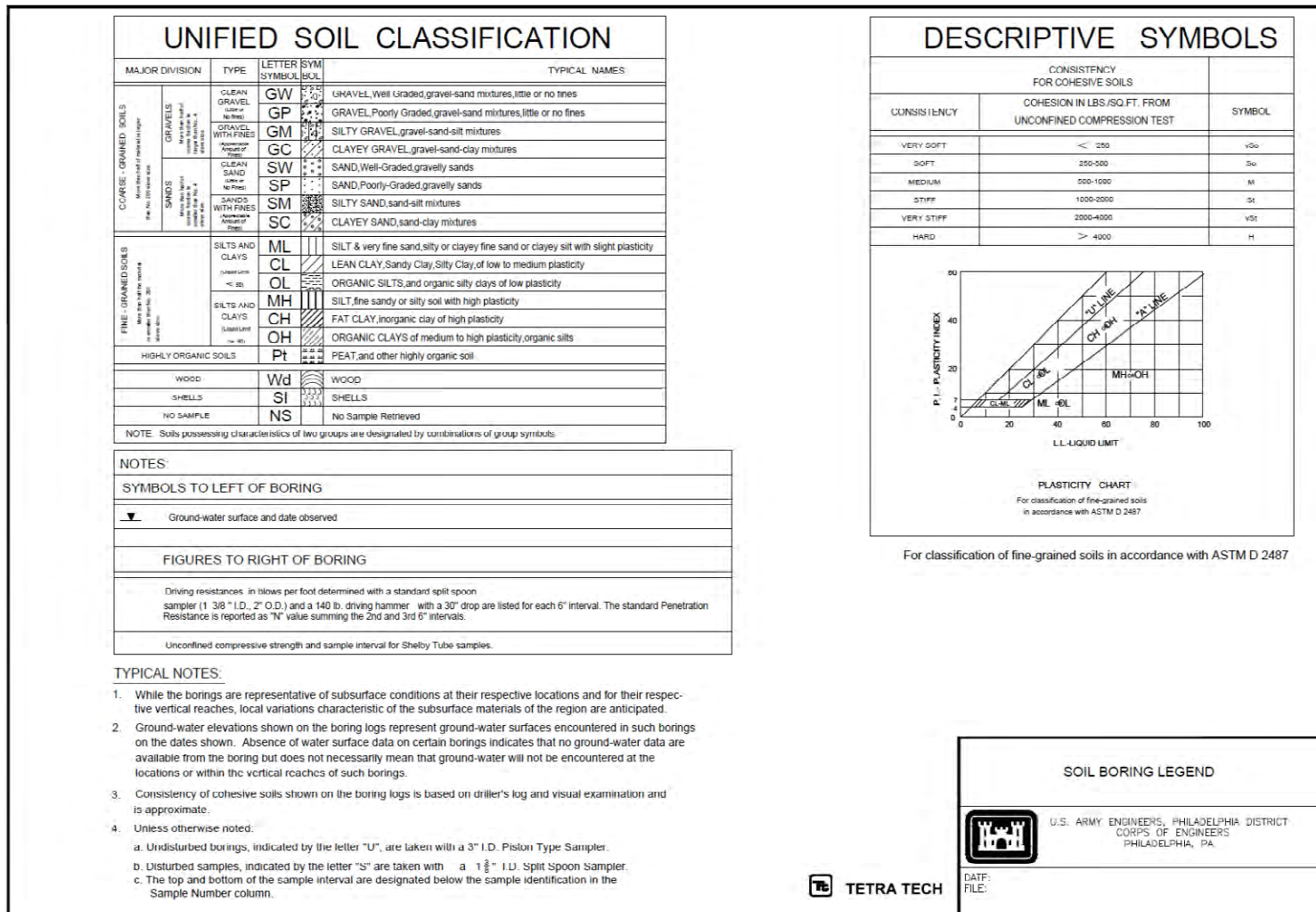


Figure A4 con't: Geotechnical Subsurface Exploration, Lambertville, New Jersey – Test Boring Logs