1. PROJECT DESCRIPTION

The project consists of the stabilization of the Cushman Lake Dam Culvert (NJDEP File No. 31-97) located at the southeast Cushman Lake in Folsom Borough, Atlantic County, New Jersey. We understand that the proposed project conditions consist of the following:

- observed boiling at the toe of the existing main concrete culvert;
- provided an evaluation of the seepage issue and report findings;
- provided sizing for a driven sheet pile cutoff wall on the upstream side of the culvert.

The purpose of our geotechnical engineering services was to provide emergency engineering analysis for seepage issue, and to size a sheet pile for the design and construction of the proposed cutoff wall structure.

2. DOCUMENTS REVIEWED

To assist with the development of this calculation package, we reviewed the following:

- 19-page Geotechnical report titled, "Cushman Lake Dam: Geotechnical Investigation and Report for Reconstruction," prepared by Lippincott Jacobs, dated August of 2012;
- 16-page plan set titled, "Cushman Lake Dam: Proposed Dam Modifications," prepared by Lippincott Jacobs, dated February 12, 2013 (revision #1 dated October 15, 2019, rev. engineer of record); and
- Historical Dam and Culvert Drawings for Cushman Lake Dam titled, "Concrete Gate and Spillway," dated June 22, 1953.

3. EXISTING CONDITIONS

It has been reported on April 24, 2025, that the Cushman Lake Dam had been experiencing seepage at the end of the main spillway. On May 2, 2025, the Dam was inspected by the engineers from the Bureau of Dam Safety (Bureau), upon their inspection seepage was observed discharging fine material immediately downstream of the primary spillway structure. Based on our review of historical data, soils information, and a brief analysis consisting of a flow net model indicated that the current Dam conditions are experiencing a seepage failure with factors of safety less than 1.0. The seepage conditions were noticed when upstream water levels of the lake were at Elev. 68.5 and downstream water levels were at or near Elev. 58.0.

In response to this observation, Pennoni has been tasked with providing geotechnical analysis to assist in developing a seepage repair plan.

Based on our review of the provided plan set and historical data from 1953, we understand that the existing culvert is supported by 8 in. diameter, 20 ft long, timber piles. It was also documented from 1953 that there were 3 in. thick tongue and groove (T. & G.) sheeting driven around the culvert. After the original Culvert was constructed, three wing walls consisting of PZ 40 sheet piles were installed along the north, east, and south portions of the main culvert spillway. Based on the as-built documentation these sheets were driven to or near Elev. 28.0. (recent conversations with the sheet pile contractor confirmed this as-built condition.)

4. SUBSURFACE CHARACTERISTICS

For this analysis, Pennoni utilized the historic geotechnical information provided by Lippincott Jacobs Consulting Engineers (LJCE) from August of 2012. Per the 2012 study, four borings were performed across the existing Dam, after a breach occurred to the north as a result of a major hurricane.

4.1 GEOLOGY

The project site is located within the Outer Coastal Plain Physiographic Province of New Jersey, which is characterized by flat terrain and unconsolidated sediment deposits. The Outer Coastal Plain consists of more recent deposits, such as unconsolidated Tertiary deposits of sands, silts and gravels. The soils are sandy with less clay than the inner coastal plain, and are more acidic and dry. The topography of this area can be characterized by rolling low land. Available geologic data shows the site is underlain by the Cohansey Formation (Geologic Symbol – Tch) which consists primarily of white to light-yellow sand. The sand is typically medium grained and moderately sorted, although it ranges from fine to very coarse grained and from poorly to well sorted. Sand consists of quartz and siliceous rock fragments.

4.2 SUBSURFACE STRATIGRAPHY

Subsurface stratigraphy encountered within the SPT borings generally consisted of very loose to loose sand, underlain by medium dense sand, eventually underlain by dense to very dense sand to silty sand. For this analysis, Pennoni utilized information from LJCE's Nearest Boring, B-2, and made conservative assumptions as to the densities of sands below the boring termination depth. The underlying subsurface stratigraphy has been summarized below. For descriptive purposes the soil layers can be classified as follows:

Table 1: Subsurface Stratigraphy

Stratum	Approximate Thickness (ft)	Description
A	Current Surface to Elev. 35.0	Brown to tan to white to black fine to medium SAND, trace silt (very loose to loose, dry to saturated)
B	-	Medium to fine to coarse SAND, trace silt (medium dense, saturated)

5.3 GROUNDWATER

Groundwater observations from the historic boring B-2 indicated that groundwater was encountered during drilling at a depth of 12 ft below the existing grade of Elev. 72.8. Groundwater levels are anticipated to fluctuate based on the water level of Braddock Lake and Cushman Lake.

5. EARTH PRESSURE PARAMETERS

The following resources and references were utilized to estimate the lateral earth pressure parameters:

TABLE 3-4 **Empirical values for ϕ, D_r, and unit weight of granular soils based on the SPT at about 6 m depth and normally consolidated**

Description	Very loose	Loose	Medium	Dense	Very dense
Relative density D_r	0 – 0.15		0.35 – 0.65		0.85 –
SPT N'_{70}: fine	1–2	3–6	7–15	16–30	?
medium	2–3	4–7	8–20	21–40	>40
coarse	3–6	5–9	10–25	26–45	>45
ϕ: fine	26–28	28–30	30–34	33–38	
medium	27–28	30–32	32–36	36–42	<50
coarse	28–30	30–34	33–40	40–50	
γ_{wet}, pcf	70–100†	90–115	110–130	110–140	130–150
(kN/m^3)	(11–16)	(14–18)	(17–20)	(17–22)	(20–23)

† Excavated soil or material dumped from a truck will weigh 11 to 14 kN/m^3 and must be quite dense to weigh much over 21 kN/m^3. No existing soil has a $D_r = 0.00$ nor a value of 1.00—common ranges are from 0.3 to 0.7.

Table A.3 Estimation of friction angle of granular soils from SPT test results (after Peck, et. al., 1974)

$(N_1)_{60}$ (blows/ft)	Relative density	ϕ (°)
0 – 4	Very loose	< 28
4 – 10	Loose	28 – 30
10 – 30	Medium dense	30 – 36
30 – 50	Dense	36 – 41
> 50	Very dense	> 41

Estimated Soil Parameters Values Based on Above References:

Stratum A – generally very loose to loose SAND: Phi Angle (f) = 28° and Moist Unit Weight (g) = 106 pounds/cubic foot (pcf)

Stratum B – generally medium dense SAND: Phil Angle (f) = 30° and Moist Unit Weight (g) = 115 pcf

Lateral Earth Pressure Parameter Table

Parameter	*Stratum A*	*Stratum B*
Angle of Internal Friction, degrees	28	30
Cohesion, psf	0	0
Friction Factor, f	0.34	0.36
k_a	0.36	0.33
k_o	0.53	0.50
k_p	2.77	3.00

6. SEEPAGE ANALYSIS

6.1 Seepage Model and Parameters

We performed seepage analyses of water flow through embankment and subsurface soils beneath the existing culvert structure with respect to where the boiling is occurring. The model was initially created to model the existing conditions showing a failure condition with a Factor of Safety (FOS) of less than 1.0. Then this model was modified to create a sheet pile sizing for the emergency repairs. The flownet was modeled to illustrate the water flow channels through the embankment and subsurface soils. The performance of a flownet analysis at the culvert cross section was used to estimate the seepage through the dam at the toe of the downstream embankment and evaluate the factor of safety against upward seepage (soil piping/heave).

Our analyses are based on the topography and proposed construction provided in the above referenced design drawings and estimated soil parameters and stratigraphy depths/thicknesses based on the above referenced subsurface information summarized in Section 4. In our analysis, we modeled the water elevation of Cushman Lake at the 100-year design storm elevation of Elev. 71.0 and a downstream elevation of Elev. 61.0.

In discussions with the project team, a sheetpile cutoff wall was discussed to be installed at the upstream side of the culvert and was modeled with the cutoff wall installed at tip elevation Elev. 25.0, which is near the tip elevation of the wingwall sheets. The sheeting is anticipated to be installed a small distance from the upstream portion of the culvert approximately 4 to 6 ft.

The seepage analysis was performed for the following proposed conditions and the resulting factors of safety are discussed further below.

- Cross-Section at Existing Culvert at Station 3+22 with sheet pile cutoff wall installed at upstream side of the culvert

6.2 Seepage Analysis Results and Discussion

The purpose of a seepage analysis is to provide an estimation of water flow through embankment and subsurface soils based on the proposed embankment and culvert structure resulting in the estimation of a minimum factor of safety against upward seepage (piping/soil heave). The seepage modeled is indicative of upward flow on the downstream side of the dam where the upward flow of water reduces the effective stress in granular (cohesionless) material to zero, thereby inducing piping, soil heave. The hydraulic exit gradient is estimated at the downstream end of the culvert and the point at which the gradient causes the effective stress of the soil to equal zero is defined as the critical gradient. The factor of safety with respect to the exit gradient at the toe of the dam is generally defined as the ratio of critical gradient to the estimated exit gradient. General design practice considers a minimum factor of safety of 3.0 for upward seepage stability.

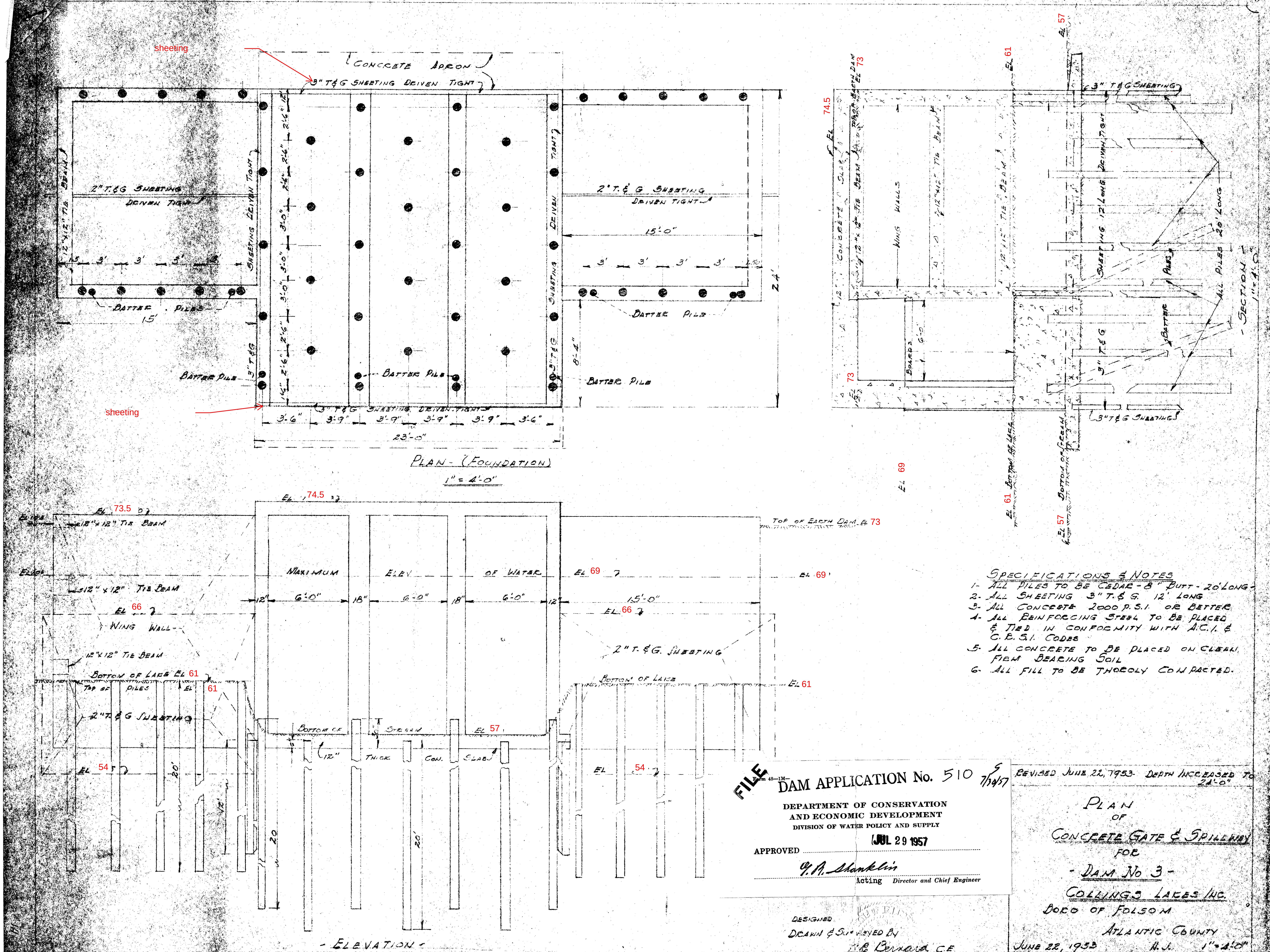
The results of the analyses and approximate locations where the cross-sections were selected and modeled as a part of the upward seepage analysis are presented at the end of this report. A summary of the results from the analyses performed on the cross section is provided below. If proposed construction is different than the assumed the conditions utilized in our models, we should be presented with this information to revise our analysis and provide further discussion, if warranted.

Table 2 – Seepage Analysis Cross-Section Results

Cross-Section Analyzed	Station Number	Minimum Factor of Safety (FS)[1]
Box Culvert with Sheet pile Cutoff Wall (D.S. Elev. 61.0)	3+22	5.4
Box Culvert with Sheet pile Cutoff Wall (D.S. Elev. 58.0)	3+22	4.5
NOTES: [1] FS – Factor of Safety		

Based on the results from the upward seepage analyses, the following is noted:

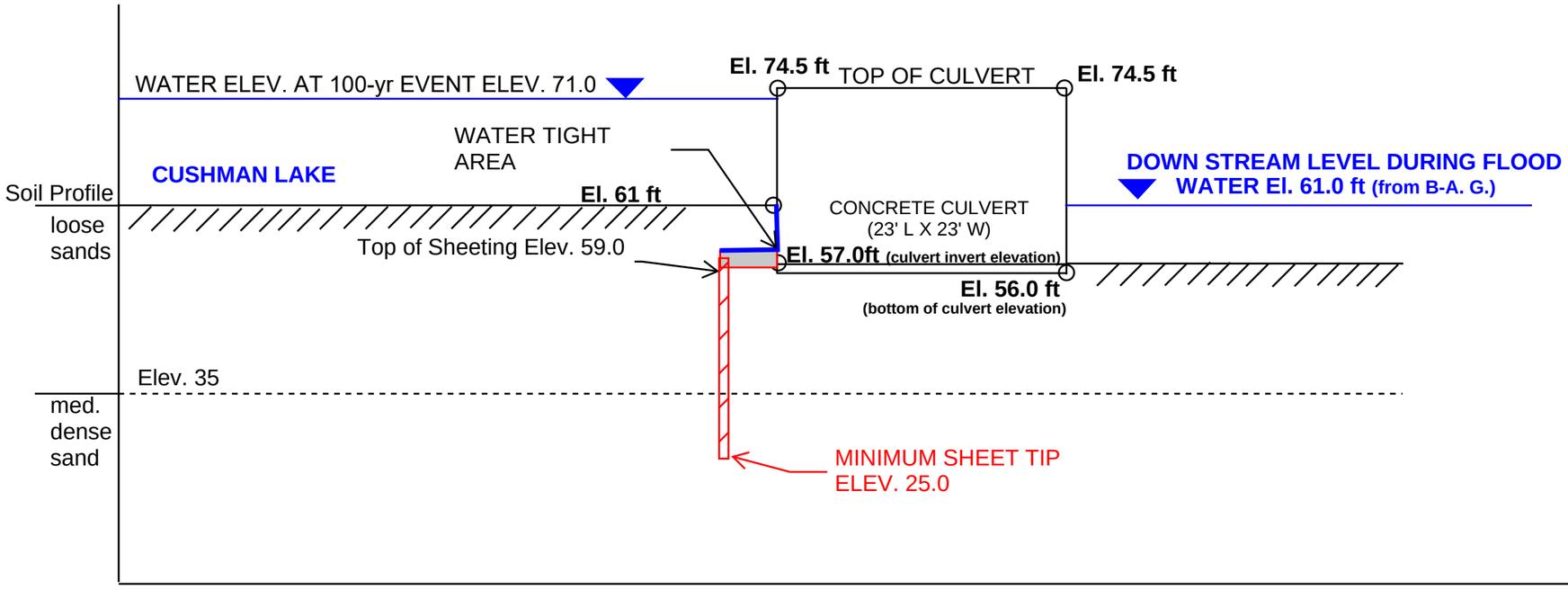
- The cross-sections analyzed estimated a minimum factor of safety greater than 3.0 for the proposed construction indicating stability against upward seepage at the toe of the dam in the earthen embankment and box culvert areas, respectively;
- A sheet pile cutoff wall is to be installed at the upstream side of Cushman Lake Dam at the existing culvert. The bottom of the sheetpile wall is recommended to be installed at a minimum elevation of Elev. 25.0. The sheet pile wall location is anticipated to be extended laterally approximately 4 to 6 feet northwest of the upstream side of the culvert.



Concrete Apron
3" T&G Sheeting Driven Tight
2" T.&G Sheeting Driven Tight
12"x12" Tie Beam
Batter Piles
15'
Sheeting Driven Tight
3" T&G
Batter Pile
3" T&G Sheeting Driven Tight
3'-6" 3'-9" 3'-9" 3'-9" 3'-9" 3'-6"
23'-0"
24'
8'-4"
15'-0"
Plan - (Foundation)
1" = 4'-0"
sheeting
Concrete Slab
Wing Walls
12"x12" Tie Beam
Boards
3" T&G Sheeting
Sheeting 12' Long Driven Tight
All Piles 20' Long
Batter
Top of Earth Dam El 73
Bottom of Lake El 61
Bottom of Stream El 57
Section 1" = 4'-0"
El 73.5
El 74.5
El 69
El 66
El 61
El 57
El 54
18"x12" Tie Beam
12"x12" Tie Beam
Wing Wall
Maximum Elev of Water
6'-0" 18" 6'-0" 18" 6'-0" 12"
2" T.&G. Sheeting
Bottom of Lake
Top of Piles
12" Thick Con. Slab
20'
Elevation
Specifications & Notes
1- All piles to be cedar - 8" butt - 20' long
2- All sheeting 3" T.&G. 12' long
3- All concrete 2000 P.S.I. or better
4- All reinforcing steel to be placed & tied in conformity with A.C.I. & C.R.S.I. Codes
5- All concrete to be placed on clean, firm bearing soil
6- All fill to be thoroly compacted.
FILE
DAM APPLICATION No. 510
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
APPROVED JUL 29 1957
Acting Director and Chief Engineer
Revised June 22, 1953 Depth increased to 24'-0"
Plan of Concrete Gate & Spillway for - Dam No 3 -
Collings Lakes Inc.
Boro of Folsom
Atlantic County N.J.
June 22, 1933
1" = 4'-0"
Designed
Drawn & Surveyed by
C.E.

Cross-Section at Sta. 3+22 (Area of Concern) Cushman Lake

SKETCH NTS



NOTES:
(1) - TOPOGRAPHIC ELEVATIONS ESTIMATED FROM HISTORIC DRAWINGS PREPARED BY LIPPINCOTT AND JACOBS, WATER LEVELS PROVIDED BY HDH TRANS.
(2) - MODEL SHOWN NOT TO SCALE, FOR REPRESENTATIVE PURPOSES ONLY.

Pennoni Associates, Inc.

DRAWN BY:	SCALE:	DATE:
EGB	NTS	5-4-25
NOT CHECKED	FIGURE No.	
PROJECT No: CLCAX19001	CS-1	

Braddock and Cushman Lake Dams Rehabilitation - Borough of Folsom, Atlantic County, New Jersey

SECTION 1

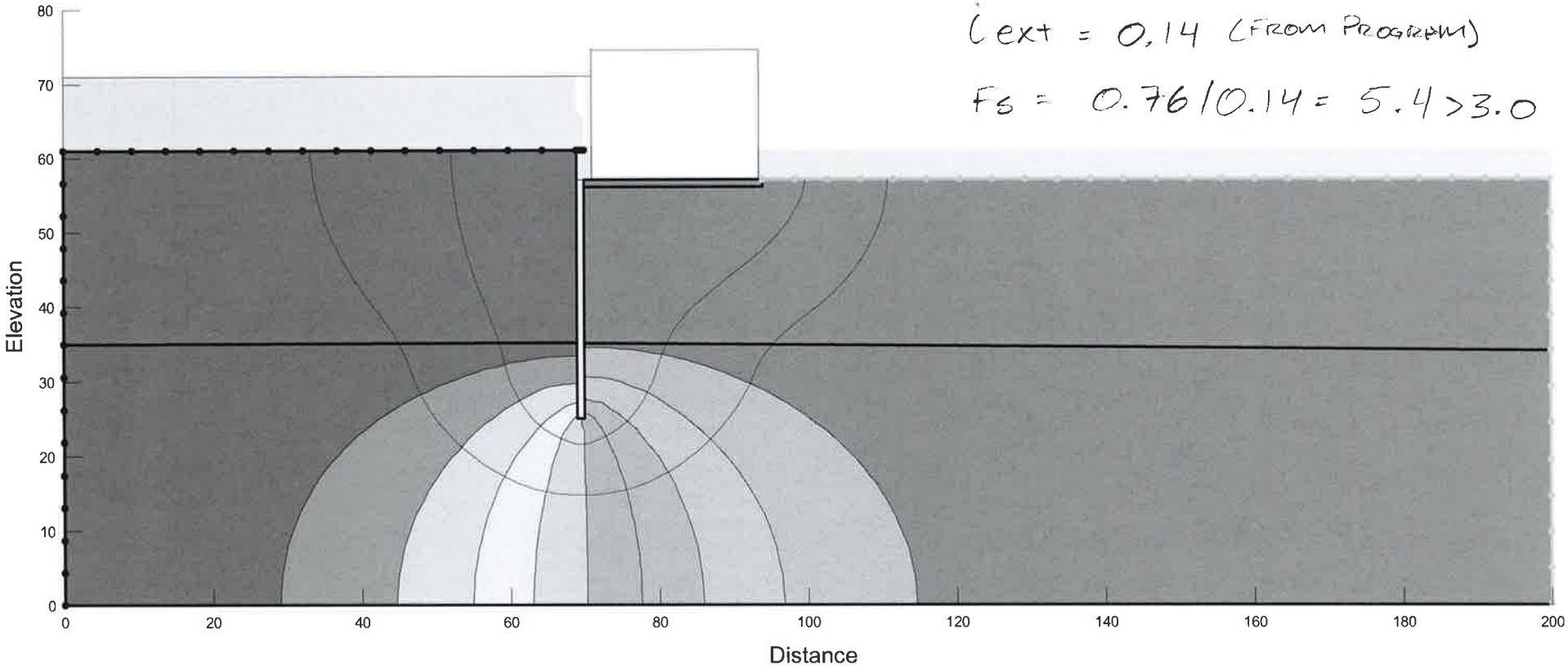
$F_S = \frac{i_{CR}}{i_{EXIT}}$ / $i_{CR} = \frac{\gamma'}{\gamma_w}$ / i_{EXIT} = SEEPW

EST. γ_{SAT} = 110 PCF LOOSE SAND

$i_{CR} = \frac{110_{PCF} - 62.4_{PCF}}{62.4_{PCF}} = 0.76$

i_{EXIT} = 0.14 (FROM PROGRAM)

F_S = 0.76/0.14 = 5.4 > 3.0



i_{EXIT} = 0.14

SECTION 2

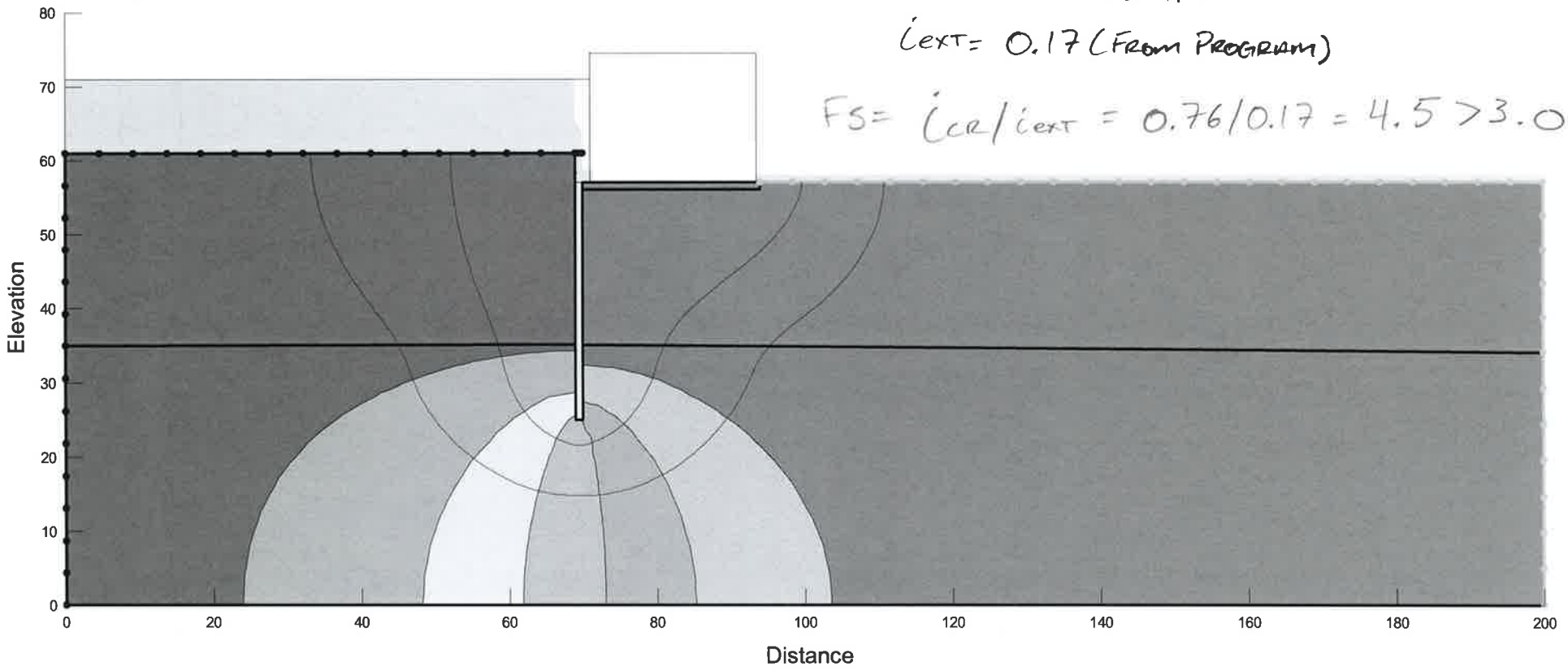
$$F_S = \frac{i_{CR}}{i_{EXT}} \quad / \quad i_{CR} = \frac{\gamma'}{\gamma_w} \quad / \quad i_{EXT} = \text{RESULT SEEP W}$$

EST $\gamma_{SAT} = 110 PCF$

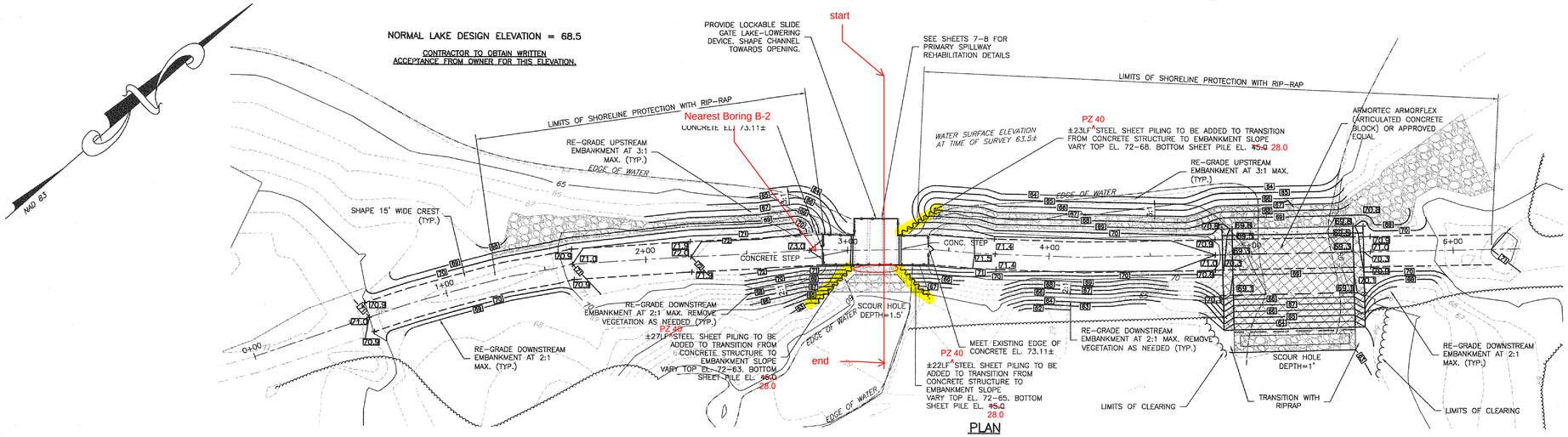
$$i_{CR} = \frac{110 PCF - 62.4 PCF}{62.4 PCF} = 0.76$$

$i_{EXT} = 0.17$ (FROM PROGRAM)

$F_S = i_{CR} / i_{EXT} = 0.76/0.17 = 4.5 > 3.0$

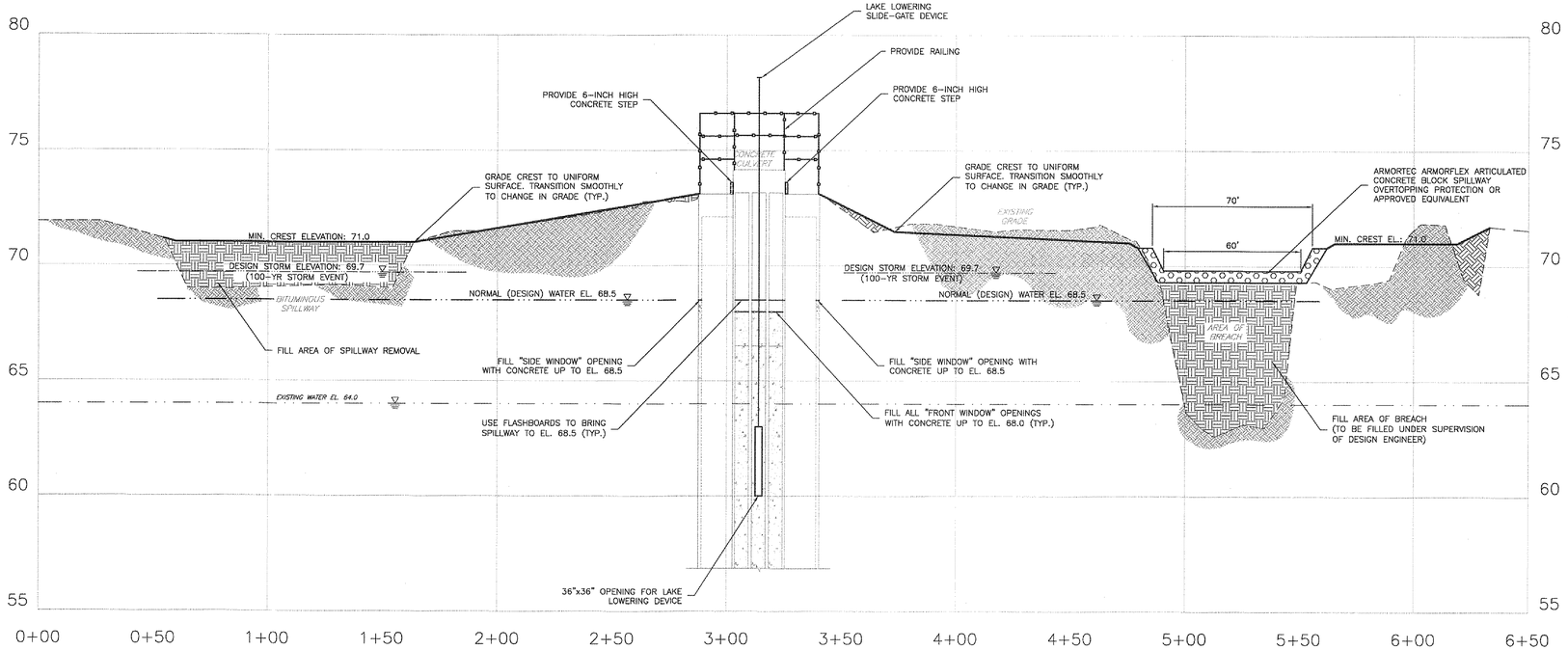


$i_{ext} = 0.17$



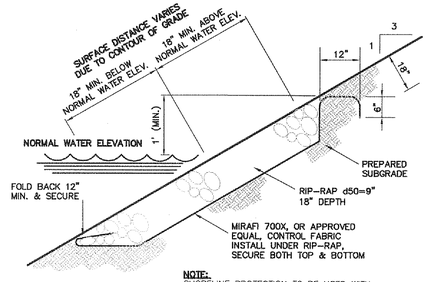
PLAN

1"=30'



EXISTING PROFILE ALONG BASELINE

SCALE:
HORIZONTAL 1"=30'
VERTICAL 1"=3'



NOTE:
SHORELINE PROTECTION TO BE USED WITH TOPSOIL & GRASS CONES OR VEGETATION MAT.

SHORELINE PROTECTION WITH RIP-RAP

N.T.S.

NOTE FOR EXCAVATION & BACKFILL

THE QUALITY & CONDITION OF SOILS IN THE 1) EMBANKMENT & 2) FOR FOUNDATIONS IS SUBJECT TO THE INSPECTION OF THE DESIGN ENGINEER & SHALL BE APPROVED BY THE ENGINEER BEFORE PROCEEDING WITH FILLING OPERATION. EXCAVATION FOR NEW STRUCTURE & EMBANKMENT RESTORATION SHALL BE CARRIED A MINIMUM OF ONE (1) FOOT BENEATH OR BEYOND THE EXISTING GRADE. WHERE ZONE THREE BACKFILLS ARE USED, THE MAXIMUM PASSING THE #200 SIEVE SHALL NOT EXCEED 20 PERCENT (20%). DENSITIES SHALL BE AS THOSE SPECIFIED ON DRAWING #7. A 50# SAMPLE OF BORROW SOURCE MATERIAL SHALL BE PROVIDED TO THE DESIGN ENGINEER FOR LABORATORY TESTING INCLUDING, GRADATION, HYDROMETER & DENSITY DETERMINATION. THE DESIGN ENGINEER WILL MAKE THE JUDGMENT AS TO ACCEPTABILITY OF BORROW MATERIAL. PAY LIMITS SHALL BE THE EXISTING GRADE LIMITS SHOWN ON THE DRAWINGS WHICH SHALL INCLUDE AN ALLOWANCE UP TO TWO (2) FEET OF EXCAVATION & BACKFILL BEYOND & BELOW THE EXISTING LIMITS SHOWN.

SITE NOTE:

1. THE PURPOSE OF THIS PROJECT IS TO SUPPLEMENT THE EXISTING SPILLWAY WITH IMPROVEMENTS & DOWNSTREAM OUTLET PROTECTION. THE EMBANKMENT & ROADWAY IS TO BE FILLED, RAISED, CONSTRUCTED & GRADED AS SHOWN. STEEL SHEET PILE WING WALLS ARE REQUIRED TO TRANSITION FROM THE CONCRETE STRUCTURE TO EMBANKMENT SLOPE.

CONSTRUCTION NOTES:

1. PRIOR TO INITIATING WORK, THE CONTRACTOR IS TO MEET WITH THE ENGINEER & OWNER TO FIRMLY ESTABLISH THE ELEVATION OF THE CONCRETE WEIR LUG ALONG THE UPSTREAM PORTION OF THE ARTICULATED CONCRETE BLOCK SPILLWAY.
2. TWO PERMANENT CONTROL MONUMENTS WILL BE SET BY THE ENGINEER, ONE AT EACH END OF THE EMBANKMENTS OUTSIDE THE AREA OF CONSTRUCTION DISTURBANCES. ANY LOSS OF THE CONSTRUCTION CONTROL MONUMENTATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
3. UPON REMOVAL OF ALL CONCRETE, ASPHALT & MISCELLANEOUS MATERIALS, THE ENGINEER WILL SAMPLE EXISTING SOIL SUBGRADE FOR GRADATION ANALYSIS AT A MINIMUM OF THREE (3) LOCATIONS. WHERE BORROW MATERIAL IS USED FOR BACKFILLING AND SUBGRADE PREPARATION, THE CONTRACTOR WILL SUBMIT A 50 POUND BULK SAMPLE TO THE ENGINEER FOR TESTING. SOIL SHALL BE A FINE TO COARSE SAND WITH LITTLE TO SOME SILTY CLAY RAGING FROM 10% TO 20%. FINAL DETERMINATION AS TO ACCEPTABILITY OF THE MATERIAL WILL BE MADE BY THE ENGINEER AFTER TESTING. BASED ON SOIL COMPOSITION, THE ENGINEER WILL MAKE A FINAL DETERMINATION OF THE GEOFABRIC DRAINAGE CHARACTERISTICS WHICH HAS BEEN SPECIFIED BASED UPON GENERAL EXPERIENCE.
4. THE CONTRACTOR SHALL USE THE GENERAL PLAN CONFIGURATION FOR THE ARTICULATED CONCRETE BLOCK LAYOUT. IT IS THE RESPONSIBILITY OF THE MANUFACTURER TO PROVIDE SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION, HOWEVER THE CONTRACTOR SHOULD EXPECT TO CUT & FIT BLOCK MATS TO THE ANGLES AND/OR SKEWED CONTOURS & FILL THE VOIDS WITH CONCRETE.

N.T.S.

GRAPHIC SCALE
1 inch = 30 feet

NOTE TO CONTRACTOR:

EARTHWORK PAY LIMIT LINES ARE THOSE SHOWN ON CROSS-SECTIONS. FILL (BORROW MATERIAL) REQUIRED SHOULD ALLOW FOR LOSS OF UNSUITABLE MATERIAL OF NO LESS THAN 12 INCHES FROM EXISTING GRADE. CONTRACTOR SHALL MAKE ALLOWANCE IN THE BID FOR EXCAVATION UP TO TWO FEET WITHIN THE PAY LIMIT OF ANY SECTION. BORINGS ARE AVAILABLE FOR INFORMATION ONLY AND NOT TO BE RELIED ON FOR QUANTITIES DETERMINATION.

CALL BEFORE YOU DIG
1-800-272-1000
It's THE LAW
NEW JERSEY ONE CALL Dig Safely.

CONTRACTOR TO CALL AT LEAST 72 HOURS PRIOR TO COMMENCEMENT OF EXCAVATION WORK.

PLANNING/ZONING BOARD APPLICATION NO. _____

CURRENT STATUS OF DRAWING SUBMISSION: B REVIEW PHASE

A. CONCEPTUAL REVIEW – ISSUED FOR DISCUSSION PURPOSES ONLY. NOT FOR CONSTRUCTION.
B. REGULATORY REVIEW – ISSUED FOR REVIEW AND APPROVAL PURPOSES ONLY. NOT FOR CONSTRUCTION.
C. CONSTRUCTION PURPOSES– ALL DIMENSIONS AND CONDITIONS MUST BE FIELD VERIFIED PRIOR TO PROCEEDING WITH CONSTRUCTION OF ANY IMPROVEMENTS SHOWN HEREON.
D. OTHER PURPOSE (SPECIFY & DATE):

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CHECK SITE CONDITIONS AND PLAN DIMENSIONS. ANY UNUSUAL CONDITIONS OR INCONSISTENCIES WHICH WOULD ALTER THE INTENT OF THE INFORMATION SHOWN ON THIS DRAWING SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE PROCEEDING. ALL SCALED FIGURES AND DIMENSIONS MUST BE SUBSTANTIATED.

NO	DATE	REVISION	DRN	CHK

DAM MODIFICATIONS PLAN AND PLAN

BLOCK 2518, LOT 101 & 1.01
LANDS SITUATE IN
BOROUGH OF FOLSOM
ATLANTIC COUNTY, NEW JERSEY
PREPARED FOR

CUSHMAN LAKE DAM (#31-98)

WEI NJ Cert. Of Authorization No. 24GA28165900 WAYPOINT ENTERPRISES, INCORPORATED T/A
Lippincott Jacobs
CONSULTING ENGINEERS
1 PAVILION AVENUE ■ RIVERSIDE NJ 08075 ■ P 856-461-1100 ■ F 856-461-3166 ■ WWW.LJCE.NET
CIVIL ■ SURVEY ■ STRUCTURAL ■ ENVIRONMENTAL ■ GEOTECHNICAL ■ QUALITY CONTROL ■ PROJECT MANAGEMENT

T. WAYNE LIPPINCOTT
PROFESSIONAL ENGINEER
N.J. LICENSE No. 16247

DRAWN BY:	WTS
CHECK BY:	IWL
SCALE:	AS NOTED
DATE:	02/12/13
JOB NO.	14991
SHEET NO.	3 OF 14

CAD File No: Z:\14000\14991 Cushmon Lake Dam (Collings Lakes Civic Assoc)\CAD\DWG\14991 Plans.dwg - 3-Site Plan and Profile Plotted By: Kathy Orc

Log of Test Boring — B-1

Lippincott & Jacobs Consulting Engineers
One Pavilion Avenue, Riverside, NJ 08075

Project No. 14991 — Date: 8-1-2012 — Plate No. 1 of 6 — Boring No. B-1 — Sheet 1 of 1
Project: Cushman Lake Dam — Client: Collings Lake Civic Association — Surface Elev. 69.0
Location: Folsom, NJ
Drill Method: Hollow Stem Auger ID 3.25" — Casing ID
Grouted ☐ Date
Groundwater Data: Depth 7' — Date 8-1-12 — Time End of Boring

Sample Number	Blow Count (Blows per 6 inches)	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
S-1	2-2-2	Asphalt 3" Brown Medium to Fine SAND, Trace to Little Silt, Trace of Gravel			
S-2	2-2-2-2	Brown Fine SAND, Trace of Silt			
S-3	2-2-3-3				
S-4	2-1-2-2				
S-5	1-1-1-1				
S-6	2-2-2-8				
S-7	6-7-8-8				
S-8	10-10-11-14	Brown Fine SAND, Trace of Silt, Occasional Gravel			
S-9	9-8-10-11	Brown Medium to Fine SAND, Trace of Silt, Trace of Gravel			
		End of Boring at 25'			

Inspector ______ Driller E. Blemmings Helper M. Schick Equipment CME-55

Log of Test Boring — B-2

Lippincott & Jacobs Consulting Engineers
One Pavilion Avenue, Riverside, NJ 08075

Project No. 14991 — Date: 8-1-2012 — Plate No. 2 of 6 — Boring No. B-2 — Sheet 1 of 1
Project: Cushman Lake Dam — Client: Collings Lake Civic Association — Surface Elev. 72.8
Location: Folsom, NJ
Drill Method: Hollow Stem Auger ID 3.25" — Casing ID
Grouted ☐ Date
Groundwater Data: Depth 12' — Date 8-1-12 — Time End of Boring

Sample Number	Blow Count (Blows per 6 inches)	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
S-1	30-6-6-4	Fill: Brown Medium to Fine SAND, Trace to Little Concrete Fragments, Trace of Silt			
S-2	2-2-1-1	Brown Medium to Fine SAND, Trace to Little Silt, Trace of Gravel			
S-3	2-2-2-2	Yellowish brown coarse-fine SAND, little Silt		4.5	
S-4	1-1-1-1				
S-5	2-3-4-2	Brown Medium to Fine SAND, Trace to Little Silt, Trace to Little Ironstone Fragments			
S-6	2-2-2-2	Brown Medium to Fine SAND, Trace to Little Silt, Trace of Gravel			
S-7	2-2-2-2				
S-8	3-4-7-8	Yellowish brown coarse to Fine SAND, Trace of Silt, Trace of Gravel		14.2	
S-9	5-4-7-8	Brown Medium to Fine SAND, Trace of Silt, Trace of Gravel			
		End of Boring at 25'			

Inspector ______ Driller E. Blemmings Helper M. Schick Equipment CME-55

Log of Test Boring — B-3

Lippincott & Jacobs Consulting Engineers
One Pavilion Avenue, Riverside, NJ 08075

Project No. 14991 — Date: 8-1-2012 — Plate No. 3 of 6 — Boring No. B-3 — Sheet 1 of 1
Project: Cushman Lake Dam — Client: Collings Lake Civic Association — Surface Elev. 71.0
Location: Folsom, NJ
Drill Method: Hollow Stem Auger ID 3.25" — Casing ID
Grouted ☐ Date
Groundwater Data: Depth 8' — Date 8-1-12 — Time End of Boring

Sample Number	Blow Count (Blows per 6 inches)	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
S-1	5-11-4-3	Brown Medium to Fine SAND, Trace of Gravel, Trace of Silt			
S-2	3-3-3-2	Yellowish brown coarse-fine SAND, little Silt, trace fine Gravel		4.4	
S-3	2-2-2-2				
S-4	2-2-2-3	Yellowish brown coarse to Fine SAND, Little Silt, Trace of Gravel		10.3	
S-5	1-1-1-1	Gray Medium to Fine SAND, Trace of Silt			
S-6	2-2-2-2	Dark Gray Organic CLAYEY SILT, Trace of Fine Sand, Trace of Decomposed Vegetation			
S-7	2-4-5-5	Grey Medium to Fine SAND, Trace of Silt			
S-8	8-10-13-25	Brown Medium to Fine SAND, Trace of Silt, Trace of Gravel			
S-9	8-9-12-13				
		End of Boring at 25'			

Inspector ______ Driller E. Blemmings Helper M. Schick Equipment CME-55

Log of Test Boring — B-4

Lippincott & Jacobs Consulting Engineers
One Pavilion Avenue, Riverside, NJ 08075

Project No. 14991 — Date: 8-1-2012 — Plate No. 4 of 6 — Boring No. B-4 — Sheet 1 of 1
Project: Cushman Lake Dam — Client: Collings Lake Civic Association — Surface Elev. 71.5
Location: Folsom, NJ
Drill Method: Hollow Stem Auger ID 3.25" — Casing ID
Grouted ☐ Date
Groundwater Data: Depth 9' — Date 8-1-12 — Time End of Boring

Sample Number	Blow Count (Blows per 6 inches)	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
S-1	3-3-7-18	Brown Medium to Fine SAND, Trace of Silt			
S-2	11-13-18-10	Brown Medium to Fine SAND, Trace of Silt, Trace of Gravel			
S-3	11-4-3-3	Brown or Gray Fine SAND, Trace of Silt			
S-4	2-2-2-2				
S-5	3-3-4-3	Brown Medium to Fine SAND, Trace of Silt			
S-6	3-3-3-7				
S-7	6-8-15-16	Brown Medium to Fine SAND, Trace of Silt, Trace of Gravel			
S-8	6-8-7-11	Gray Medium to Fine SAND, Trace of Silt, Some Gravel			
S-9	8-10-11-9	Brown Medium to Fine SAND, Trace of Silt, Some Gravel			
		End of Boring at 25'			

Inspector ______ Driller E. Blemmings Helper M. Schick Equipment CME-55

Log of Test Boring — B-5

Lippincott & Jacobs Consulting Engineers
One Pavilion Avenue, Riverside, NJ 08075

Project No. 14991 — Date: 8-1-2012 — Plate No. 5 of 6 — Boring No. B-5 — Sheet 1 of 1
Project: Cushman Lake Dam — Client: Collings Lake Civic Association — Surface Elev. 67.0
Location: Folsom, NJ
Drill Method: Hollow Stem Auger ID 3.25" — Casing ID
Grouted ☐ Date
Groundwater Data: Depth 6' — Date 8-1-12 — Time End of Boring

Sample Number	Blow Count (Blows per 6 inches)	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
S-1	2-2-2-2	Gray Fine SAND, Trace of Silt, Occasional Roots			
S-2	4-4-3-4	Brown or Gray Fine SAND, Trace of Silt			
S-3	3-2-2-3	Brown Medium to Fine SAND, Trace of Silt			
S-4	4-5-9-10				
S-5	7-8-10-14	Gray Medium to Fine SAND, Trace of Silt, Trace of Gravel			
		End of Boring at 10'			

Inspector ______ Driller E. Blemmings Helper M. Schick Equipment CME-55

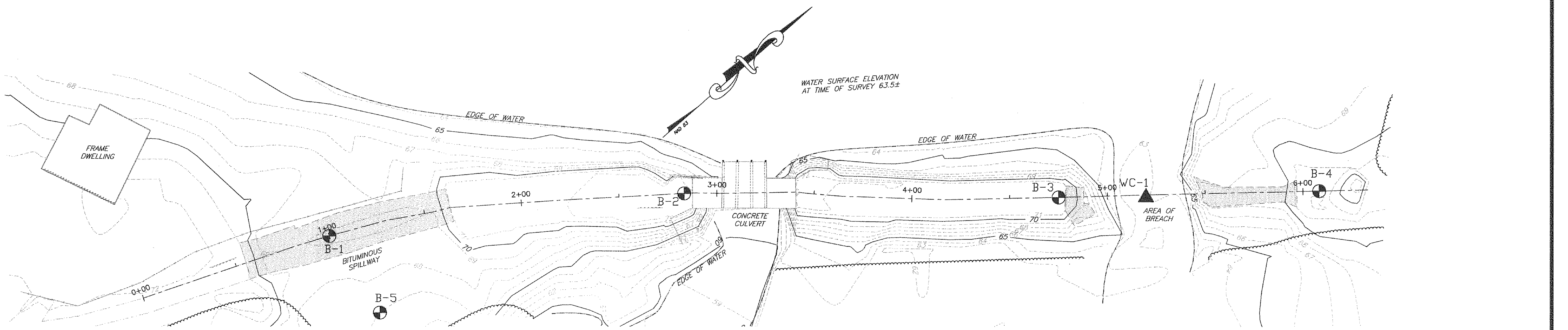
Log of Test Boring — WC-1

Lippincott & Jacobs Consulting Engineers
One Pavilion Avenue, Riverside, NJ 08075

Project No. 14991 — Date: 8-1-2012 — Plate No. 6 of 6 — Boring No. WC-1 — Sheet 1 of 1
Project: Cushman Lake Dam — Client: Collings Lake Civic Association — Surface Elev. 63.0
Location: Folsom, NJ
Drill Method: Hollow Stem Auger ID — Casing ID 4"
Grouted ☐ Date
Groundwater Data: Depth None — Date 8-1-2012 — Time End of Boring

Sample Number	Blow Count (Blows per 6 inches)	Classification of Materials (Based upon samples recovered and observation of materials returned between samples)	Stratum	Moisture Content, %	Other Tests
S-1	Hand Auger	Brown or Gray Medium to Fine SAND, Trace of Silt, Occasional Gravel			
S-2	Hand Auger				
S-3	Hand Auger				
S-4	Hand Auger				
S-5	Hand Auger				
S-6	Hand Auger				
S-7	Hand Auger				
S-8	Hand Auger				
S-9	Hand Auger				
S-10	Hand Auger				
		End of Boring at 10'			

Inspector ______ Driller E. Blemmings Helper M. Schick Equipment CME-55



GENERAL NOTES:

1. CONSTRUCTION MATERIALS, METHODS & WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE LATEST NJDOT STANDARD SPECIFICATIONS. NOT INCLUDING METHOD OF PRICING AND PAYMENT.
2. THESE DRAWINGS WERE PREPARED FOR PERMITTING PURPOSES ONLY. ADDITIONAL PLANS MAY BE REQUIRED FOR CONSTRUCTION.
3. ALL QUESTIONS REGARDING THE APPLICABILITY OF DESIGN OR DESIGN DETAILS SHALL BE IN WRITING (R.F.I.) PRIOR TO CONSTRUCTION.

CAD File No. Z:\14000\14991 Cushman Lake Dam (Collings Lakes Civic Assoc)\CAD\DWG\14991 Plans.dwg -- 14-Logs Plotted By: Kelly On: 2/12/2013

CALL BEFORE YOU DIG
1-800-272-1000
It's THE LAW
NEW JERSEY ONE CALL Dig Safely.

CONTRACTOR TO CALL AT LEAST 72 HOURS PRIOR TO COMMENCEMENT OF EXCAVATION WORK.

PLANNING/ZONING BOARD APPLICATION NO.______

CURRENT STATUS OF DRAWING SUBMISSION — B — REVIEW PHASE

A. CONCEPTUAL REVIEW – ISSUED FOR DISCUSSION PURPOSES ONLY. NOT FOR CONSTRUCTION.
B. REGULATORY REVIEW – ISSUED FOR REVIEW AND APPROVAL PURPOSES ONLY. NOT FOR CONSTRUCTION.
C. CONSTRUCTION PURPOSES– ALL DIMENSIONS AND CONDITIONS MUST BE FIELD VERIFIED PRIOR TO PROCEEDING WITH CONSTRUCTION OF ANY IMPROVEMENTS SHOWN HEREON.
D. OTHER PURPOSE (SPECIFY & DATE):

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CHECK SITE CONDITIONS AND PLAN DIMENSIONS. ANY UNUSUAL CONDITIONS OR INCONSISTENCIES WHICH WOULD ALTER THE INTENT OF THE INFORMATION SHOWN ON THIS DRAWING SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE PROCEEDING. ALL SCALED FIGURES AND DIMENSIONS MUST BE SUBSTANTIATED.

NO	DATE	REVISION	DRN	CHK

SOIL BORING LOGS

BLOCK 2518, LOT 101 & 1.01
LANDS SITUATE IN
BOROUGH OF FOLSOM
ATLANTIC COUNTY, NEW JERSEY
PREPARED FOR
CUSHMAN LAKE DAM (#31–98)

WEI NJ Cert. Of Authorization No. 24GA28165900 WAYPOINT ENTERPRISES, INCORPORATED T/A
Lippincott Jacobs CONSULTING ENGINEERS
1 PAVILION AVENUE ■ RIVERSIDE NJ 08075 ■ P 856-461-1100 ■ F 856-461-3166 ■ WWW.LJCE.NET
CIVIL ■ SURVEY ■ STRUCTURAL ■ ENVIRONMENTAL ■ GEOTECHNICAL ■ QUALITY CONTROL ■ PROJECT MANAGEMENT

I. WAYNE LIPPINCOTT
PROFESSIONAL ENGINEER
N.J. LICENSE No. 16247

DRAWN BY:	WTS
CHECK BY:	IWL
SCALE:	AS NOTED
DATE:	02/12/13
JOB NO.	14991
SHEET NO.	14 OF 14

Pennoni

Project: **Cushman Lake Dam Modifications**
Subject: **Cutoff Wall Sheet Piling Design**

Job No: **CLCAX19001**
Designed By: **RT** Date: **5/14/25**
Checked By: Date:

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
  DATE: 14-MAY-2025                                          TIME: 16:23:40

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

       I.--HEADING
      'CUSHMAN DAM
      'CUTOFF WALL SHEET PILING DESIGN
      'CASE 1: CONSTRUCTED CONDITION
      'PENETRATION DESIGN RUN

      II.--CONTROL
         CANTILEVER WALL DESIGN
         FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.00
         FACTOR OF SAFETY FOR PASSIVE PRESSURES = 2.00

     III.--WALL DATA
         ELEVATION AT TOP OF WALL    = 59.00 FT.

      IV.--SURFACE POINT DATA

           IV.A.--RIGHTSIDE
              DIST. FROM     ELEVATION
              WALL (FT)         (FT)
                   0.00         59.00

           IV.B.--LEFTSIDE
              DIST. FROM     ELEVATION
              WALL (FT)         (FT)
                   0.00         56.00

       V.--SOIL LAYER DATA

          V.A.--RIGHTSIDE
              LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
              LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                 ANGLE OF         ANGLE OF                          <-SAFETY->
   SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
  WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
  (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
 110.00  106.00    28.00    0.00    14.00    0.00                   DEF  DEF

          V.B.--LEFTSIDE
              LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
              LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                 ANGLE OF         ANGLE OF                          <-SAFETY->
   SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
  WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
  (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
 110.00  106.00    28.00    0.00    14.00    0.00                   DEF  DEF

      VI.--WATER DATA
         UNIT WEIGHT          = 62.40 (PCF)
         RIGHTSIDE ELEVATION = 68.50 (FT)
         LEFTSIDE ELEVATION  = 68.50 (FT)
         NO SEEPAGE

     VII.--VERTICAL SURCHARGE LOADS
         NONE

    VIII.--HORIZONTAL LOADS
         NONE
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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
DATE: 14-MAY-2025                                            TIME: 16:24:11

                               ***************************
                               *   SOIL PRESSURES FOR    *
                               * CANTILEVER WALL DESIGN  *
                               ***************************

    I.--HEADING
     'CUSHMAN DAM
     'CUTOFF WALL SHEET PILING DESIGN
     'CASE 1: CONSTRUCTED CONDITION
     'PENETRATION DESIGN RUN

   II.--SOIL PRESSURES

        RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
        AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

        LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
        AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

                                                <------NET------>
         NET     <---LEFTSIDE--->     (SOIL + WATER)     <--RIGHTSIDE--->
ELEV.    WATER   PASSIVE    ACTIVE     ACTIVE   PASSIVE    ACTIVE   PASSIVE
(FT)     (PSF)     (PSF)     (PSF)      (PSF)     (PSF)     (PSF)     (PSF)
 59.0      0.0       0.0       0.0        0.0       0.0       0.0       0.0
 58.0      0.0       0.0       0.0       15.1     199.8      15.1     199.8
 57.0      0.0       0.0       0.0       30.1     399.5      30.1     399.5
 56.0      0.0       0.0       0.0       45.2     599.3      45.2     599.3
 55.8      0.0      48.9       3.7        0.0     644.5      48.9     648.2
 55.0      0.0     199.8      15.1     -139.5     784.0      60.3     799.0
 54.0      0.0     399.5      30.1     -324.2     968.7      75.4     998.8
 53.0      0.0     599.3      45.2     -508.8    1153.3      90.4    1198.6
 52.0      0.0     799.0      60.3     -693.5    1338.0     105.5    1398.3
 51.0      0.0     998.8      75.4     -878.2    1522.7     120.6    1598.1
 50.0      0.0    1198.6      90.4    -1062.9    1707.4     135.7    1797.9
 49.0      0.0    1398.3     105.5    -1247.6    1892.1     150.7    1997.6
 48.0      0.0    1598.1     120.6    -1432.3    2076.8     165.8    2197.4
 47.0      0.0    1797.9     135.7    -1617.0    2261.5     180.9    2397.1
 46.0      0.0    1997.6     150.7    -1801.6    2446.2     196.0    2596.9
 45.0      0.0    2197.4     165.8    -1986.3    2630.8     211.0    2796.7
 44.0      0.0    2397.1     180.9    -2171.0    2815.5     226.1    2996.4
 43.0      0.0    2596.9     196.0    -2355.7    3000.2     241.2    3196.2
```

42.0	0.0	2796.7	211.0	-2540.4	3184.9	256.3	3395.9
41.0	0.0	2996.4	226.1	-2725.1	3369.6	271.3	3595.7
40.0	0.0	3196.2	241.2	-2909.8	3554.3	286.4	3795.5
39.0	0.0	3395.9	256.3	-3094.5	3739.0	301.5	3995.2
38.0	0.0	3595.7	271.3	-3279.1	3923.6	316.6	4195.0
37.0	0.0	3795.5	286.4	-3463.8	4108.3	331.6	4394.7
36.0	0.0	3995.2	301.5	-3648.5	4293.0	346.7	4594.5
35.0	0.0	4195.0	316.6	-3833.2	4477.7	361.8	4794.3
34.0	0.0	4394.7	331.6	-4017.9	4662.4	376.9	4994.0
33.0	0.0	4594.5	346.7	-4202.6	4847.1	391.9	5193.8
32.0	0.0	4794.3	361.8	-4387.3	5031.8	407.0	5393.6
31.0	0.0	4994.0	376.9	-4572.0	5216.5	422.1	5593.3
30.0	0.0	5193.8	391.9	-4756.6	5401.1	437.2	5793.1
29.0	0.0	5393.6	407.0	-4941.3	5585.8	452.2	5992.8
28.0	0.0	5593.3	422.1	-5126.0	5770.5	467.3	6192.6
27.0	0.0	5793.1	437.2	-5310.7	5955.2	482.4	6392.4
26.0	0.0	5992.8	452.2	-5495.4	6139.9	497.4	6592.1
25.0	0.0	6192.6	467.3	-5680.1	6324.6	512.5	6791.9

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:24:13

****
* SUMMARY OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 1: CONSTRUCTED CONDITION
'PENETRATION DESIGN RUN

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

WALL BOTTOM ELEV. (FT) : 53.62 (Seepage El. 25 is controlled)
PENETRATION (FT) : 2.38

MAX. BEND. MOMENT (LB-FT) : 1.2895E+02
AT ELEVATION (FT) : 54.86

MAX. SCALED DEFL. (LB-IN^3): 1.7137E+06
AT ELEVATION (FT) : 59.00

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:24:13

****
* COMPLETE OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 1: CONSTRUCTED CONDITION
'PENETRATION DESIGN RUN

II.--RESULTSO. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
59.00	0.0000E+00	0.	1.7137E+06	0.00
58.00	2.5124E+00	8.	1.2542E+06	15.07
57.00	2.0099E+01	30.	8.0112E+05	30.15
56.00	6.7834E+01	68.	3.8714E+05	45.22
55.76	8.5347E+01	73.	2.9990E+05	0.00
55.00	1.2750E+02	21.	9.4016E+04	-139.46
54.11	6.8451E+01	-177.	2.9010E+03	-304.41
54.00	4.8300E+01	-194.	1.1225E+03	-7.65
53.62	0.0000E+00	0.	0.0000E+00	1038.25

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION (FT)	PRESSURE (PSF)	PASSIVE (PSF)	ACTIVE (PSF)	ACTIVE (PSF)	PASSIVE (PSF)
59.00	0.	0.	0.	0.	0.
58.00	0.	0.	0.	15.	200.
57.00	0.	0.	0.	30.	400.
56.00	0.	0.	0.	45.	599.
55.76	0.	49.	4.	49.	648.
55.00	0.	200.	15.	60.	799.
54.11	0.	378.	29.	74.	977.
54.00	0.	400.	30.	75.	999.
53.62	0.	599.	45.	90.	1199.
52.00	0.	799.	60.	106.	1398.

Pennoni

Project: **Cushman Lake Dam Modifications**
Subject: **Cutoff Wall Sheet Piling Design**

Job No: **CLCAX19001**
Designed By: **RT** Date: **5/14/25**
Checked By: Date:

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
  DATE: 14-MAY-2025                                          TIME: 16:30:57

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

       I.--HEADING
      'CUSHMAN DAM
      'CUTOFF WALL SHEET PILING DESIGN
      'CASE 1: CONSTRUCTED CONDITION
      'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

      II.--CONTROL
         CANTILEVER WALL DESIGN
         FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.00
         FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

     III.--WALL DATA
         ELEVATION AT TOP OF WALL    = 59.00 FT.

      IV.--SURFACE POINT DATA

           IV.A.--RIGHTSIDE
              DIST. FROM     ELEVATION
              WALL (FT)         (FT)
                   0.00         59.00

           IV.B.--LEFTSIDE
              DIST. FROM     ELEVATION
              WALL (FT)         (FT)
                   0.00         56.00

       V.--SOIL LAYER DATA

          V.A.--RIGHTSIDE
              LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
              LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                 ANGLE OF          ANGLE OF                          <-SAFETY->
   SAT.   MOIST  INTERNAL  COH-      WALL     ADH-    <--BOTTOM-->  <-FACTOR->
  WGHT.   WGHT.  FRICTION  ESION   FRICTION  ESION    ELEV.  SLOPE  ACT. PASS.
  (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)    (FT)  (FT/FT)
 110.00  106.00    28.00    0.00    14.00    0.00                     DEF  DEF

          V.B.--LEFTSIDE
              LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
              LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                 ANGLE OF          ANGLE OF                          <-SAFETY->
   SAT.   MOIST  INTERNAL  COH-      WALL     ADH-    <--BOTTOM-->  <-FACTOR->
  WGHT.   WGHT.  FRICTION  ESION   FRICTION  ESION    ELEV.  SLOPE  ACT. PASS.
  (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)    (FT)  (FT/FT)
 110.00  106.00    28.00    0.00    14.00    0.00                     DEF  DEF

      VI.--WATER DATA
         UNIT WEIGHT          = 62.40 (PCF)
         RIGHTSIDE ELEVATION = 68.50 (FT)
         LEFTSIDE ELEVATION  = 68.50 (FT)
         NO SEEPAGE

     VII.--VERTICAL SURCHARGE LOADS
         NONE

    VIII.--HORIZONTAL LOADS
         NONE
```

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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
DATE: 14-MAY-2025                                            TIME: 16:31:13

                               ***************************
                               *   SOIL PRESSURES FOR    *
                               * CANTILEVER WALL DESIGN  *
                               ***************************

    I.--HEADING
     'CUSHMAN DAM
     'CUTOFF WALL SHEET PILING DESIGN
     'CASE 1: CONSTRUCTED CONDITION
     'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

   II.--SOIL PRESSURES

        RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
        AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

        LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
        AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

                                                <------NET------>
          NET     <---LEFTSIDE--->     (SOIL + WATER)     <--RIGHTSIDE--->
ELEV.    WATER    PASSIVE    ACTIVE     ACTIVE    PASSIVE    ACTIVE    PASSIVE
(FT)     (PSF)     (PSF)     (PSF)      (PSF)     (PSF)     (PSF)     (PSF)
 59.0      0.0       0.0       0.0        0.0       0.0       0.0       0.0
 58.0      0.0       0.0       0.0       15.1     199.8      15.1     199.8
 57.0      0.0       0.0       0.0       30.1     399.5      30.1     399.5
 56.0      0.0       0.0       0.0       45.2     599.3      45.2     599.3
 55.8      0.0      48.9       3.7        0.0     644.5      48.9     648.2
 55.0      0.0     199.8      15.1     -139.5     784.0      60.3     799.0
 54.0      0.0     399.5      30.1     -324.2     968.7      75.4     998.8
 53.0      0.0     599.3      45.2     -508.8    1153.3      90.4    1198.6
 52.0      0.0     799.0      60.3     -693.5    1338.0     105.5    1398.3
 51.0      0.0     998.8      75.4     -878.2    1522.7     120.6    1598.1
 50.0      0.0    1198.6      90.4    -1062.9    1707.4     135.7    1797.9
 49.0      0.0    1398.3     105.5    -1247.6    1892.1     150.7    1997.6
 48.0      0.0    1598.1     120.6    -1432.3    2076.8     165.8    2197.4
 47.0      0.0    1797.9     135.7    -1617.0    2261.5     180.9    2397.1
 46.0      0.0    1997.6     150.7    -1801.6    2446.2     196.0    2596.9
 45.0      0.0    2197.4     165.8    -1986.3    2630.8     211.0    2796.7
 44.0      0.0    2397.1     180.9    -2171.0    2815.5     226.1    2996.4
 43.0      0.0    2596.9     196.0    -2355.7    3000.2     241.2    3196.2
```

42.0	0.0	2796.7	211.0	-2540.4	3184.9	256.3	3395.9
41.0	0.0	2996.4	226.1	-2725.1	3369.6	271.3	3595.7
40.0	0.0	3196.2	241.2	-2909.8	3554.3	286.4	3795.5
39.0	0.0	3395.9	256.3	-3094.5	3739.0	301.5	3995.2
38.0	0.0	3595.7	271.3	-3279.1	3923.6	316.6	4195.0
37.0	0.0	3795.5	286.4	-3463.8	4108.3	331.6	4394.7
36.0	0.0	3995.2	301.5	-3648.5	4293.0	346.7	4594.5
35.0	0.0	4195.0	316.6	-3833.2	4477.7	361.8	4794.3
34.0	0.0	4394.7	331.6	-4017.9	4662.4	376.9	4994.0
33.0	0.0	4594.5	346.7	-4202.6	4847.1	391.9	5193.8
32.0	0.0	4794.3	361.8	-4387.3	5031.8	407.0	5393.6
31.0	0.0	4994.0	376.9	-4572.0	5216.5	422.1	5593.3
30.0	0.0	5193.8	391.9	-4756.6	5401.1	437.2	5793.1
29.0	0.0	5393.6	407.0	-4941.3	5585.8	452.2	5992.8
28.0	0.0	5593.3	422.1	-5126.0	5770.5	467.3	6192.6
27.0	0.0	5793.1	437.2	-5310.7	5955.2	482.4	6392.4
26.0	0.0	5992.8	452.2	-5495.4	6139.9	497.4	6592.1
25.0	0.0	6192.6	467.3	-5680.1	6324.6	512.5	6791.9

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:31:15

****
* SUMMARY OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 1: CONSTRUCTED CONDITION
'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

WALL BOTTOM ELEV. (FT) : 53.62 (Seepage El. 25 is controlled)
PENETRATION (FT) : 2.38

MAX. BEND. MOMENT (LB-FT) : 1.2895E+02
AT ELEVATION (FT) : 54.86

MAX. SCALED DEFL. (LB-IN^3): 1.7137E+06
AT ELEVATION (FT) : 59.00

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:31:15

****
* COMPLETE OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 1: CONSTRUCTED CONDITION
'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

II.--RESULTSO. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
59.00	0.0000E+00	0.	1.7137E+06	0.00
58.00	2.5124E+00	8.	1.2542E+06	15.07
57.00	2.0099E+01	30.	8.0112E+05	30.15
56.00	6.7834E+01	68.	3.8714E+05	45.22
55.76	8.5347E+01	73.	2.9990E+05	0.00
55.00	1.2750E+02	21.	9.4016E+04	-139.46
54.11	6.8451E+01	-177.	2.9010E+03	-304.41
54.00	4.8300E+01	-194.	1.1225E+03	-7.65
53.62	0.0000E+00	0.	0.0000E+00	1038.25

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION (FT)	PRESSURE (PSF)	PASSIVE (PSF)	ACTIVE (PSF)	ACTIVE (PSF)	PASSIVE (PSF)
59.00	0.	0.	0.	0.	0.
58.00	0.	0.	0.	15.	200.
57.00	0.	0.	0.	30.	400.
56.00	0.	0.	0.	45.	599.
55.76	0.	49.	4.	49.	648.
55.00	0.	200.	15.	60.	799.
54.11	0.	378.	29.	74.	977.
54.00	0.	400.	30.	75.	999.
53.62	0.	599.	45.	90.	1199.
52.00	0.	799.	60.	106.	1398.

Pennoni

Project: **Cushman Lake Dam Modifications**
Subject: **Cutoff Wall Sheet Piling Design**

Job No: **CLCAX19001**
Designed By: **RT** Date: **5/14/25**
Checked By: Date:

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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
  DATE: 14-MAY-2025                                          TIME: 16:18:55

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

       I.--HEADING
      'CUSHMAN DAM
      'CUTOFF WALL SHEET PILING DESIGN
      'CASE 2: FLOOD CONDITION
      'PENETRATION DESIGN RUN

      II.--CONTROL
         CANTILEVER WALL DESIGN
         FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.00
         FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.75

     III.--WALL DATA
         ELEVATION AT TOP OF WALL    = 59.00 FT.

      IV.--SURFACE POINT DATA

           IV.A.--RIGHTSIDE
              DIST. FROM     ELEVATION
              WALL (FT)         (FT)
                   0.00         59.00

           IV.B.--LEFTSIDE
              DIST. FROM     ELEVATION
              WALL (FT)         (FT)
                   0.00         56.00

       V.--SOIL LAYER DATA

          V.A.--RIGHTSIDE
              LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
              LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                 ANGLE OF          ANGLE OF                            <-SAFETY->
   SAT.   MOIST  INTERNAL  COH-      WALL     ADH-     <--BOTTOM-->  <-FACTOR->
  WGHT.   WGHT.  FRICTION  ESION   FRICTION  ESION    ELEV.  SLOPE  ACT. PASS.
  (PCF)   (PCF)    (DEG)   (PSF)     (DEG)   (PSF)    (FT)  (FT/FT)
 110.00  106.00    28.00    0.00     14.00    0.00                    DEF  DEF

          V.B.--LEFTSIDE
              LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
              LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                 ANGLE OF          ANGLE OF                            <-SAFETY->
   SAT.   MOIST  INTERNAL  COH-      WALL     ADH-     <--BOTTOM-->  <-FACTOR->
  WGHT.   WGHT.  FRICTION  ESION   FRICTION  ESION    ELEV.  SLOPE  ACT. PASS.
  (PCF)   (PCF)    (DEG)   (PSF)     (DEG)   (PSF)    (FT)  (FT/FT)
 110.00  106.00    28.00    0.00     14.00    0.00                    DEF  DEF

      VI.--WATER DATA
         UNIT WEIGHT          = 62.40 (PCF)
         RIGHTSIDE ELEVATION = 68.50 (FT)
         LEFTSIDE ELEVATION  = 68.50 (FT)
         NO SEEPAGE

     VII.--VERTICAL SURCHARGE LOADS
         NONE

    VIII.--HORIZONTAL LOADS
         NONE
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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
DATE: 14-MAY-2025                                            TIME: 16:19:26

                               ***************************
                               *   SOIL PRESSURES FOR    *
                               * CANTILEVER WALL DESIGN  *
                               ***************************

    I.--HEADING
     'CUSHMAN DAM
     'CUTOFF WALL SHEET PILING DESIGN
     'CASE 2: FLOOD CONDITION
     'PENETRATION DESIGN RUN

   II.--SOIL PRESSURES

        RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
        AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

        LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
        AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

                                                <------NET------>
         NET     <---LEFTSIDE--->     (SOIL + WATER)     <--RIGHTSIDE--->
ELEV.    WATER   PASSIVE    ACTIVE     ACTIVE   PASSIVE    ACTIVE   PASSIVE
(FT)     (PSF)     (PSF)     (PSF)      (PSF)     (PSF)     (PSF)     (PSF)
 59.0      0.0       0.0       0.0        0.0       0.0       0.0       0.0
 58.0      0.0       0.0       0.0       15.1     199.8      15.1     199.8
 57.0      0.0       0.0       0.0       30.1     399.5      30.1     399.5
 56.0      0.0       0.0       0.0       45.2     599.3      45.2     599.3
 55.8      0.0      48.9       3.7        0.0     644.5      48.9     648.2
 55.0      0.0     199.8      15.1     -139.5     784.0      60.3     799.0
 54.0      0.0     399.5      30.1     -324.2     968.7      75.4     998.8
 53.0      0.0     599.3      45.2     -508.8    1153.3      90.4    1198.6
 52.0      0.0     799.0      60.3     -693.5    1338.0     105.5    1398.3
 51.0      0.0     998.8      75.4     -878.2    1522.7     120.6    1598.1
 50.0      0.0    1198.6      90.4    -1062.9    1707.4     135.7    1797.9
 49.0      0.0    1398.3     105.5    -1247.6    1892.1     150.7    1997.6
 48.0      0.0    1598.1     120.6    -1432.3    2076.8     165.8    2197.4
 47.0      0.0    1797.9     135.7    -1617.0    2261.5     180.9    2397.1
 46.0      0.0    1997.6     150.7    -1801.6    2446.2     196.0    2596.9
 45.0      0.0    2197.4     165.8    -1986.3    2630.8     211.0    2796.7
 44.0      0.0    2397.1     180.9    -2171.0    2815.5     226.1    2996.4
 43.0      0.0    2596.9     196.0    -2355.7    3000.2     241.2    3196.2
```

42.0	0.0	2796.7	211.0	-2540.4	3184.9	256.3	3395.9
41.0	0.0	2996.4	226.1	-2725.1	3369.6	271.3	3595.7
40.0	0.0	3196.2	241.2	-2909.8	3554.3	286.4	3795.5
39.0	0.0	3395.9	256.3	-3094.5	3739.0	301.5	3995.2
38.0	0.0	3595.7	271.3	-3279.1	3923.6	316.6	4195.0
37.0	0.0	3795.5	286.4	-3463.8	4108.3	331.6	4394.7
36.0	0.0	3995.2	301.5	-3648.5	4293.0	346.7	4594.5
35.0	0.0	4195.0	316.6	-3833.2	4477.7	361.8	4794.3
34.0	0.0	4394.7	331.6	-4017.9	4662.4	376.9	4994.0
33.0	0.0	4594.5	346.7	-4202.6	4847.1	391.9	5193.8
32.0	0.0	4794.3	361.8	-4387.3	5031.8	407.0	5393.6
31.0	0.0	4994.0	376.9	-4572.0	5216.5	422.1	5593.3
30.0	0.0	5193.8	391.9	-4756.6	5401.1	437.2	5793.1
29.0	0.0	5393.6	407.0	-4941.3	5585.8	452.2	5992.8
28.0	0.0	5593.3	422.1	-5126.0	5770.5	467.3	6192.6
27.0	0.0	5793.1	437.2	-5310.7	5955.2	482.4	6392.4
26.0	0.0	5992.8	452.2	-5495.4	6139.9	497.4	6592.1
25.0	0.0	6192.6	467.3	-5680.1	6324.6	512.5	6791.9

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:19:27

****
* SUMMARY OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 2: FLOOD CONDITION
'PENETRATION DESIGN RUN

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

WALL BOTTOM ELEV. (FT) : 53.62 (Seepage El. 25 is controlled)
PENETRATION (FT) : 2.38

MAX. BEND. MOMENT (LB-FT) : 1.2895E+02
AT ELEVATION (FT) : 54.86

MAX. SCALED DEFL. (LB-IN^3): 1.7137E+06
AT ELEVATION (FT) : 59.00

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:19:27

****
* COMPLETE OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 2: FLOOD CONDITION
'PENETRATION DESIGN RUN

II.--RESULTSO. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
59.00	0.0000E+00	0.	1.7137E+06	0.00
58.00	2.5124E+00	8.	1.2542E+06	15.07
57.00	2.0099E+01	30.	8.0112E+05	30.15
56.00	6.7834E+01	68.	3.8714E+05	45.22
55.76	8.5347E+01	73.	2.9990E+05	0.00
55.00	1.2750E+02	21.	9.4016E+04	-139.46
54.11	6.8451E+01	-177.	2.9010E+03	-304.41
54.00	4.8300E+01	-194.	1.1225E+03	-7.65
53.62	0.0000E+00	0.	0.0000E+00	1038.25

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

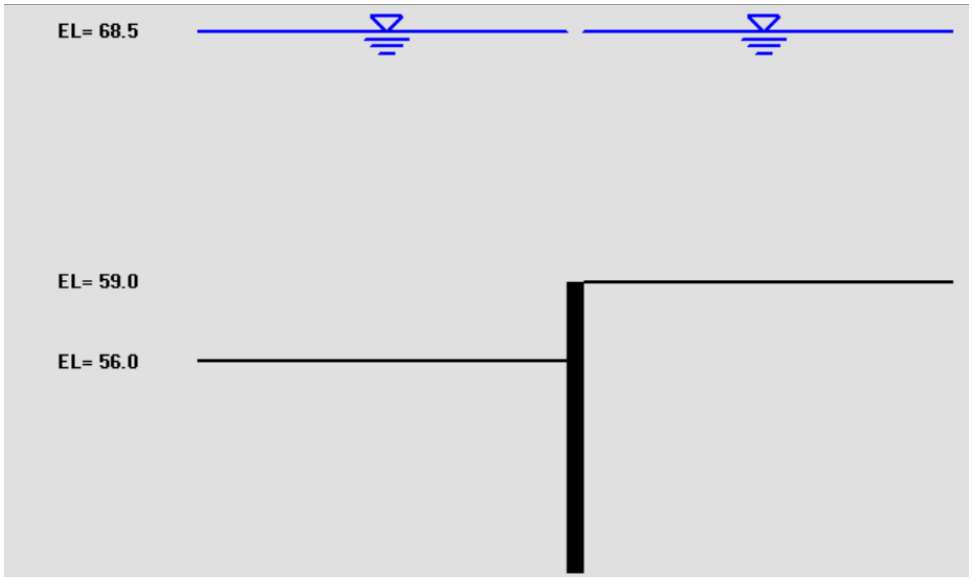
III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION (FT)	PRESSURE (PSF)	PASSIVE (PSF)	ACTIVE (PSF)	ACTIVE (PSF)	PASSIVE (PSF)
59.00	0.	0.	0.	0.	0.
58.00	0.	0.	0.	15.	200.
57.00	0.	0.	0.	30.	400.
56.00	0.	0.	0.	45.	599.
55.76	0.	49.	4.	49.	648.
55.00	0.	200.	15.	60.	799.
54.11	0.	378.	29.	74.	977.
54.00	0.	400.	30.	75.	999.
53.62	0.	599.	45.	90.	1199.
52.00	0.	799.	60.	106.	1398.

Pennoni

Project: **Cushman Lake Dam Modifications**
Subject: **Cutoff Wall Sheet Piling Design**

Job No: **CLCAX19001**
Designed By: **RT** Date: **5/14/25**
Checked By: Date:

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 PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
 DATE: 14-MAY-2025                                          TIME: 16:15:28

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

       I.--HEADING
       'CUSHMAN DAM
       'CUTOFF WALL SHEET PILING DESIGN
       'CASE 2: FLOOD CONDITION
       'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

       II.--CONTROL
          CANTILEVER WALL DESIGN
          FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.00
          FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

      III.--WALL DATA
          ELEVATION AT TOP OF WALL    = 59.00 FT.

       IV.--SURFACE POINT DATA

            IV.A.--RIGHTSIDE
               DIST. FROM     ELEVATION
               WALL (FT)         (FT)
                    0.00         59.00

            IV.B.--LEFTSIDE
               DIST. FROM     ELEVATION
               WALL (FT)         (FT)
                    0.00         56.00

         V.--SOIL LAYER DATA

            V.A.--RIGHTSIDE
                LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
                LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                  ANGLE OF          ANGLE OF                          <-SAFETY->
  SAT.    MOIST   INTERNAL  COH-      WALL     ADH-     <--BOTTOM-->  <-FACTOR->
 WGHT.    WGHT.   FRICTION  ESION   FRICTION   ESION    ELEV.  SLOPE  ACT. PASS.
 (PCF)    (PCF)     (DEG)   (PSF)     (DEG)    (PSF)    (FT)  (FT/FT)
110.00   106.00    28.00     0.00     14.00     0.00                   DEF  DEF

            V.B.--LEFTSIDE
                LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = 1.00
                LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = 1.00

                  ANGLE OF          ANGLE OF                          <-SAFETY->
  SAT.    MOIST   INTERNAL  COH-      WALL     ADH-     <--BOTTOM-->  <-FACTOR->
 WGHT.    WGHT.   FRICTION  ESION   FRICTION   ESION    ELEV.  SLOPE  ACT. PASS.
 (PCF)    (PCF)     (DEG)   (PSF)     (DEG)    (PSF)    (FT)  (FT/FT)
110.00   106.00    28.00     0.00     14.00     0.00                   DEF  DEF

        VI.--WATER DATA
           UNIT WEIGHT          = 62.40 (PCF)
           RIGHTSIDE ELEVATION = 68.50 (FT)
           LEFTSIDE ELEVATION  = 68.50 (FT)
           NO SEEPAGE

       VII.--VERTICAL SURCHARGE LOADS
           NONE

      VIII.--HORIZONTAL LOADS
           NONE

 PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                        BY CLASSICAL METHODS
 DATE: 14-MAY-2025                                          TIME: 16:15:53

                              ***************************
                              *   SOIL PRESSURES FOR    *
                              * CANTILEVER WALL DESIGN  *
                              ***************************

       I.--HEADING
        'CUSHMAN DAM
        'CUTOFF WALL SHEET PILING DESIGN
```

Pennoni

Project: **Cushman Lake Dam Modifications**
Subject: **Cutoff Wall Sheet Piling Design**

Job No: **CLCAX19001**
Designed By: **RT** Date: **5/14/25**
Checked By: Date:

'CASE 2: FLOOD CONDITION
'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

				<------NET------>			
	NET	<---LEFTSIDE--->		(SOIL + WATER)		<--RIGHTSIDE--->	
ELEV.	WATER	PASSIVE	ACTIVE	ACTIVE	PASSIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
59.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58.0	0.0	0.0	0.0	15.1	199.8	15.1	199.8
57.0	0.0	0.0	0.0	30.1	399.5	30.1	399.5
56.0	0.0	0.0	0.0	45.2	599.3	45.2	599.3
55.8	0.0	48.9	3.7	0.0	644.5	48.9	648.2
55.0	0.0	199.8	15.1	-139.5	784.0	60.3	799.0
54.0	0.0	399.5	30.1	-324.2	968.7	75.4	998.8
53.0	0.0	599.3	45.2	-508.8	1153.3	90.4	1198.6
52.0	0.0	799.0	60.3	-693.5	1338.0	105.5	1398.3
51.0	0.0	998.8	75.4	-878.2	1522.7	120.6	1598.1
50.0	0.0	1198.6	90.4	-1062.9	1707.4	135.7	1797.9
49.0	0.0	1398.3	105.5	-1247.6	1892.1	150.7	1997.6
48.0	0.0	1598.1	120.6	-1432.3	2076.8	165.8	2197.4
47.0	0.0	1797.9	135.7	-1617.0	2261.5	180.9	2397.1
46.0	0.0	1997.6	150.7	-1801.6	2446.2	196.0	2596.9
45.0	0.0	2197.4	165.8	-1986.3	2630.8	211.0	2796.7
44.0	0.0	2397.1	180.9	-2171.0	2815.5	226.1	2996.4
43.0	0.0	2596.9	196.0	-2355.7	3000.2	241.2	3196.2
42.0	0.0	2796.7	211.0	-2540.4	3184.9	256.3	3395.9
41.0	0.0	2996.4	226.1	-2725.1	3369.6	271.3	3595.7
40.0	0.0	3196.2	241.2	-2909.8	3554.3	286.4	3795.5
39.0	0.0	3395.9	256.3	-3094.5	3739.0	301.5	3995.2
38.0	0.0	3595.7	271.3	-3279.1	3923.6	316.6	4195.0
37.0	0.0	3795.5	286.4	-3463.8	4108.3	331.6	4394.7
36.0	0.0	3995.2	301.5	-3648.5	4293.0	346.7	4594.5
35.0	0.0	4195.0	316.6	-3833.2	4477.7	361.8	4794.3
34.0	0.0	4394.7	331.6	-4017.9	4662.4	376.9	4994.0
33.0	0.0	4594.5	346.7	-4202.6	4847.1	391.9	5193.8
32.0	0.0	4794.3	361.8	-4387.3	5031.8	407.0	5393.6
31.0	0.0	4994.0	376.9	-4572.0	5216.5	422.1	5593.3
30.0	0.0	5193.8	391.9	-4756.6	5401.1	437.2	5793.1
29.0	0.0	5393.6	407.0	-4941.3	5585.8	452.2	5992.8
28.0	0.0	5593.3	422.1	-5126.0	5770.5	467.3	6192.6
27.0	0.0	5793.1	437.2	-5310.7	5955.2	482.4	6392.4
26.0	0.0	5992.8	452.2	-5495.4	6139.9	497.4	6592.1
25.0	0.0	6192.6	467.3	-5680.1	6324.6	512.5	6791.9

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:15:55

****
* SUMMARY OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 2: FLOOD CONDITION
'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

WALL BOTTOM ELEV. (FT) : 53.62 (Seepage El. 25 is controlled)
PENETRATION (FT) : 2.38

MAX. BEND. MOMENT (LB-FT) : 1.2895E+02
AT ELEVATION (FT) : 54.86

MAX. SCALED DEFL. (LB-IN^3): 1.7137E+06
AT ELEVATION (FT) : 59.00

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 14-MAY-2025 TIME: 16:15:55

****
* COMPLETE OF RESULTS FOR *
* CANTILEVER WALL DESIGN *
****

I.--HEADING
'CUSHMAN DAM
'CUTOFF WALL SHEET PILING DESIGN
'CASE 2: FLOOD CONDITION
'DEFLECTION, SHEAR, AND MOMENT DESIGN RUN

II.--RESULTS0. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)

Pennoni

Project: **Cushman Lake Dam Modifications**
Subject: **Cutoff Wall Sheet Piling Design**

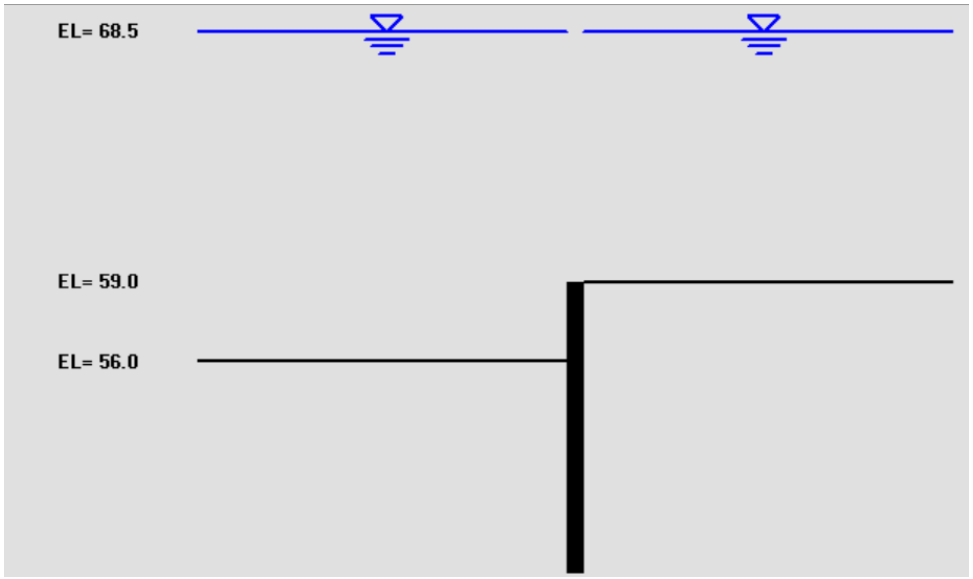
Job No: **CLCAX19001**
Designed By: **RT** Date: **5/14/25**
Checked By: Date:

59.00	0.0000E+00	0.	1.7137E+06	0.00
58.00	2.5124E+00	8.	1.2542E+06	15.07
57.00	2.0099E+01	30.	8.0112E+05	30.15
56.00	6.7834E+01	68.	3.8714E+05	45.22
55.76	8.5347E+01	73.	2.9990E+05	0.00
55.00	1.2750E+02	21.	9.4016E+04	-139.46
54.11	6.8451E+01	-177.	2.9010E+03	-304.41
54.00	4.8300E+01	-194.	1.1225E+03	-7.65
53.62	0.0000E+00	0.	0.0000E+00	1038.25

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION (FT)	PRESSURE (PSF)	PASSIVE (PSF)	ACTIVE (PSF)	ACTIVE (PSF)	PASSIVE (PSF)
59.00	0.	0.	0.	0.	0.
58.00	0.	0.	0.	15.	200.
57.00	0.	0.	0.	30.	400.
56.00	0.	0.	0.	45.	599.
55.76	0.	49.	4.	49.	648.
55.00	0.	200.	15.	60.	799.
54.11	0.	378.	29.	74.	977.
54.00	0.	400.	30.	75.	999.
53.62	0.	599.	45.	90.	1199.
52.00	0.	799.	60.	106.	1398.



		JOB NO. **CLCAX**	**19001**
			DATE
PROJECT	**Cushman Lake Dam Modifications**	BY: **RT**	**5/14/2025**
SUBJECT	**Cutoff Wall Sheet Piling Design Iterations**	CHK'D:	

Description:

The purpose of the following calculations is to check the design of the sheet piling cutoff wall for the Cushman Lake Dam modifications. Three (3) cases will be considered. Case 1 will be the "Usual" constructed condition, Case 2 will be the "Unusual" flood condition, and Case 3 will be the "Extreme" flood plus scour condition. Please note that *Case 3 does not apply here.*

References:

- National Engineering Handbook, Technical Supplement 14R [TS14R]
- NJDOT Design Manual for Bridges and Structures, 6th Edition, 2016 [NJDOT]
- Hammer & Steel Sheet Piling (hammersteel.com) [H&S]
- Gerdau Steel Sheet Piling (sheet-piling.com) [GERDAU]

Sheet Pile Section Properties:

Sheet Pile Type =	PZ 22	
I =	84.38	in^4/ft
S =	18.10	in^3/ft
Av =	6.47	in^2/ft

Material Properties:	Case 1	Case 2	Case 3	
f_y (ksi) =	50	50	50	
E (ksi) =	29000	29000	29000	
f_b (ksi) =	25.00	33.25	43.75	[TS14R, Eq.'s 3, 4, & 5]
f_v (ksi) =	16.50	21.95	28.88	[TS14R, Eq.'s 6, 7, & 8]
Deflection Limit =	0.3600	0.3600	N/A	[NJDOT 17.2.6]

CASE 1 - "USUAL" CONSTRUCTED CONDITION

Wall Stability Check (Determine Penetration Elevation)

Active Soil Pressure F.S. =	1.00
Passive Soil Pressure F.S. =	2.00

Top of Wall Elev. (ft.)	Bot of Wall Elev. (ft.)	Anchor Elev. (ft.)	Penetration Elev. (ft.)	Exposed Height (ft.)
59.00	56.00	N/A	25.00	3.00

Seepage El. 25 is controlled

Sheet Pile Length =	34.00
Embedment Length =	31.00

Moment, Shear and Deflection Check (Determine Sheet Pile Section)

Active Soil Pressure F.S. =	1.00
Passive Soil Pressure F.S. =	1.00

Max. Bending Moment (lb-ft)	fb (ksi)	Moment Check (OK/NG)	Max. Shear (lb)	fv (ksi)	Shear Check (OK/NG)	Max. Deflection ($lb\text{-}in^3$)	Max. Deflection (in)	Deflection Check (OK/NG)
128.95	0.09	OK	194	0.03	OK	1.71E+06	0.00	OK

CASE 2 - "UNUSUAL" FLOOD CONDITION

Wall Stability Check (Determine Penetration Elevation)

Active Soil Pressure F.S. =	1.00
Passive Soil Pressure F.S. =	1.75

Top of Wall Elev. (ft.)	Bot of Wall Elev. (ft.)	Anchor Elev. (ft.)	Penetration Elev. (ft.)	Exposed Height (ft.)
59.00	56.00	N/A	25.00	3.00

Seepage El. 25 is controlled

Sheet Pile Length =	34.00	ft.
Embedment Length =	31.00	ft.

Moment, Shear and Deflection Check (Determine Sheet Pile Section)

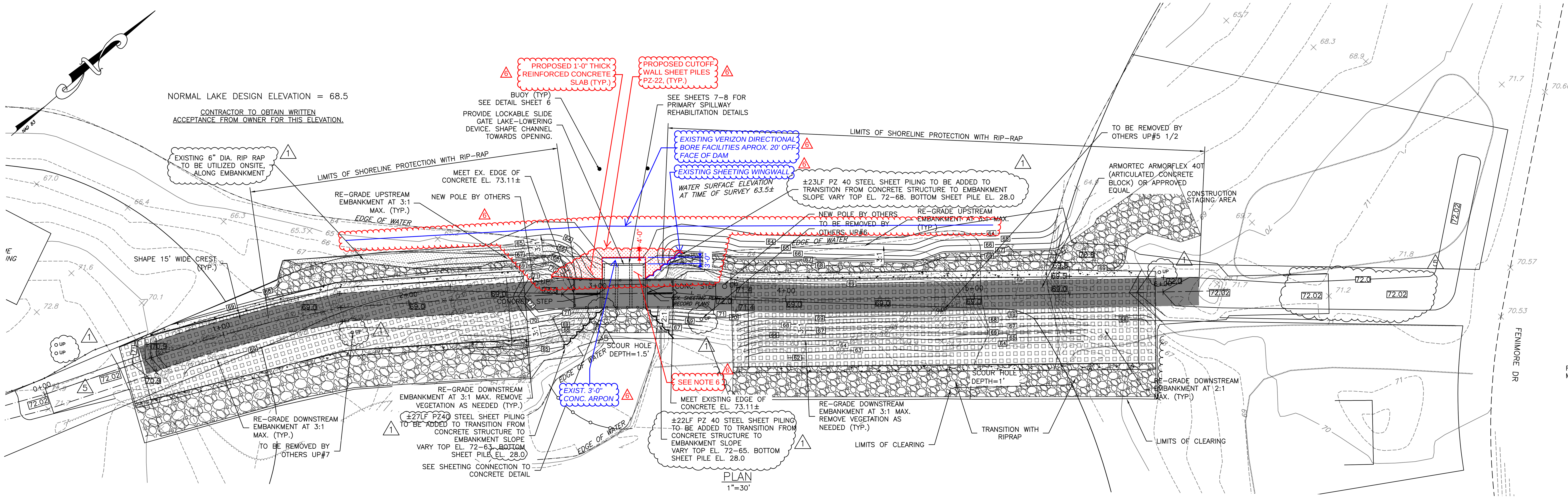
Active Soil Pressure F.S. =	1.00
Passive Soil Pressure F.S. =	1.00

Max. Bending Moment (lb-ft)	fb (ksi)	Moment Check (OK/NG)	Max. Shear (lb)	fv (ksi)	Shear Check (OK/NG)	Max. Deflection ($lb\text{-}in^3$)	Max. Deflection (in)	Deflection Check (OK/NG)
128.95	0.09	OK	194	0.03	OK	1.71E+06	0.00	OK

Pennoni			JOB NO. **CLCAX**	**19001**
				DATE
	PROJECT	**Cushman Lake Dam Modifications**	BY: **RT**	**5/14/2025**
	SUBJECT	**Cutoff Wall Sheet Piling Design Iterations**	CHK'D:	

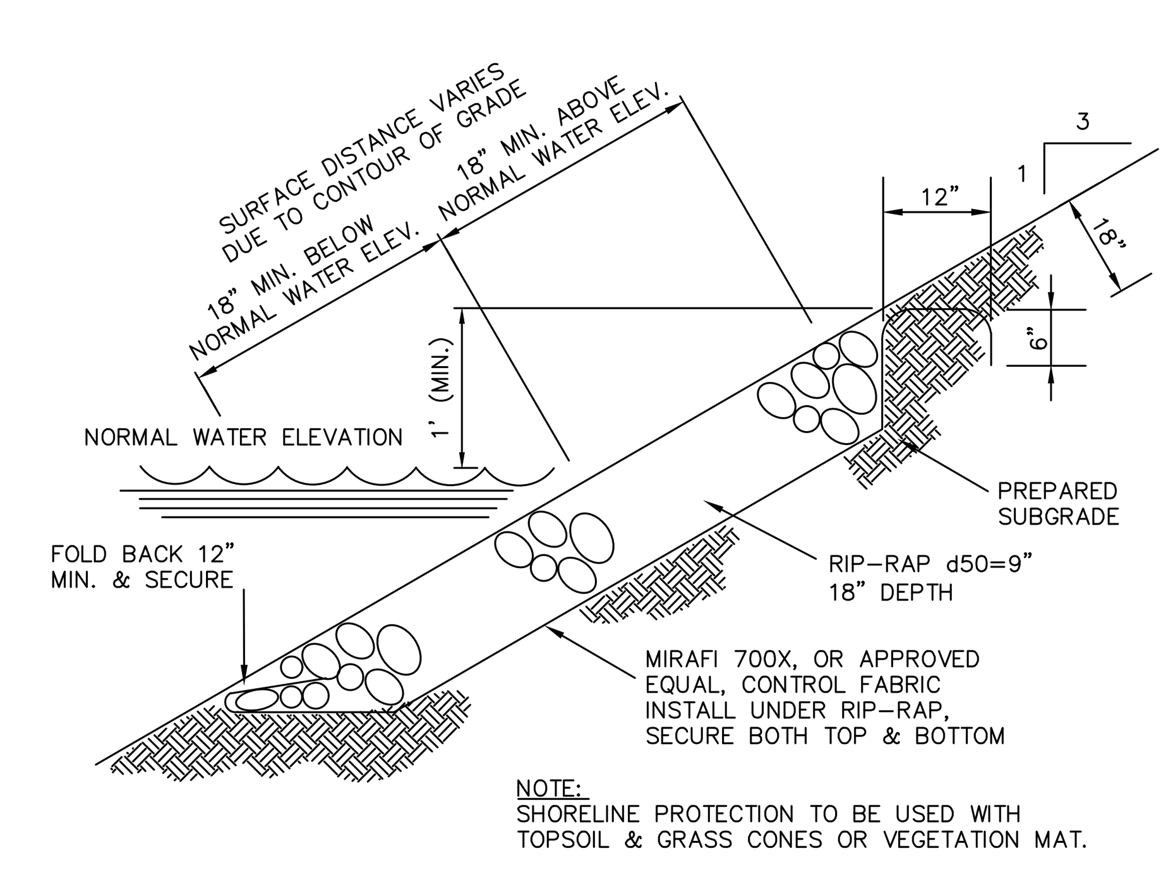
Design Summary

Sheet Piling Section =	**PZ 22**	
Bottom of Sheeting Elev. =	**25.00**	**ft.**
Sheet Piling Length =	**34.00**	**ft.**
Embedment Length =	**31.00**	**ft.**


NORMAL LAKE DESIGN ELEVATION = 68.5
CONTRACTOR TO OBTAIN WRITTEN ACCEPTANCE FROM OWNER FOR THIS ELEVATION.
EXISTING 6" DIA. RIP RAP TO BE UTILIZED ONSITE ALONG EMBANKMENT
LIMITS OF SHORELINE PROTECTION WITH RIP-RAP
PROPOSED 1'-0" THICK REINFORCED CONCRETE SLAB (TYP.)
PROPOSED CUTOFF WALL SHEET PILES PZ-22, (TYP.)
SEE SHEETS 7-8 FOR PRIMARY SPILLWAY REHABILITATION DETAILS
EXISTING VERIZON DIRECTIONAL BORE FACILITIES APROX. 20' OFF FACE OF DAM
EXISTING SHEETING WINGWALL
WATER SURFACE ELEVATION AT TIME OF SURVEY 63.5±
±23LF PZ 40 STEEL SHEET PILING TO BE ADDED TO TRANSITION FROM CONCRETE STRUCTURE TO EMBANKMENT SLOPE VARY TOP EL. 72-68. BOTTOM SHEET PILE EL. 28.0
TO BE REMOVED BY OTHERS UP#5 1/2
ARMORTEC ARMORFLEX 40T (ARTICULATED CONCRETE BLOCK) OR APPROVED EQUAL
CONSTRUCTION STAGING AREA
RE-GRADE UPSTREAM EMBANKMENT AT 3:1 MAX. (TYP.)
NEW POLE BY OTHERS
MEET EX. EDGE OF CONCRETE EL. 73.11±
SHAPE 15' WIDE CREST (TYP.)
RE-GRADE DOWNSTREAM EMBANKMENT AT 3:1 MAX. REMOVE VEGETATION AS NEEDED (TYP.)
±27LF PZ40 STEEL SHEET PILING TO BE ADDED TO TRANSITION FROM CONCRETE STRUCTURE TO EMBANKMENT SLOPE VARY TOP EL. 72-63. BOTTOM SHEET PILE EL. 28.0
SEE SHEETING CONNECTION TO CONCRETE DETAIL
EXIST. 3'-0" CONC. ARPON
SCOUR HOLE DEPTH=1.5'
SEE NOTE 6
MEET EXISTING EDGE OF CONCRETE EL. 73.11±
±22LF PZ 40 STEEL SHEET PILING TO BE ADDED TO TRANSITION FROM CONCRETE STRUCTURE TO EMBANKMENT SLOPE VARY TOP EL. 72-65. BOTTOM SHEET PILE EL. 28.0
RE-GRADE DOWNSTREAM EMBANKMENT AT 3:1 MAX. REMOVE VEGETATION AS NEEDED (TYP.)
LIMITS OF CLEARING
TRANSITION WITH RIPRAP
SCOUR HOLE DEPTH=1'
RE-GRADE DOWNSTREAM EMBANKMENT AT 2:1 MAX. (TYP.)
FENIMORE DR
PLAN
1"=30'

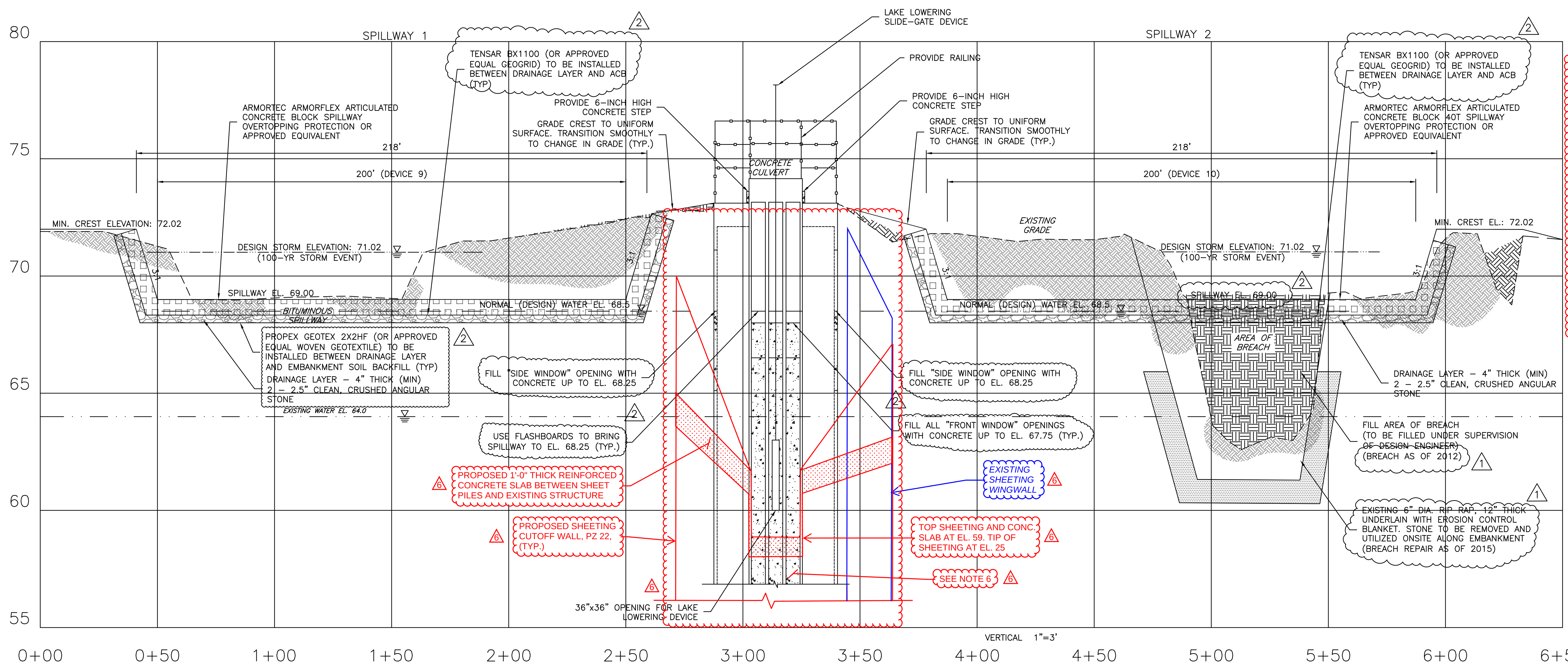
NOTE FOR EXCAVATION & BACKFILL

THE QUALITY & CONDITION OF SOILS IN THE 1) EMBANKMENT & 2) FOR FOUNDATIONS IS SUBJECT TO THE INSPECTION OF THE DESIGN ENGINEER & SHALL BE APPROVED BY THE ENGINEER BEFORE PROCEEDING WITH FILLING OPERATION. EXCAVATION FOR NEW STRUCTURE & EMBANKMENT RESTORATION SHALL BE CARRIED A MINIMUM OF ONE (1) FOOT BENEATH OR BEYOND THE EXISTING GRADE. WHERE ZONE THREE BACKFILLS ARE USED, THE MAXIMUM PASSING THE #200 SIEVE SHALL NOT EXCEED 20 PERCENT (20%). DENSITIES SHALL BE AS THOSE SPECIFIED ON DRAWING #7. A 50# SAMPLE OF BORROW SOURCE MATERIAL SHALL BE PROVIDED TO THE DESIGN ENGINEER FOR LABORATORY TESTING INCLUDING, GRADATION, HYDROMETER & DENSITY DETERMINATION. THE DESIGN ENGINEER WILL MAKE THE JUDGMENT AS TO ACCEPTABILITY OF BORROW MATERIAL. PAY LIMITS SHALL BE THE EXISTING GRADE LIMITS SHOWN ON THE DRAWINGS WHICH SHALL INCLUDE AN ALLOWANCE UP TO TWO (2) FEET OF EXCAVATION & BACKFILL BEYOND & BELOW THE EXISTING LIMITS SHOWN.


SURFACE DISTANCE VARIES DUE TO CONTOUR OF GRADE
18" MIN. BELOW NORMAL WATER ELEV.
18" MIN. ABOVE NORMAL WATER ELEV.
NORMAL WATER ELEVATION
FOLD BACK 12" MIN. & SECURE
PREPARED SUBGRADE
RIP-RAP d50=9" 18" DEPTH
MIRAFI 700X, OR APPROVED EQUAL, CONTROL FABRIC INSTALL UNDER RIP-RAP, SECURE BOTH TOP & BOTTOM
NOTE: SHORELINE PROTECTION TO BE USED WITH TOPSOIL & GRASS CONES OR VEGETATION MAT.

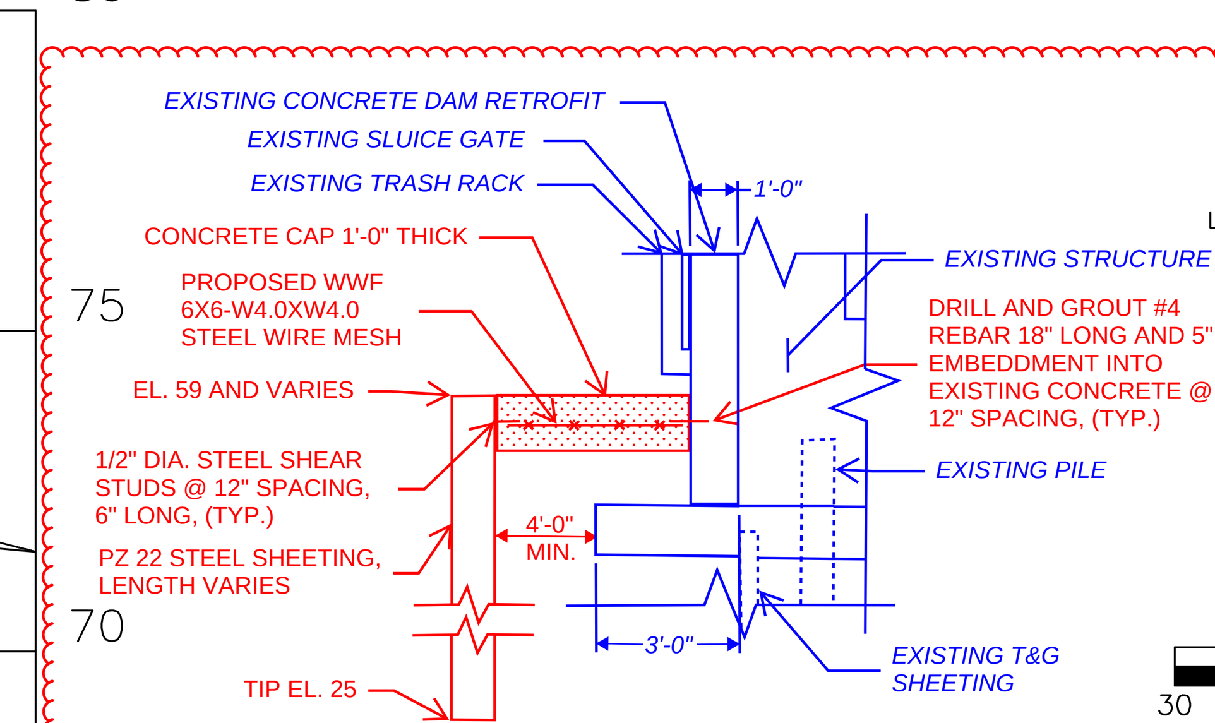
SHORELINE PROTECTION WITH RIP-RAP

N.T.S.


SPILLWAY 1
SPILLWAY 2
TENSAR BX1100 (OR APPROVED EQUAL GEOGRID) TO BE INSTALLED BETWEEN DRAINAGE LAYER AND ACB (TYP)
ARMORTEC ARMORFLEX ARTICULATED CONCRETE BLOCK SPILLWAY OVERTOPPING PROTECTION OR APPROVED EQUIVALENT
LAKE LOWERING SLIDE-GATE DEVICE
PROVIDE RAILING
PROVIDE 6-INCH HIGH CONCRETE STEP
GRADE CREST TO UNIFORM SURFACE. TRANSITION SMOOTHLY TO CHANGE IN GRADE (TYP.)
218'
200' (DEVICE 9)
200' (DEVICE 10)
MIN. CREST ELEVATION: 72.02
DESIGN STORM ELEVATION: 71.02 (100-YR STORM EVENT)
SPILLWAY EL. 69.00
NORMAL (DESIGN) WATER EL. 68.5
PROPEX GEOTEX 2X2HF (OR APPROVED EQUAL WOVEN GEOTEXTILE) TO BE INSTALLED BETWEEN DRAINAGE LAYER AND EMBANKMENT SOIL BACKFILL (TYP)
DRAINAGE LAYER - 4" THICK (MIN) 2 - 2.5" CLEAN, CRUSHED ANGULAR STONE
EXISTING WATER EL. 64.0
FILL "SIDE WINDOW" OPENING WITH CONCRETE UP TO EL. 68.25
USE FLASHBOARDS TO BRING SPILLWAY TO EL. 68.25 (TYP.)
PROPOSED 1'-0" THICK REINFORCED CONCRETE SLAB BETWEEN SHEET PILES AND EXISTING STRUCTURE
PROPOSED SHEETING CUTOFF WALL, PZ 22, (TYP.)
36"x36" OPENING FOR LAKE LOWERING DEVICE
FILL ALL "FRONT WINDOW" OPENINGS WITH CONCRETE UP TO EL. 67.75 (TYP.)
EXISTING SHEETING WINGWALL
TOP SHEETING AND CONC. SLAB AT EL. 59. TIP OF SHEETING AT EL. 25
SEE NOTE 6
EXISTING GRADE
AREA OF BREACH
FILL AREA OF BREACH (TO BE FILLED UNDER SUPERVISION OF DESIGN ENGINEER) (BREACH AS OF 2012)
EXISTING 6" DIA. RIP RAP, 12" THICK UNDERLAIN WITH EROSION CONTROL BLANKET. STONE TO BE REMOVED AND UTILIZED ONSITE ALONG EMBANKMENT (BREACH REPAIR AS OF 2015)
VERTICAL 1"=3'
80
75
70
65
60
55
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
5+50
6+00
6+50

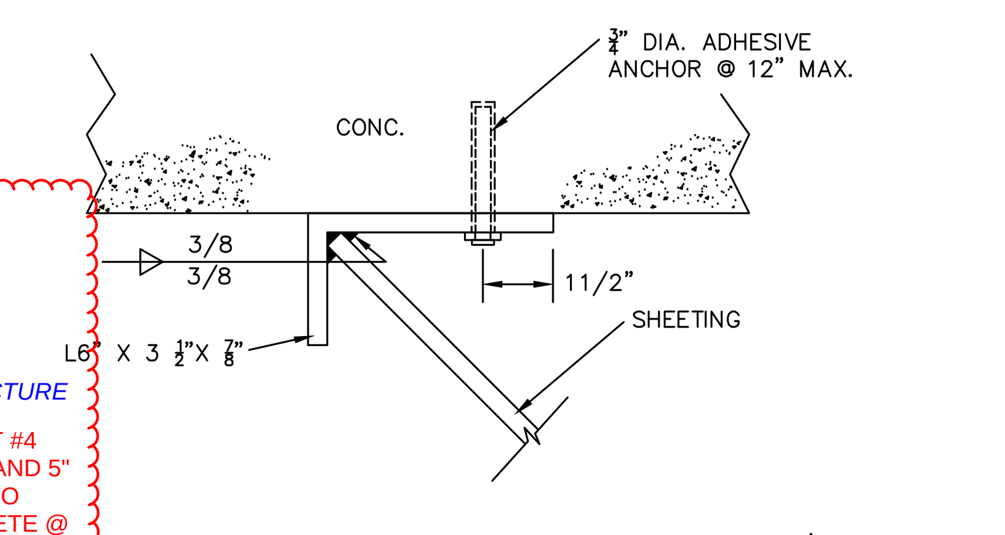
EXISTING PROFILE ALONG BASELINE

SCALE:
HORIZONTAL 1"=30'


EXISTING CONCRETE DAM RETROFIT
EXISTING SLUICE GATE
EXISTING TRASH RACK
CONCRETE CAP 1'-0" THICK
PROPOSED WWF 6X6-W4.0XW4.0 STEEL WIRE MESH
EL. 59 AND VARIES
1/2" DIA. STEEL SHEAR STUDS @ 12" SPACING, 6" LONG, (TYP.)
PZ 22 STEEL SHEETING, LENGTH VARIES
TIP EL. 25
EXISTING STRUCTURE
DRILL AND GROUT #4 REBAR 18" LONG AND 5" EMBEDMENT INTO EXISTING CONCRETE @ 12" SPACING, (TYP.)
EXISTING PILE
EXISTING T&G SHEETING
1'-0"
4'-0" MIN.
3'-0"

TYPICAL CUTOFF WALL SECTION

SCALE: NTS



SHEETING CONNECTION TO CONCRETE

N.T.S.

GRAPHIC SCALE
1 inch = 30 feet

DESCRIPTION	UNIT	Quantities
EXCAVATION	CY	66
CONCRETE SLAB (CLASS S CONCRETE)	CY	24
PERMANENT SHEETING	SF	3096
SHEAR CONNECTOR	U	150
PRESSURE INJECTION GROUT	LS	1

NO	DATE	REVISION	DRN	CHK
6	5/20/25	REV ADDED CUTOFF WALL DETAIL	CQ	
5	10/13/22	REV PER NJ DAM SAFETY COMMENTS	BM	
4	9/21/22	REV TITLE BLOCK	BM	
3	3/16/22	REV PER NJ DAM SAFETY COMMENTS	BM	
2	8/10/21	REV OVERTOPPING PROTECTION	BM	
1	9/13/19	REV ENGINEER OF RECORD	MT	

DAM MODIFICATIONS PLAN AND PROFILE

BLOCK 2609, LOT 1.01 & BLOCK 2710, LOT 11

LANDS SITUATE IN

BOROUGH OF FOLSOM
ATLANTIC COUNTY, NEW JERSEY

PREPARED FOR

CUSHMAN LAKE DAM (#31-98)

CUTOFF WALL NOTES:

1. STEEL SHEET PILES SHALL CONFORM TO ASTM A572 GRADE 50. ALL SHEAR STUD CONNECTORS SHALL BE IN ACCORDANCE WITH AASHTO M169.
2. CONTRACTOR TO DRIVE SHEETING TO TOP EL. OF 59 ACROSS THE FACE OF THE EXISTING DAM STRUCTURE. CONTRACTOR TO DRIVE SHEETING TO TOP EL. 63 TO 1'-0" BELOW GRADE FROM END OF FACE OF EXISTING DAM STRUCTURE, TO TERMINATION ON EMBANKMENTS.
3. CONCRETE SLAB SHALL BE CLASS S CONCRETE.
4. CONTRACTOR TO EXCAVATE BEHIND SHEETING AS FAR AS FEASIBLY POSSIBLE TO REDUCE THE SLOPE OF THE CONCRETE CAP SLAB AS IT TRANSITIONS FROM ELEVATION 59 IN FRONT OF THE EXISTING DAM STRUCTURE TO THE TERMINATION POINTS ON BOTH EMBANKMENTS.
5. STEEL WIRE FABRIC SHALL CONFORM TO ASTM A1064 GRADE 75. FY = 75,000 PSI FOR DEFORMED WELDED WIRE FABRIC. PROVIDE GRADE 60 REINFORCEMENT STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615/615M. ALL REINFORCEMENT STEEL BARS AND WELDED WIRE MESH SHALL BE EPOXY-COATED. ALL COSTS OF REINFORCEMENT, WELDED WIRE MESH, DRILL AND GROUT SHALL BE INCLUDED IN THE "CONCRETE SLAB (CLASS S CONCRETE)" PAY ITEM.
6. PRESSURE GROUTING THE FOUNDATION THROUGH PORT HOLES IN THE BASE OF THE EXISTING DAM STRUCTURE DUE TO UNDERMINING. THE CONTRACTOR HAS AN OPTION TO USE A POLY GROUT TO FILL VOIDS. ALL COSTS SHALL BE INCLUDED IN THE "PRESSURE INJECTION GROUT" PAY ITEM.
7. THE CONTRATOR MUST MONITOR THE INTERITY OF THE EXISTING DAM STRUCTURE COMPONENTS DURING THE DRIVING SHEET PILE OPERATION AND SUSPEND ALL OPERATIONS AT THE SIGN OF ANY DISTRESS OR MOVEMENT IN THE EXISTING DAM STRUCTURE.
8. CONTRACTOR SHALL RESTORE GRADE TO EXISTING CONDITIONS UPON COMPLETION OF CUTOFF WALL WORK.

SITE NOTE:

1. THE PURPOSE OF THIS PROJECT IS TO SUPPLEMENT THE EXISTING SPILLWAY WITH IMPROVEMENTS & DOWNSTREAM OUTLET PROTECTION. THE EMBANKMENT & ROADWAY IS TO BE FILLED, RAISED, CONSTRUCTED & GRADED AS SHOWN. STEEL SHEET PILE WING WALLS ARE REQUIRED TO TRANSITION FROM THE CONCRETE STRUCTURE TO EMBANKMENT SLOPE.
2. VEGETATION CLEARING TO BE PERFORMED BY ASSOCIATION PRIOR TO CONSTRUCTION. HOWEVER, GROWTH BETWEEN TIME OF CLEARING AND CONSTRUCTION WILL BE THE CONTRACTORS RESPONSIBILITY AND THE CST INCLUDED IN THE BID.
3. BRICKS, CONCRETE, TIRES, FOREIGN MATERIAL OR OBJECTS LOCATED WITHIN THE WORK AREA SHALL BE REMOVED AND DISPOSED OF IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS AND INCLUDED IN THE CONTRACTORS BID PRICE
4. CONTRACTOR SHALL COORDINATE WITH UTILITY COMPANIES FOR AERIAL UTILITY AND POLE CONFLICT. CONTACT MIKE LEONE AT 856-306-8611 (W), 609-922-2763 (C) OR mike.leone@verizon.com.

CONSTRUCTION NOTES:

1. PRIOR TO INITIATING WORK, THE CONTRACTOR IS TO MEET WITH THE ENGINEER & OWNER TO FIRMLY ESTABLISH THE ELEVATION OF THE CONCRETE WEIR LUG ALONG THE UPSTREAM PORTION OF THE ARTICULATED CONCRETE BLOCK SPILLWAY.
2. TWO PERMANENT CONTROL MONUMENTS WILL BE SET BY THE ENGINEER, ONE AT EACH END OF THE EMBANKMENTS OUTSIDE THE AREA OF CONSTRUCTION DISTURBANCES. ANY LOSS OF THE CONSTRUCTION CONTROL MONUMENTATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
3. UPON REMOVAL OF ALL CONCRETE, ASPHALT & MISCELLANEOUS MATERIALS, THE ENGINEER WILL SAMPLE EXISTING SOIL SUBGRADE FOR GRADATION ANALYSIS AT A MINIMUM OF THREE (3) LOCATIONS. WHERE BORROW MATERIAL IS USED FOR BACKFILLING AND SUBGRADE PREPARATION, THE CONTRACTOR WILL SUBMIT A 50 POUND BULK SAMPLE TO THE ENGINEER FOR TESTING. SOIL SHALL BE A FINE TO COARSE SAND WITH LITTLE TO SOME SILTY CLAY RAGING FROM 10% TO 20%. FINAL DETERMINATION AS TO ACCEPTABILITY OF THE MATERIAL WILL BE MADE BY THE ENGINEER AFTER TESTING. BASED ON SOIL COMPOSITION, THE ENGINEER WILL MAKE A FINAL DETERMINATION OF THE GEOFABRIC DRAINAGE CHARACTERISTICS WHICH HAS BEEN SPECIFIED BASED UPON GENERAL EXPERIENCE.
4. THE CONTRACTOR SHALL USE THE GENERAL PLAN CONFIGURATION FOR THE ARTICULATED CONCRETE BLOCK LAYOUT. IT IS THE RESPONSIBILITY OF THE MANUFACTURER TO PROVIDE SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION, HOWEVER THE CONTRACTOR SHOULD EXPECT TO CUT & FIT BLOCK MATS TO THE ANGLES AND/OR SKEWED CONTOURS & FILL THE VOIDS WITH CONCRETE.

NOTE: 1
PENNONI HAS BECOME ENGINEER OF RECORD AS 7/15/19. PERMISSION HAS BEEN RECEIVED FROM LIPPINCOTT JACOBS CONSULTING ENGINEERS FOR THIS TO TAKE PLACE. ALL INFORMATION INDICATED IN THE REVISION BLOCK AS OF 9/13/19.

PENNONI ASSOCIATES INC.
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T 856.547.0505 F 856.547.9174
NJ COA NO. GA28033300
BETH-ANN M. GRASSO, P.E.
N.J. PROFESSIONAL ENGINEER
NO. 24GE04312100

WEI NJ Cert. Of Authorization No. 24GA28165900 WAYPOINT ENTERPRISES, INCORPORATED T/A
Lippincott Jacobs
CONSULTING ENGINEERS
1 PAVILION AVENUE ■ RIVERSIDE NJ 08075 ■ P 856-461-1100 ■ F 856-461-3166 ■ WWW.LJCE.NET
CIVIL ■ SURVEY ■ STRUCTURAL ■ ENVIRONMENTAL ■ GEOTECHNICAL ■ QUALITY CONTROL ■ PROJECT MANAGEMENT

I. WAYNE LIPPINCOTT
PROFESSIONAL ENGINEER
N.J. LICENSE No. 16247

DRAWN BY:	WTS
CHECK BY:	IWL
SCALE:	AS NOTED
DATE:	02/12/13
JOB NO.	14991
SHEET NO.	3 OF 14