Attachment 2

Levee Designs

SAN JOAQUIN RIVER
RESTORATION PROGRAM

San Joaquin Reach 4B Levees Appraisal Level Analysis and Design

I. General

The proposed levee system for reach 4B of the San Joaquin River (SJR) would channelize flood water flows to protect adjacent farmlands. The levee system would consist of left and right of channel levees ranging from approximately 12 miles per side to 19 miles per side based on the levee alignment. Other levee systems in the area include levees at the Chowchilla Bypass and Eastside Bypass, both maintained by the State of California and the Lower San Joaquin River Levee District.

A. Existing Levees

Original flood system levees exist on both sides of the SJR from the Sand Slough structure to the Mariposa Bypass. These levees are not system levees and no information regarding the construction or materials of these levees is available.

The levee alignment for these levees is typically very close to the original river channel. Slopes range from 1.5:1 (H:V) to 3:1 (H:V) (estimated from area topography). The levees typically range in height from approximately ground surface to 4 to 5 feet.

It is expected that if new levees will be built on the same alignment as the existing levees, the new levees will be built over the existing without degrading. If the new levees will be built on a different alignment, the material in the existing levees will likely be used as part of the fill for the new levees, dependent on the floodplain grading.

B. Regional Geology

The headwaters of the SJR originate in the high Sierra Nevada Mountains near Thousand Island Lake, California. The SJR and its tributaries drain the mountains between El Dorado and Kings Counties.

The SJR is located in two geologic provinces with the upper segment located in the Sierra Nevada Geologic Province and the lower segment moving northwest through the Central Valley Geologic Province (in which reach 4B is located). The lower SJR enters the Central Valley Geologic Province as the river exits the foothills near Friant Dam. The Central Valley Geologic Province is bounded on the east by the Sierra Nevada Mountain range and on the west by the Coastal Mountain range. The Central Valley Geologic Province is mostly comprised of alluvial, continental, and marine sediments that are up to thousands of feet thick.

C. Reach 4B Geology

Reach 4 of the SJR is dominated by sandy deposits with varying amounts of silt and clay. Borings for monitoring well installation throughout the area typically encounter laminated alluvial deposits with interlayered sandy clay, silty sand, and clayey sand. Thick layers of poorly graded sand are also common. The geology of the reach is likely related to the low gradient of the SJR in this reach allowing finer grained materials to deposit across the floodplain area.

D. Reach 4B Subdivisions

Subsurface data is relatively limited on the proposed levee alignments. Information typically consists of boring logs from Bureau of Reclamation monitoring well installations [1,2] and general subsurface profiles from older water well installations [3]. Based on the limited amount of data, reach 4B was subdivided into 8 sub-reaches as shown on Figure 1. The 8 sub-reaches were assumed to have similar geologic profiles to local monitoring well boring logs. Seepage and stability calculation results as well as levee section were then assumed to extend the length of the sub-reach.

II. Levee Design

A. Levee Design Criteria

Levee design criteria used for the reach 4B levees are based primarily on the U.S. Army Corps of Engineers Engineering Manual EM 1110-2-1913, “Design and Construction of Levees” [4]. Seepage estimates and mitigation measures included information from the U.S. Army Corps of Engineers Report DIVR 1110-1-400, Section 8, Change 2 “Groundwater and Seepage” [5]. Seepage design criteria were also changed from 1110-2-1913 values to meet updated criteria outlined in U.S. Army Corps of Engineers Engineering Technical Letter ETL 1110-2-569 “Design Guidance for Levee Underseepage” [6]. The design criteria outlined in the listed documents represents current design criteria.

1. Levee Alignment

Four levee alignment options were prepared by the Bureau of Reclamation sediment information group. Each alignment has a different setback from the river channel and was influenced by existing structures, canal alignments, property boundaries, and flood plain attributes. The four options are shown on Figure 2 and attributes of the options are listed below:

- Option A: Minimal setback levee constructed over existing levees.
    - Left Levee Length: 102,000 feet
    - Right Levee Length: 90,200 feet
- Option B: Levee setback proposed during earlier studies. Most of the levees would be setback from existing levee alignments except in the north end of the levees.
    - Left Levee Length: 77,800 feet
    - Right Levee Length: 76,400 feet
- Option C: Levee setback based on levee option B setbacks, however, incorporating further alignment alterations based on canal locations, bridge locations, and other physical obstacles to construction.
    - Left Levee Length: 72,800 feet
    - Right Levee Length: 66,300 feet
- Option D: Levee setback based on a wide floodplain and side channel model.
    - Left Levee Length: 70,200 feet
    - Right Levee Length: 65,100 feet

Levee design considerations and calculations were prepared for each levee setback option to compare costs for the various levee construction conditions.

2. Levee Height

Typically, levee height calculations take into account freeboard requirements over project flood water elevations, settlement of levee structures after construction, and increased levee sections for utility and road crossings. Ground surface elevations for the levee setback options were taken from LIDAR data of the area prepared for previous studies.

Water surface elevations were estimated with HEC-RAS modeling different river channel flows by the Bureau of Reclamation Sediment group. Water elevations also varied based on the levee setback option. The HEC-RAS models used 250 cross sections numbered starting at zero at the upstream end of Reach 4B and ending at 250 at the downstream end of Reach 4B. Water elevations were calculated for the following river channel flow values:

- 475 ft^3/s
- 1,200 ft^3/s
- 2,200 ft^3/s
- 4,500 ft^3/s

In order to minimize the number of levee options, the water elevation for the 4,500 ft^3/s flow was used for levee height design for all levee setback options. Levee height values should be adjusted if a lower project flow is ultimately used.

Levee freeboard was estimated to be 3 feet. Preliminary settlement calculations indicate typical settlement of the levee will be approximately 1 foot. The post settlement levee height will provide 2 feet of freeboard in addition to any overbuild due to ground surface elevation variations. This is estimated to be suitable freeboard due to the presence of other flood control measures (Friant Dam, Chowchilla Bypass, Eastside Bypass). The other flood control measures are expected to relatively limit uncontrolled flows into the river channel.

Levee height was then calculated to a height above ground surface at the 4,500 ft^3/s water elevation plus 3 feet of freeboard. This value was further rounded to the next higher round number of feet to provide a constant crest elevation. Large spikes in the calculated levee heights are assumed to be due to low ground elevation values such as canal and ditch crossings. The canal and ditch crossings were left out of the levee height calculations. Ground elevation values were not available for parts of levee setback D due to levee setback D being outside the boundaries of the available LIDAR data. Ground elevation and levee height values were estimated for these areas. Attachment A is a collection of charts that display the ground surface and water elevation for each levee setback option and side of the river channel followed by a chart of the calculated levee height including the 3 feet of freeboard. Distance along the river on the charts is represented by increasing HEC-RAS cross section ID's.

3. Levee Slope and Crest

The levee slopes and crest width were estimated based on maintenance and inspection criteria. Levee design guidance indicates that levee slopes should be between 2:1 (H:V) and 5:1. Steeper slopes are allowed when construction materials exhibit higher cohesion values and seepage through the levee onto the downstream slope is unlikely. Shallower slopes are easier to maintain (mowing, other vegetation removal) and facilitate inspection. Levee slopes of 3:1 on the upstream and downstream slopes were chosen due to the construction materials available combined with the ease of maintenance.

Levee design guidance indicates that levee crest width should be 10 to 12 feet with occasional wider areas for turnaround. This width allows for a minimum single lane of traffic on the levee crest which is critical for levee inspection during high water events as well as allowing for travel of construction equipment during construction. Typically, the crest width of levees is increased if the crest road will be publically accessible or for increased seepage resistance. Crest widths for the project levees at the Eastside Bypass [7] vary from 12 feet to 24 feet. The crest width for the reach 4B proposed levees is 20 feet. This value is based on increased seepage resistance and ease of construction for gravel surfacing. The typical levee section with no seepage mitigation measures is shown on Figure 3.

4. Levee Inspection Trench

The levee inspection trench is a trench excavated beneath the center line of the levee (or offset as necessary) to provide an inspection of the geologic conditions present during construction. The individual levee lengths are up to 19 miles and even extensive subsurface exploration will not be able to fully define the subsurface profile for this length of construction. The inspection trench will be used to recognize localized areas that may be subject to increased seepage (coarse sandy zones) or subject to decreased seepage (typically clay filled meander channels). The proposed levee inspection trench for the reach 4B levees is 6 feet deep and 6 feet wide with 1:1 (H:V) side slopes.

5. Levee Surfacing

Levee crest surfacing for existing levees is typically either gravel surfacing or pavement. A non-surfaced levee crest typically becomes impassable due to mud during high water events. Non-surfaced levee crests are also susceptible to considerable rutting and depressions when subject to traffic, even during clear weather. Proposed levee surfacing for the reach 4B levees is 4 inches of compacted roadbase.

6. Levee Bank Protection

Levee setback options A and B both follow the existing river channel relatively closely. The alignment of the river and the levees in these areas indicates there is potential for erosion and scour of the levee slopes during high water events. This potential will be increased after construction of the levees until significant grassy vegetation can be established on the levee slopes. A high-performance turf reinforcement mat is proposed to protect the riverside slopes and facilitate vegetation growth after levee construction for vulnerable reaches of levee setback options A and B. Figures 4 and 5 show the proposed areas of slope protection for setback options A and B, respectively.

B. Levee Slope Stability

1. Levee Slope Stability Design Criteria

Levee slope stability was calculated using Slope/W software from Geo-Slope [8]. The current design criterion for evaluating levee slope stability is based on EM 1110-2-1913 [4]. According to design criteria, levee slope stability is calculated for the following loading scenarios:

- Case I: End of construction
- Case II: Sudden drawdown
- Case III: Steady state seepage from full flood state (fully developed phreatic surface)
- Case IV: Earthquake

Criteria for the Case IV loading (seismic) are currently under development. Additionally, the case of an earthquake occurring during a large flood event is considered to be a very remote event. Therefore; for this appraisal level design, seismic stability was not calculated.

Minimum factors of safety for the loading cases used are summarized in Table 1.

Table 1. – Minimum factor of safety values for levee slope stability

Type of Structure	Applicable Stability Conditions and Required Factor of Safety Values			
	End of Construction	Steady State Seepage	Sudden Drawdown*	Seismic
New Levee	1.3	1.4	1.0 – 1.2	Study On-going
Existing Levee	N/A	1.4	1.0 – 1.2	Study On-going
Other Embankments and Dikes	1.3	1.4	1.0 – 1.2	Study On-going

* F.S. of 1.0 applies to pool levels prior to drawdown for conditions where these water levels are unlikely to persist for long periods preceding drawdown. F.S. of 1.2 applies to pool levels likely to persist for long periods prior to drawdown.

2. Levee Slope Stability Sections

Slope stability sections for the left levee of each levee setback option were used. The right levee section does not change from the left levee and slope stability was not calculated for right levee sections. Levee slope stability was also calculated for different sub-reaches to evaluate the effect of differing geologic profiles. The levee slope stability sections used include:

- Levee Setback Option A
  - Sub-reach 2
  - Sub-reach 8
- Levee Setback Option B
  - Sub-reach 6
  - Sub-reach 7
- Levee Setback Option C
  - Sub-reach 1
- Levee Setback Option D
  - Sub-reach 3

3. Levee Slope Stability Material Properties

Levee slope stability material properties were estimated based on laboratory test results from samples taken during monitoring well installations in reach 4B. The estimate was supplemented by shear strength test results on samples from the San Luis Drain project [9], which is located approximately 18 to 20 miles south of reach 4B. The material properties estimated include soil unit weight, effective stress friction angle and cohesion and undrained friction angle (zero) and cohesion. The material properties were used in the analyses as directed by levee design guidance:

- Case I: End of Construction
  - Use undrained strengths for impervious embankment materials
- Case II: Sudden Drawdown
  - Use the lowest strength (drained or undrained) at the base of each slice. Typically chosen by calculating the shear resistance at the base of each slice for drained and undrained strengths and then using the lowest strength based on the lowest shear resistance
- Case III: Steady State Seepage
  - Use drained (effective) strengths for all materials. Residual strengths should be used if previous deformation has occurred.

The material properties used for the reach 4B slope stability modeling are listed in Table 2.

Table 2. – Reach 4B slope stability material properties

Material	Soil Material Properties		
	Unit Weight (γ, pcf)	Phi Angle (degrees)	Cohesion (psf)
Levee Fill (drained)	115	28	100
Levee Fill (undrained)	118	0	300
Sandy Silt or Silty Sand (drained)	118	32	0
Sandy Silt or Silty Sand (undrained)	118	16	100
Lean Clay (drained)	112	28	300
Lean Clay (undrained)	112	0	300
Poorly Graded Sand (drained and undrained)	128	35	0

4. Levee Slope Stability Results

The results of the slope stability modeling are listed in Table 3. Annotated cross sections from the stability modeling are included in Attachment B. The factor of safety was calculated using Spencer’s method and circular failure surfaces for each cross-section. All factors of safety calculated meet or exceed the required factor of safety value from the design guidance.

Table 3. – Reach 4B slope stability results

Cross Section ID	Slope Stability Scenario								
	Case I: End of Construction			Case II: Sudden Drawdown			Case III: Steady State Seepage		
	FS (U/S)*	FS (D/S)*	FS (Req)*	FS (U/S)	FS (D/S)	FS (Req)	FS (U/S)	FS (D/S)	FS (Req)
Levee Option A, Sub-Reach 2	2.9	2.9	1.3	1.9	2.1	1.2	3.6	2.5	1.4
Levee Option A, Sub-Reach 8	2.8	2.8	1.3	2.1	2.7	1.2	2.6	1.9	1.4
Levee Option B, Sub-Reach 6	3.5	3.5	1.3	2.5	2.7	1.2	2.5	2.3	1.4
Levee Option B, Sub-Reach 7	2.8	2.8	1.3	2.3	2.4	1.2	2.5	2.3	1.4
Levee Option C, Sub-Reach 1	3.7	3.7	1.3	2.7		1.2	3.2	3.3	1.4
Levee Option D, Sub-Reach 3	2.8	2.8	1.3	2.1	2.3	1.2	2.7	2.2	1.4

* U/S is failure surface on the upstream (riverside) slope of the levee
D/S is failure surface on the downstream (landside) slope of the levee
Req is the required factor of safety value from the design guidance

C. Levee Seepage

Levee seepage and seepage mitigation measures have been studied since approximately 1940. Uncontrolled seepage beneath levees can result in the formation of sand boils, degradation of the levee crest and eventual failure. Certain foundation conditions including thick deposits of sandy materials can make seepage conditions worse. Existing levees in the Central Valley and the Sacramento-San Joaquin Delta have a history with multiple levee breaches caused by a multitude of issues, a primary one being seepage. Therefore, seepage investigation and mitigation is expected to be a primary concern for the design and construction of the reach 4B levees.

1. Levee Seepage Design Criteria

Seepage control measures for levee underseepage and through seepage include:

- Cutoff trenches
- Riverside impervious blankets
- Landside seepage berms
- Pervious toe trenches
- Pressure relief wells

Design calculations for seepage include estimating the exit gradient at the toe of the levee and determining the factor of safety versus uplift based on the exit gradient and unit weight of the in-situ soils. Recommended design limits for the estimated parameters include:

- For a computed upward gradient at the levee toe less than 0.5, no seepage mitigation is required unless severe seepage is expected or other considerations require seepage mitigation construction (for instance, continuing a seepage berm across small gaps to facilitate uniform construction).
- For a computed upward gradient at the levee toe of 0.5 to 0.8, seepage mitigation measures should be designed to reduce the exit gradient to 0.5 at the toe of the levee. If a seepage berm is used in this case, it should meet design requirements for a minimum seepage berm unless design calculations indicate otherwise.
- For a computed upward gradient at the levee toe greater than 0.8, seepage mitigation measures should be designed to reduce the exit gradient to 0.5 at the toe of the levee. If a seepage berm is used for this case, the factor of safety versus uplift at the toe of the seepage berm should be verified after seepage berm design.

For the proposed reach 4B levees, seepage calculations were performed according to the guidelines defined in Appendix B of EM 1110-2-1913 [4]. The calculations included distance to the river (point of effective seepage entrance), distance to the effective seepage exit, and the exit gradient at the toe of the levee as shown on Figure B-1 (from EM 1110-2-1913 [4]).

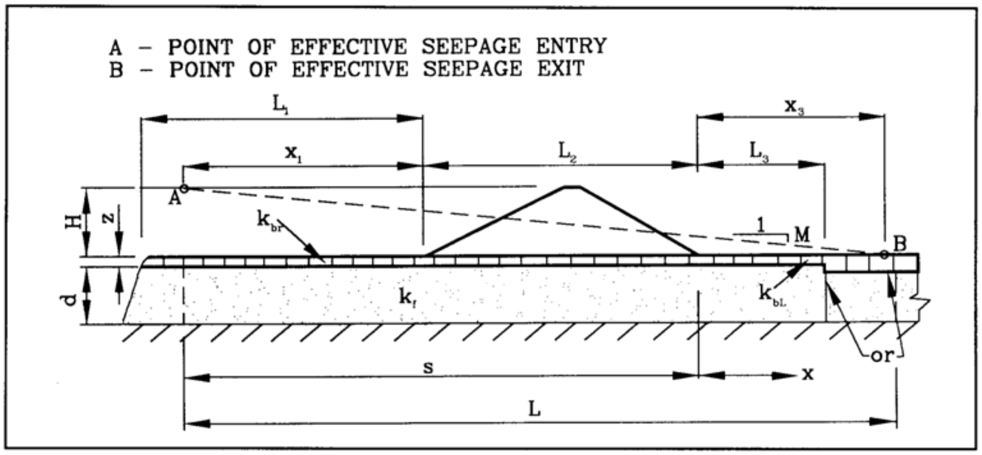

Figure B-1. Illustration of symbols used in Appendix B

2. Levee Seepage Material Properties

The primary material properties used for the seepage calculations include:

- Estimated hydraulic conductivity of the blanket (low permeability) material
- Estimated hydraulic conductivity of the pervious substratum
- Thickness of the blanket layer (transformed as described in Appendix B)

The hydraulic conductivity of the blanket material and the pervious material was estimated based on permeability tests on material at the San Luis drain site [9] and material descriptions from the monitoring well installations at reach 4B. Typically, the ratio between the blanket conductivity and the pervious layer conductivity was kept to a round number to facilitate the calculations. Typical estimated values for hydraulic conductivity by material are:

- High plasticity clay: 0.0028
- Lean clay or sandy clay: 0.028 to 0.0567 feet/day
- Lean clay interlayered with silty sand: 0.28 feet/day
- Poorly graded sand: 14 to 28 feet/day

Blanket material thicknesses were estimated based on the nearest boring log information. Materials estimated to be significantly lower permeability than the poorly graded sand pervious materials included high and low plasticity clays, silty clays and sands and clayey sands. Typically, silty sands at the top of the poorly graded sands layer were also included in the blanket thickness.

3. Levee Seepage Results

Levee seepage calculations are included in Attachment C. Exit gradient values for the calculations are listed in Table 4.

Table 4. – Reach 4B calculated levee exit gradient values

Levee Setback Option	Exit Gradient at the Levee Toe by Sub-Reach							
	1	2	3	4	5	6	7	8
Option A, Left	0.29	0.54	0.37	0.14	0.22	0.62	0.45	0.91
Option A, Right	0.29	0.15	0.50	0.26	0.31	0.84	0.31	0.74
Option B, Left	0.09	0.33	0.31	0.15	0.20	0.78	0.54	0.58
Option B, Right	0.38	0.48	0.40	0.12	0.25	0.58	0.37	0.69
Option C, Left	0.05	0.28	0.44	0.18	0.15	0.80	0.24	0.15
Option C, Right	0.28	0.18	0.06	0.07	0.12	1.0	0.36	0.20
Option D, Left	0.16	0.14	0.34	0.15	0.13	0.60	0.36	0.15
Option D, Right	0.20	0.22	0.30	0.06	0.12	0.62	0.35	0.19

Exit gradients exceeded 0.5 for every setback option for at least one sub-reach. Lower exit gradients were observed in several sub-reaches for setback options C and D due to the increased distance to the effective seepage entry point.

D. Seepage Mitigation Calculations

Exit gradients at the toe of the levee exceeded 0.5 for several sub-reaches in the different levee setback options. Design guidance indicates that seepage mitigation measures should be used when the exit gradient exceeds 0.5. Additionally, boring information for sub-reach 7 indicates that the presence of a thin, very low permeability blanket layer overlying a very thick, very permeable layer. This situation was considered very susceptible to seepage damage and seepage mitigation was deemed necessary for this sub-reach regardless of calculation results.

Of the various seepage mitigation techniques, seepage berms and cut-off walls are likely to be the most cost effective measures. These seepage mitigation measures were designed and cost estimated where needed for the levee options.

1. Seepage Berm Design

The seepage berms were designed to meet criteria from Appendix C of EM 1110-2-1913 [4]. The seepage berm design also meets minimum criteria from ETL 1110-2-569 [6]. The seepage berm design for the proposed reach 4B levees assumes that the seepage berm will be semi-pervious based on the sandy materials available for construction.

The seepage berm design was based on reducing exit gradients at the toe of the levee to 0.5. Generally for reach 4B, the calculated berm design resulted in very narrow seepage berms from approximately 1 to 16 feet wide. In these cases, design guidance indicates that a minimum seepage berm should be used with the following characteristics:

- Width equal to four times the height of the levee
- A minimum thickness at the levee toe of 5 feet
- A minimum thickness at the berm crown of 2 feet
- All seepage berms should incorporate overbuild to account for consolidation and settlement of the seepage berm

The design guidance from EM 1110-2-1913 suggests that overbuild should be 25% to account for consolidation and settlement. This value may be changed based on settlement calculations for the design material, however; for this appraisal level design, 25% was utilized due to a lack of specific material information.

Based on the design criteria, seepage berms designed for the proposed reach 4B levees range from 25 to 35 feet wide, are 6.25 feet thick at the levee toe, generally 5.5 feet thick at the crown and are sloped 40:1 (H:V) to drain. The typical levee section with a minimum seepage berm is shown on Figure 6. The exception to this design is left levee setback option A in sub-reach 8. Calculations indicated a smaller berm, however, seepage modeling indicated the need for a wider berm. For this reach, a 300 foot wide berm was chosen based on the geologic conditions.

2. Slurry Wall Design

The alternate option for seepage mitigation is a soil-bentonite slurry cut-off wall. The slurry wall cut-off design required several general assumptions including:

- The slurry wall is 3 feet wide
- The slurry wall is nearly impervious
- The slurry wall increases the seepage path twice the depth of the slurry wall

The slurry wall depth was adjusted to reduce the exit gradient at the toe of the levee to 0.5. The exception to this occurred when boring logs indicated a low permeability layer available at a depth shallower than required to reach an exit gradient of 0.5. For these cases, the slurry wall was assumed to key 3 feet into the low permeability layer. The slurry wall design also assumed a minimum depth of 15 feet into the levee foundation would be required for cut-off if the design depth indicated shallower cut-off depths. The typical levee section with a minimum slurry wall cut-off is shown on Figure 7.

The slurry wall assumed design depths range from 15 to 78 feet. The 78 foot depth is a theoretical depth that would not be achievable through conventional construction methods. This area would require further subsurface characterization to evaluate the cut-off depth. The cut-off wall is included for cost estimating purposes.

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References

[1] "San Joaquin River Restoration Program, Groundwater Monitoring Well Installation Geologic Report 1", Bureau of Reclamation, Sacramento, California, December 2010

[2] "San Joaquin River Restoration Program, Groundwater Monitoring Well Installation Geologic Report 2", Bureau of Reclamation, Sacramento, California, January 2011

[3] "Summary of Appraisal Work on Levee Design, San Joaquin River Restoration Program", California Department of Water Resources, December 2007

[4] "Design and Construction of Levees", U.S. Army Corps of Engineers, EM 1110-2-1913, Washington, DC, April 2000

[5] "Soil Mechanics Data, Section 8 Groundwater and Seepage Change 2" U.S. Army Corps of Engineers Mississippi Valley Division, DIVR 1110-1-400, December 1998

[6] "Design Guidance for Levee Underseepage" U.S. Army Corps of Engineers, ETL 1110-2-569, Washington, DC, May 2005

[7] "Lower San Joaquin River Flood Control Project, Eastside Bypass", California Department of Water Resources, Division of Design and Construction, Specification No. 61-01, March 1961

[8] "GeoStudio 2007, Version 7.13", Slope/W, Users Guide, GEO-SLOPE International, Ltd, Calgary, Alberta, Canada, 2004

[9] "2010 Geologic Investigation Report, Proposed Water Treatment Demonstration Plant, Central Valley Project, San Luis Drain", Bureau of Reclamation, Sacramento, California, January 2011

Figures

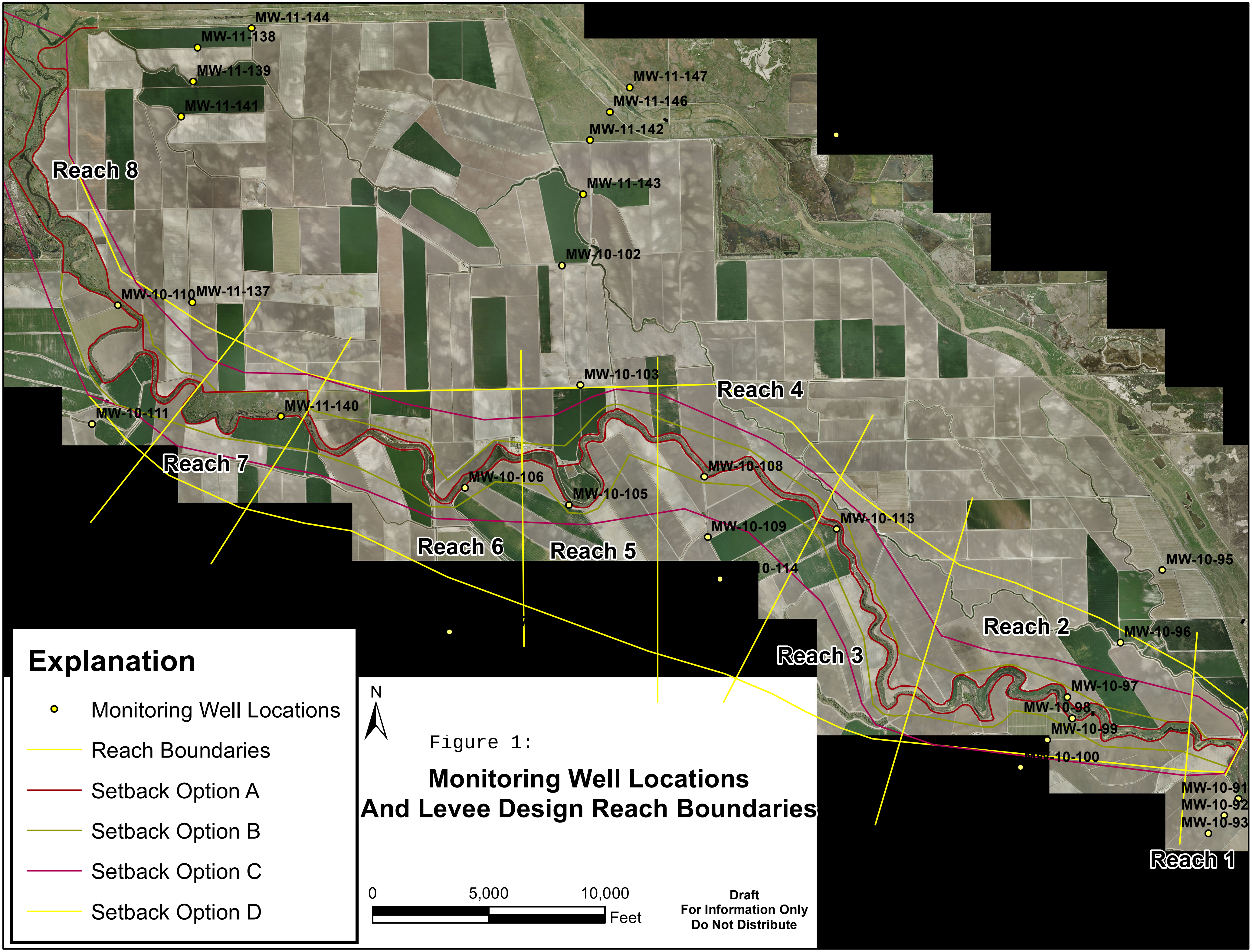

Figure 1:

Monitoring Well Locations And Levee Design Reach Boundaries

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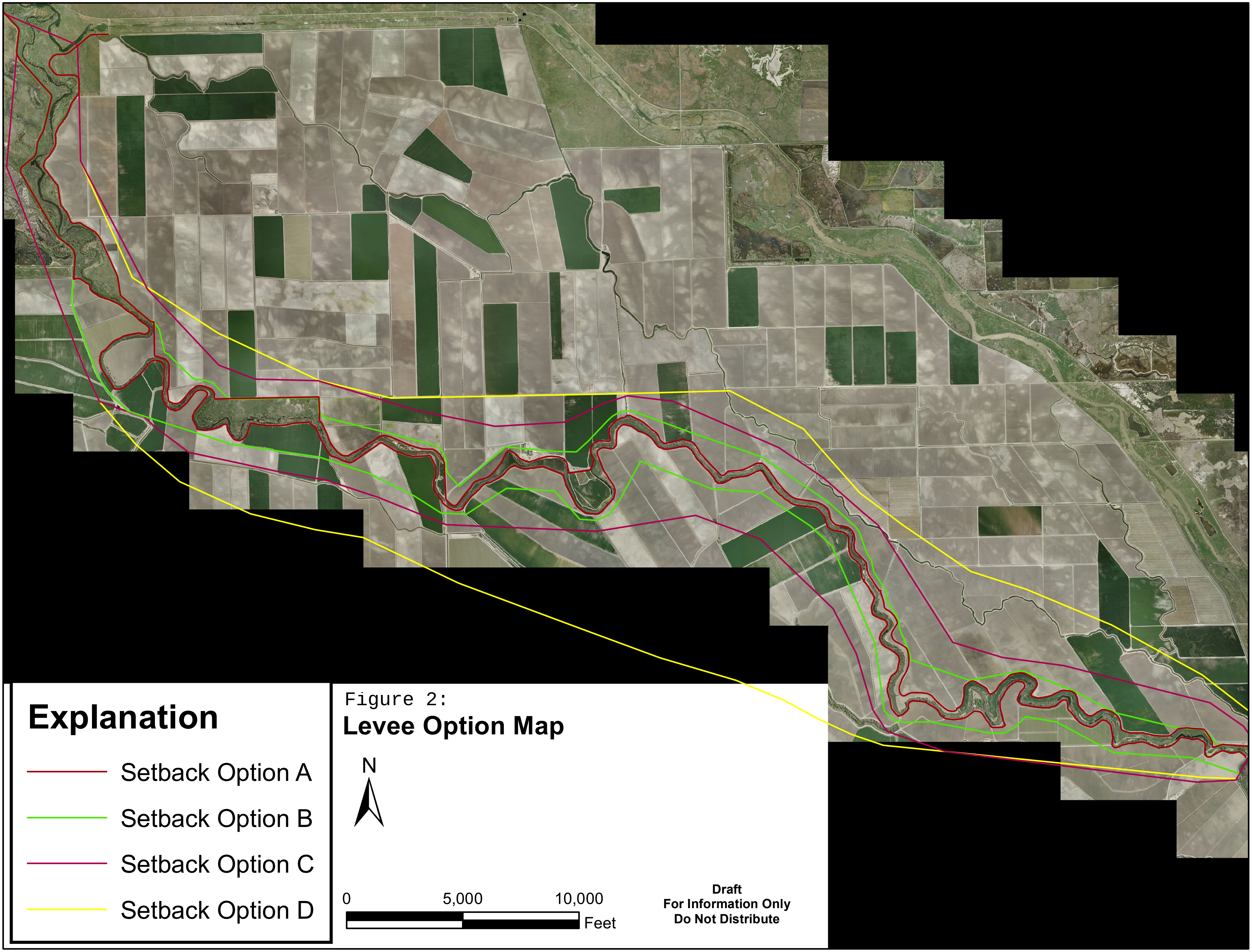


Figure 2:
Levee Option Map

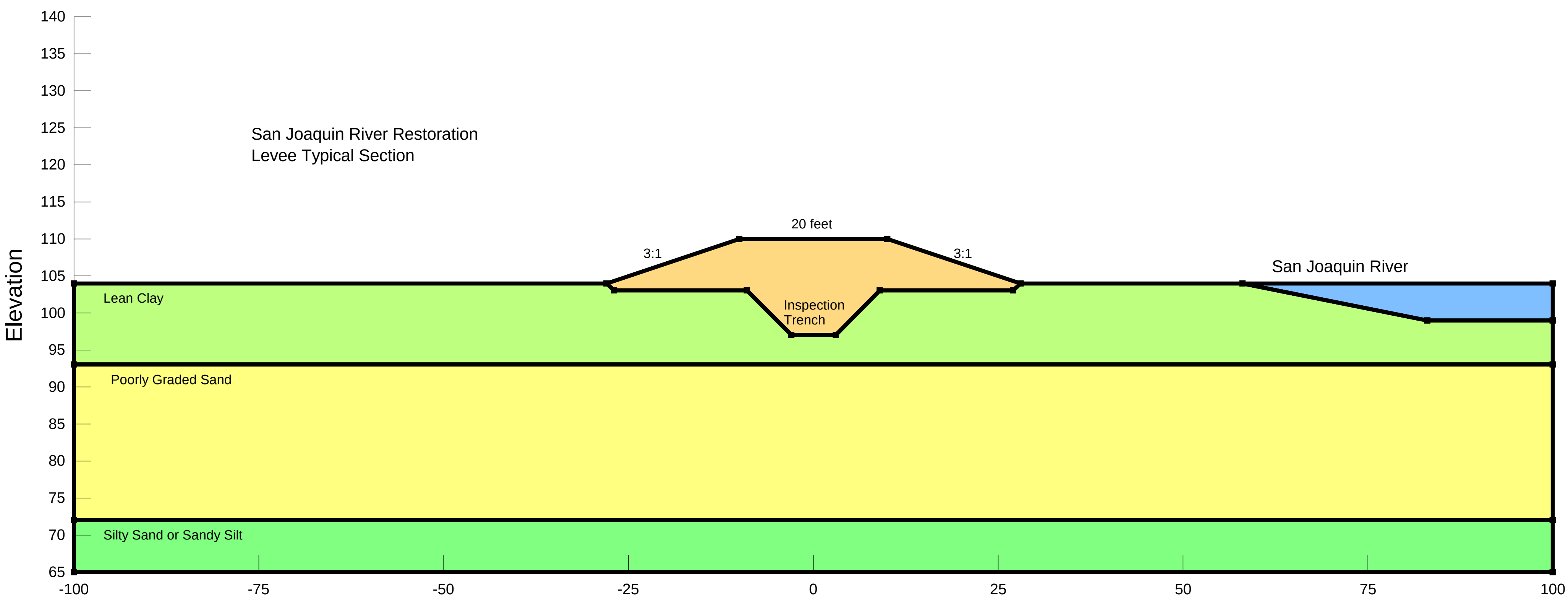
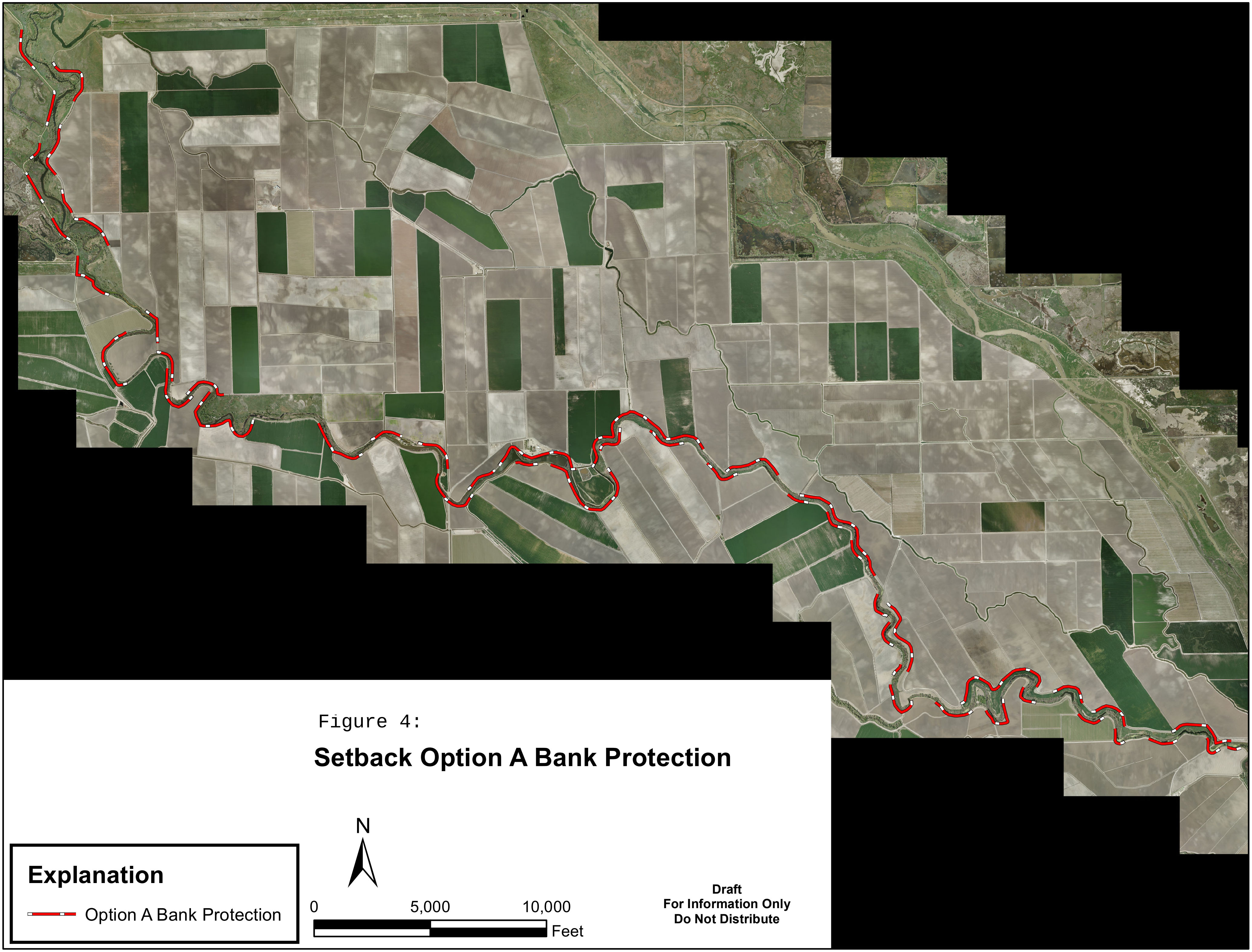


Figure 3: Levee Typical Section

Figure 4:

Setback Option A Bank Protection



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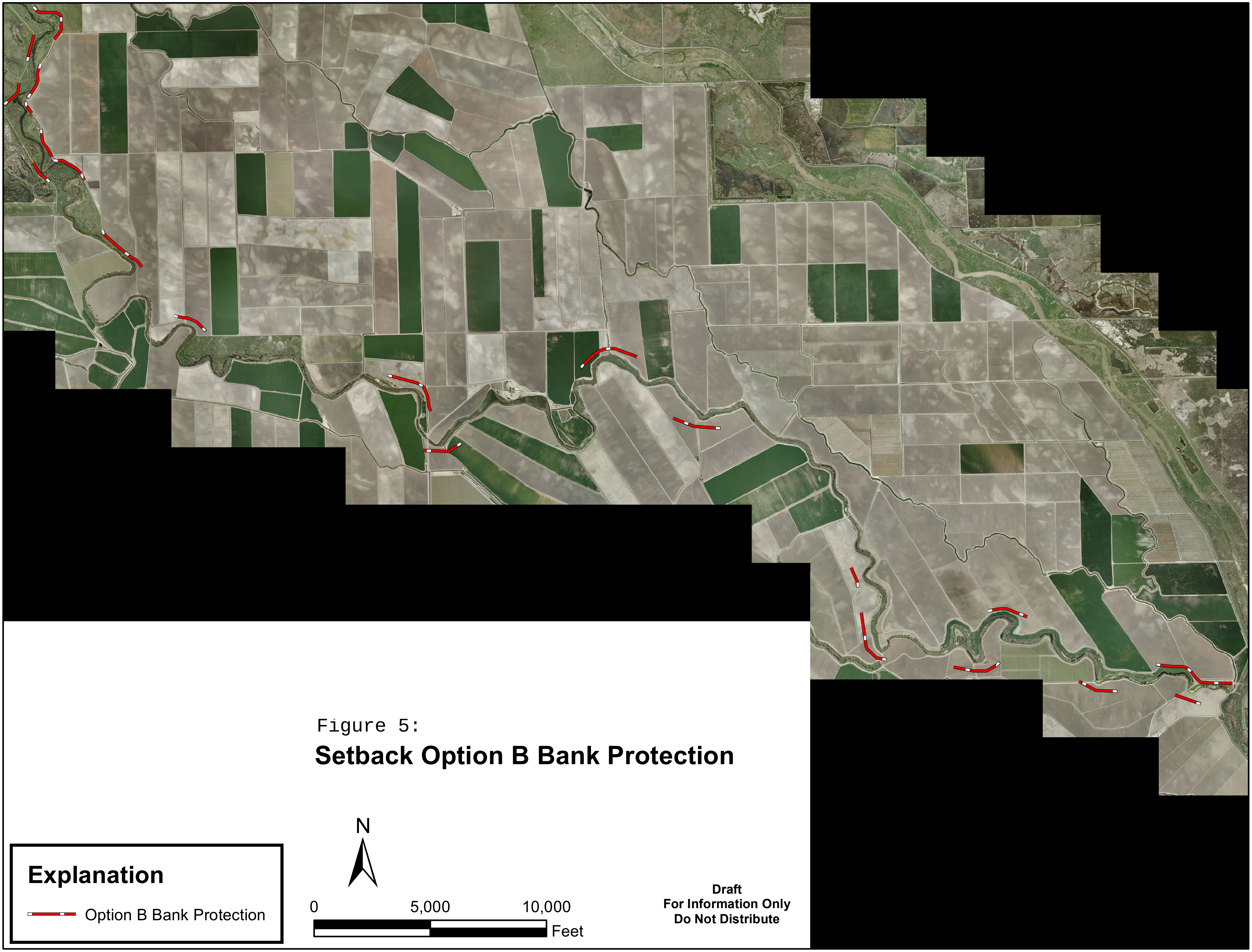

Figure 5:

Setback Option B Bank Protection

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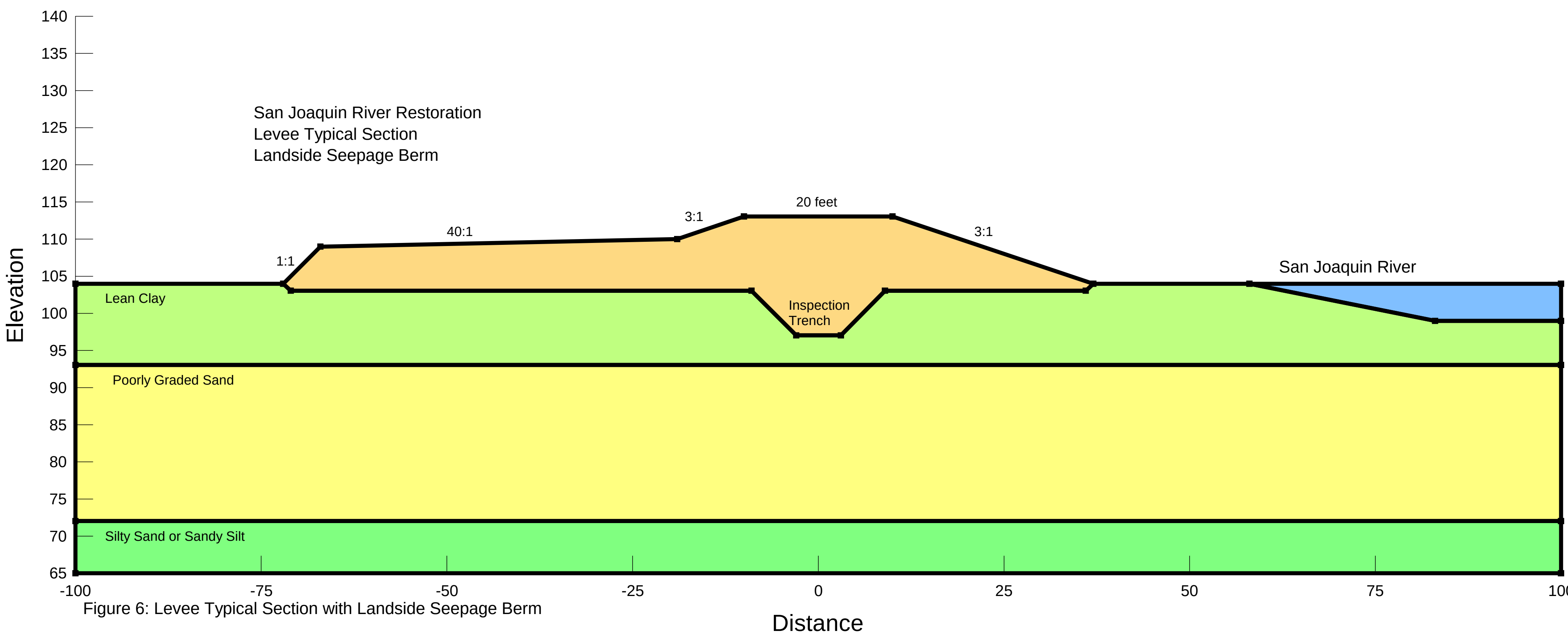


Figure 6: Levee Typical Section with Landside Seepage Berm

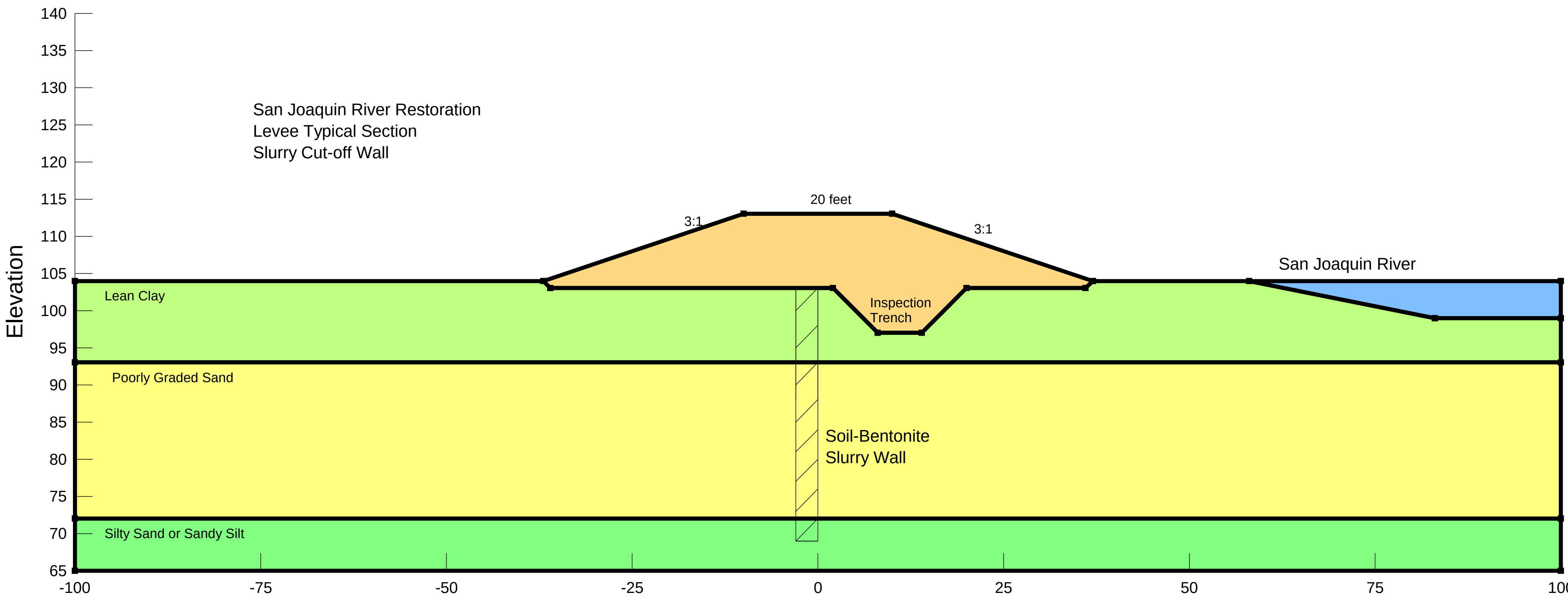


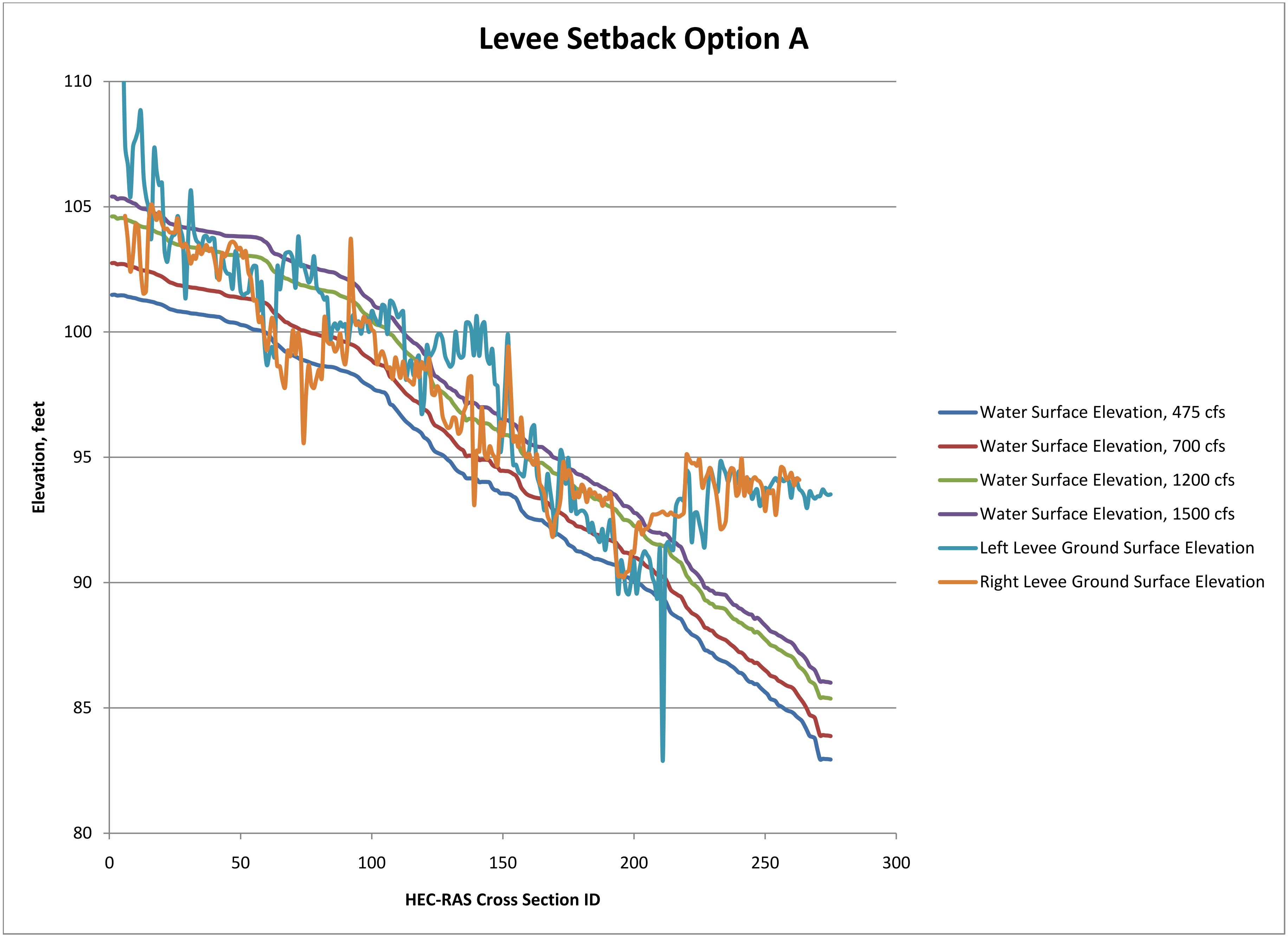
Figure 7: Levee Typical Section with Slurry Cut-off Wall

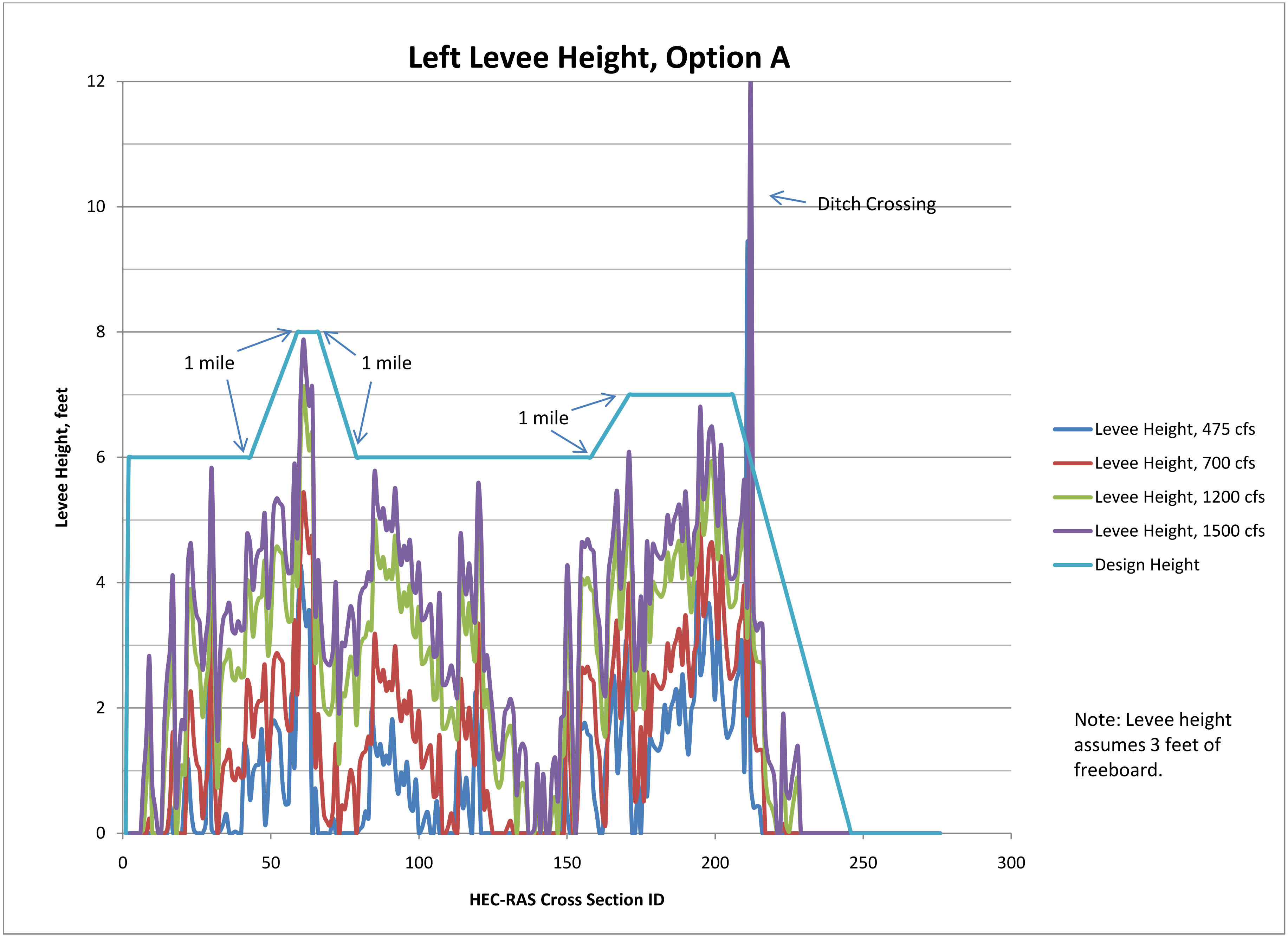
Attachment A

Water Elevation

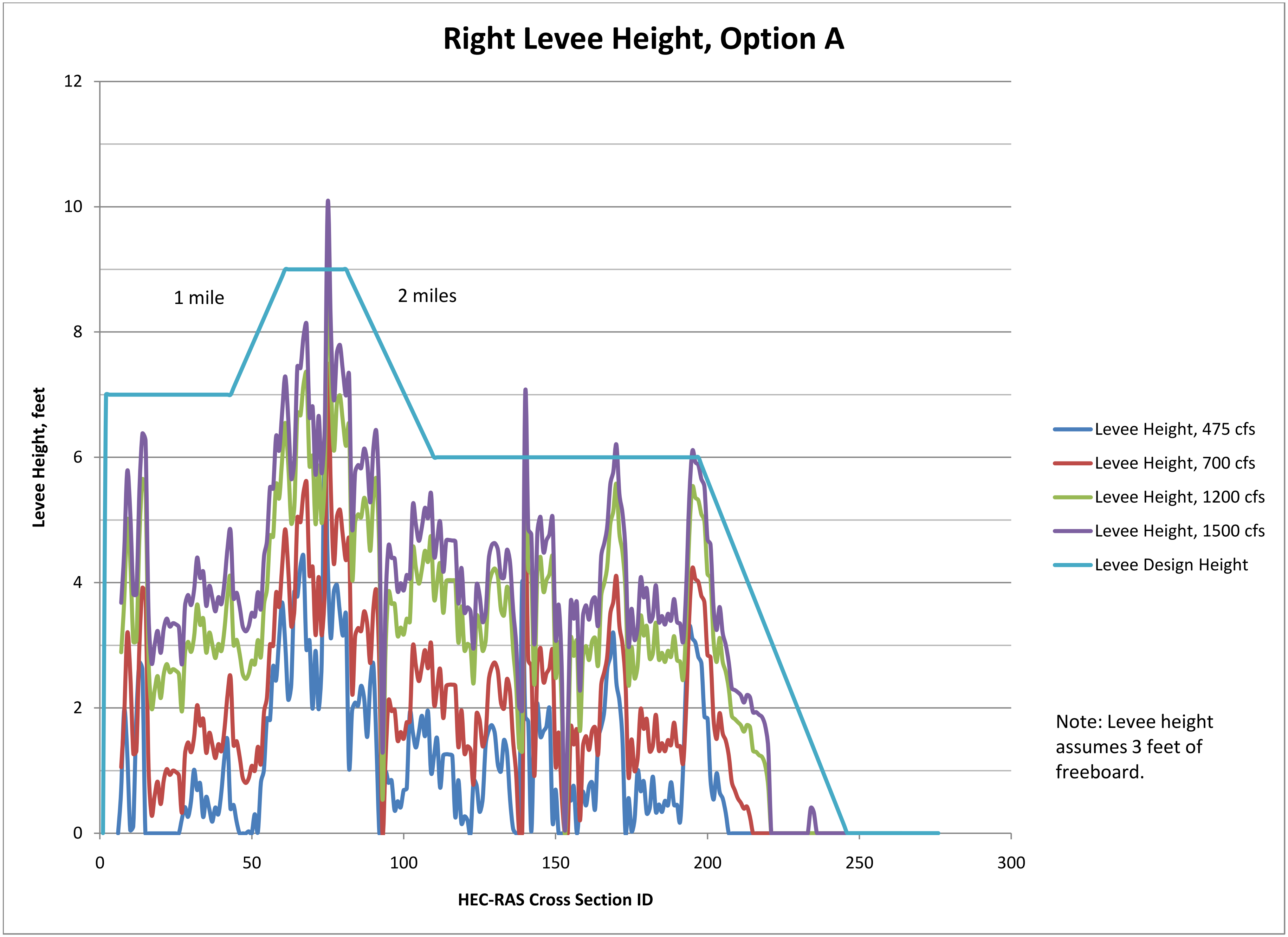
And

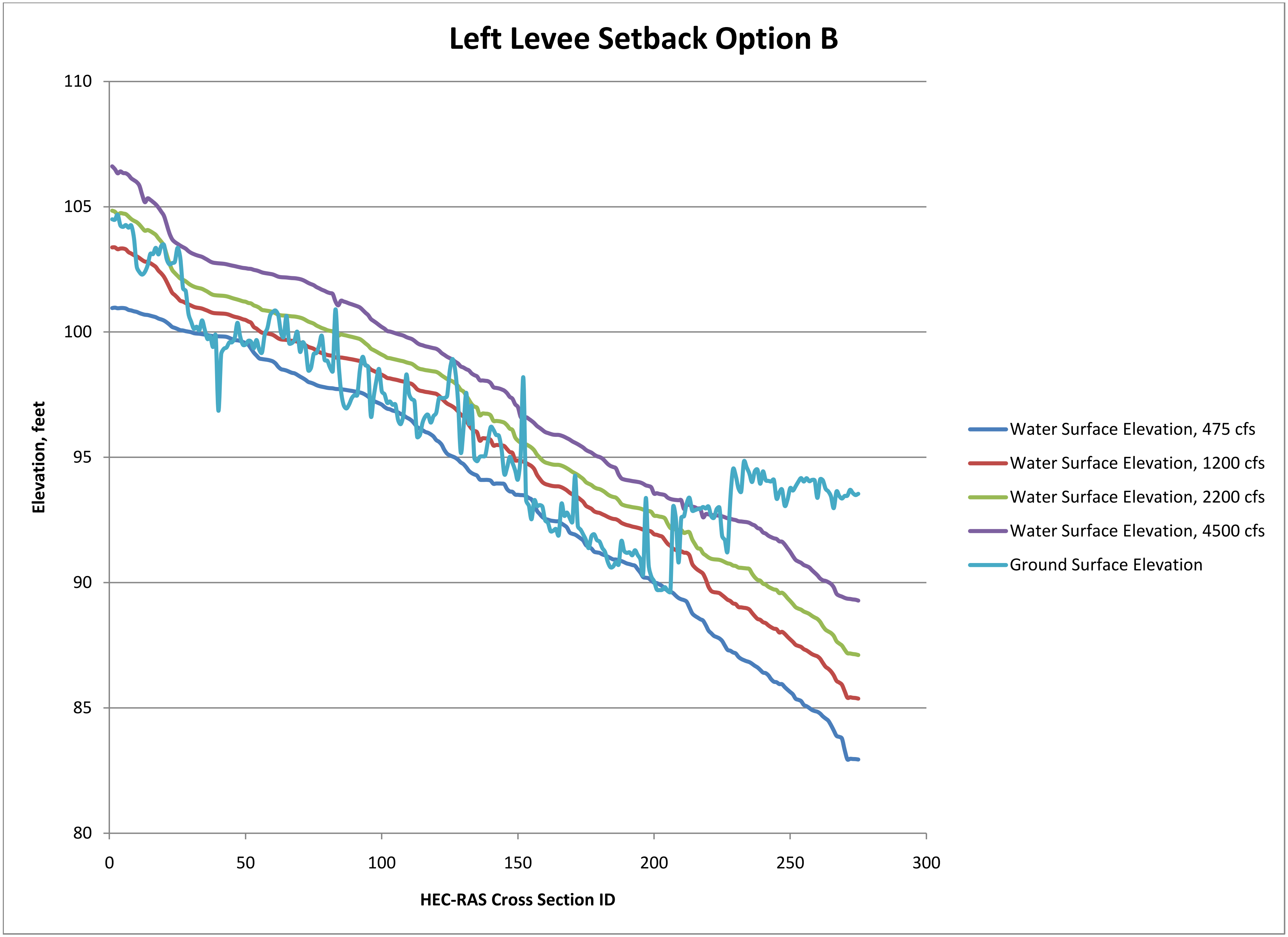
Levee Height

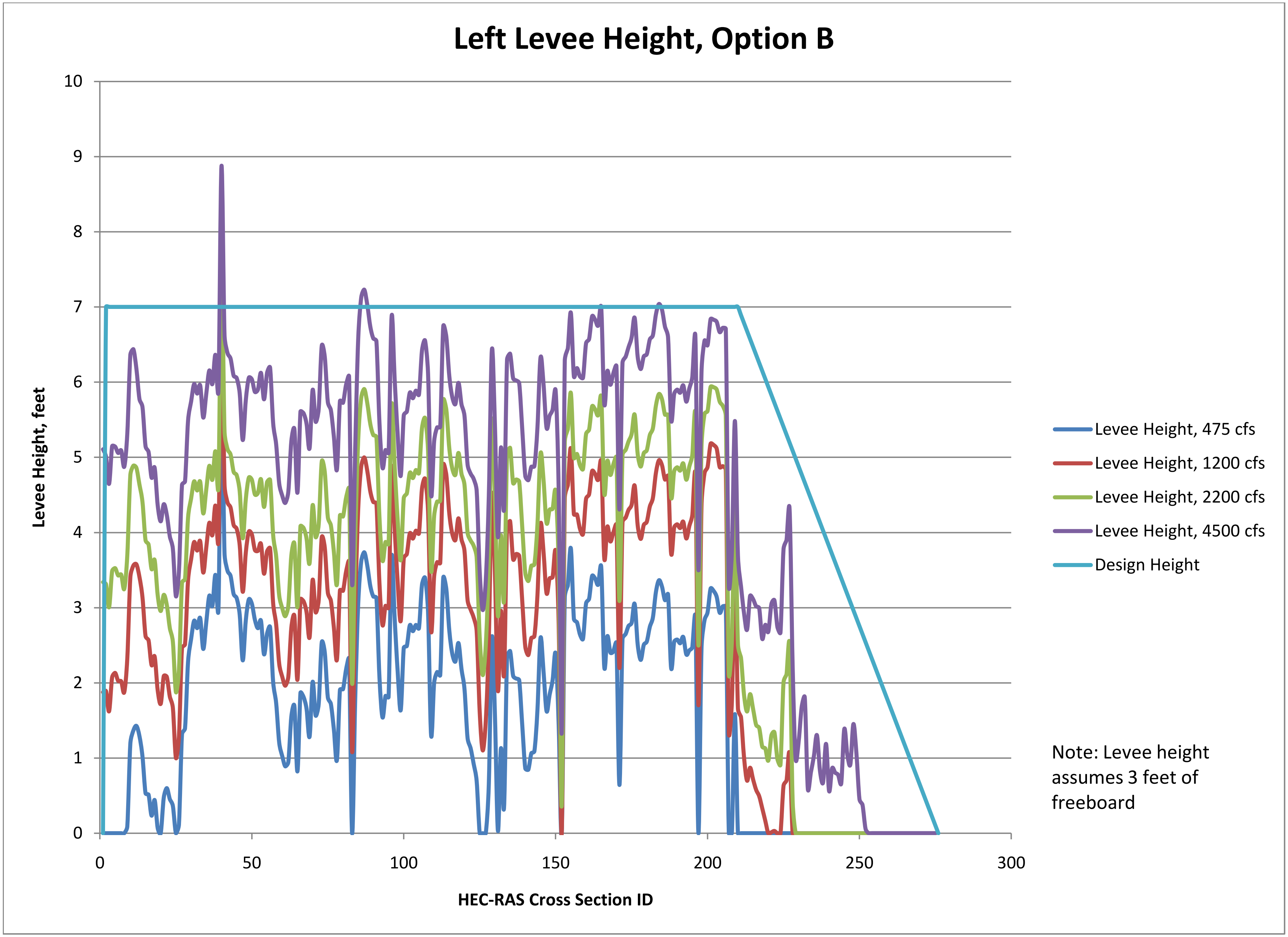

Levee Setback Option A
110
105
100
95
90
85
80
Elevation, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 700 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 1500 cfs
Left Levee Ground Surface Elevation
Right Levee Ground Surface Elevation

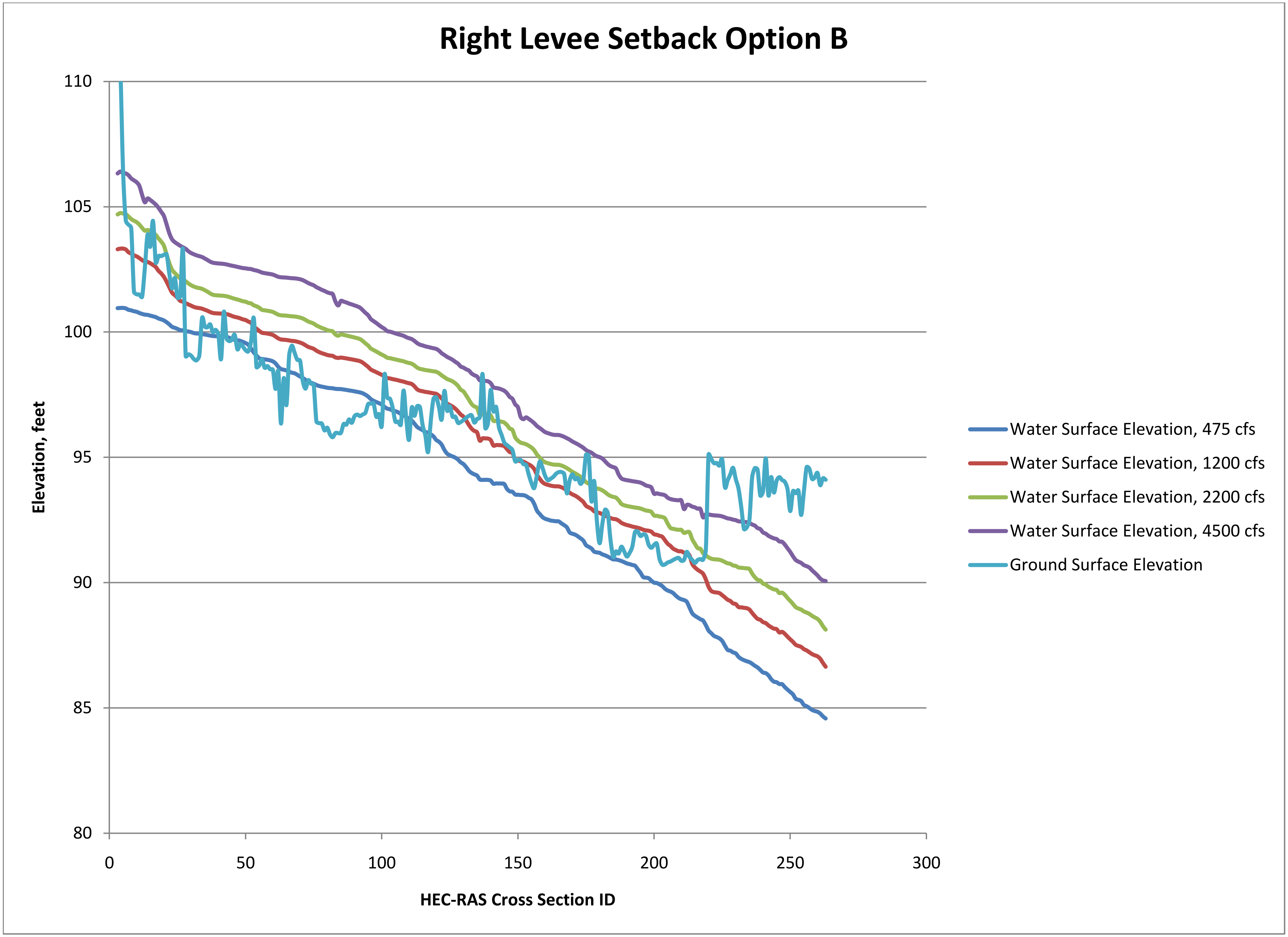


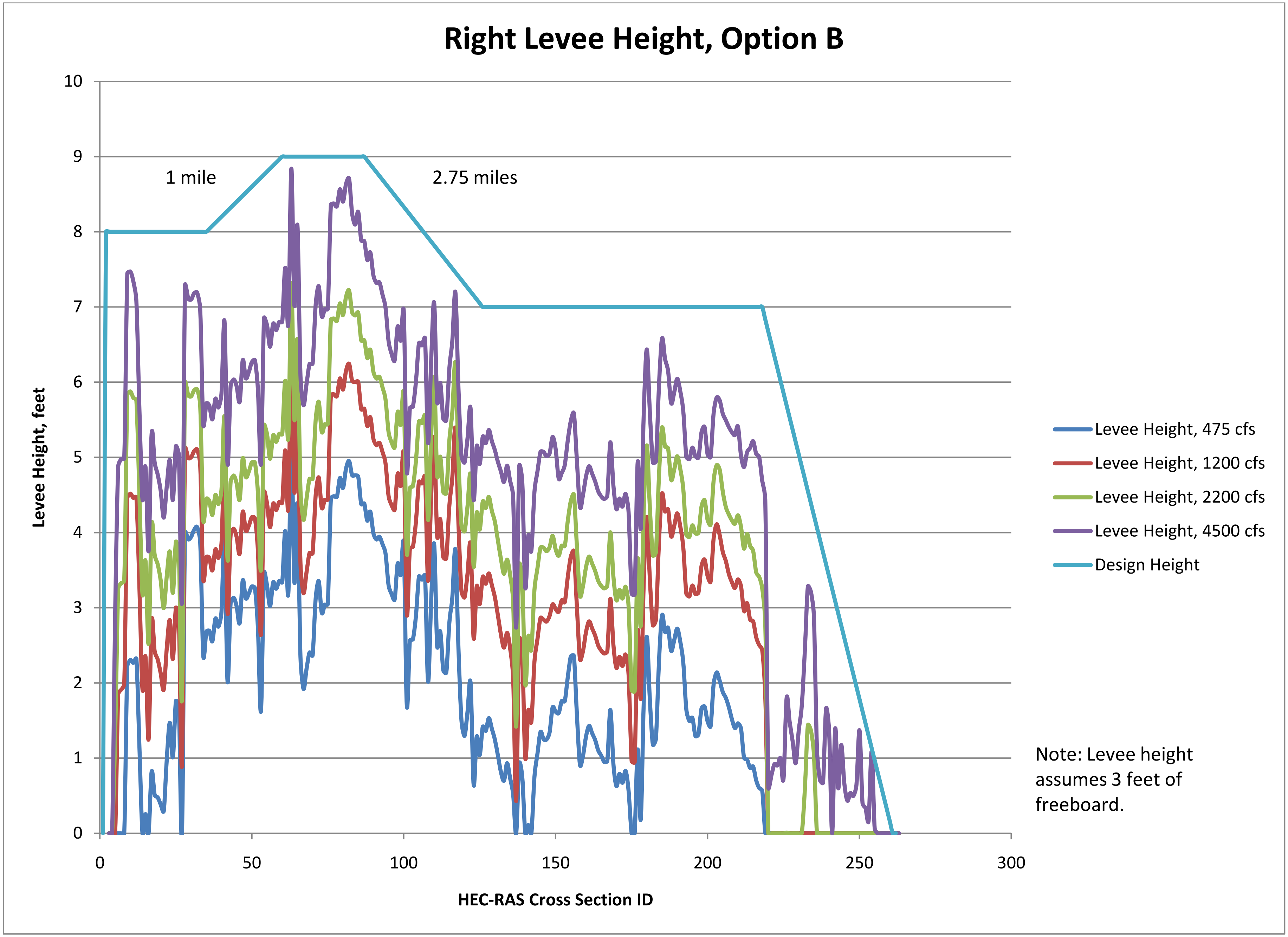
Left Levee Height, Option A
12
10
8
6
4
2
0
Levee Height, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
1 mile
1 mile
1 mile
Ditch Crossing
Levee Height, 475 cfs
Levee Height, 700 cfs
Levee Height, 1200 cfs
Levee Height, 1500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.


Right Levee Height, Option A
12
10
8
6
4
2
0
Levee Height, feet
1 mile
2 miles
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Levee Height, 475 cfs
Levee Height, 700 cfs
Levee Height, 1200 cfs
Levee Height, 1500 cfs
Levee Design Height
Note: Levee height assumes 3 feet of freeboard.

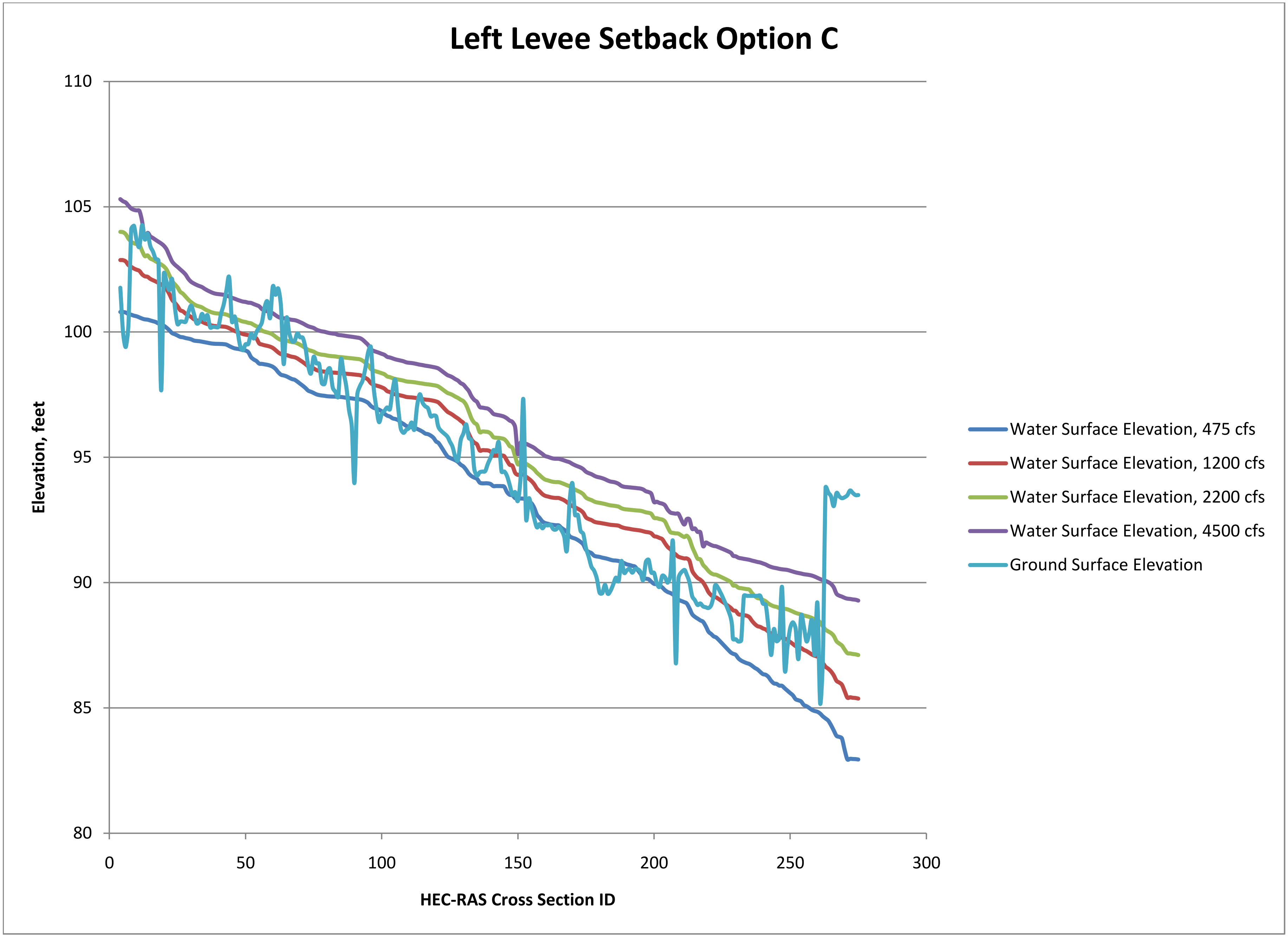

Left Levee Setback Option B
Elevation, feet
110
105
100
95
90
85
80
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation


Left Levee Height, Option B
Levee Height, feet
HEC-RAS Cross Section ID
0
1
2
3
4
5
6
7
8
9
10
0
50
100
150
200
250
300
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard

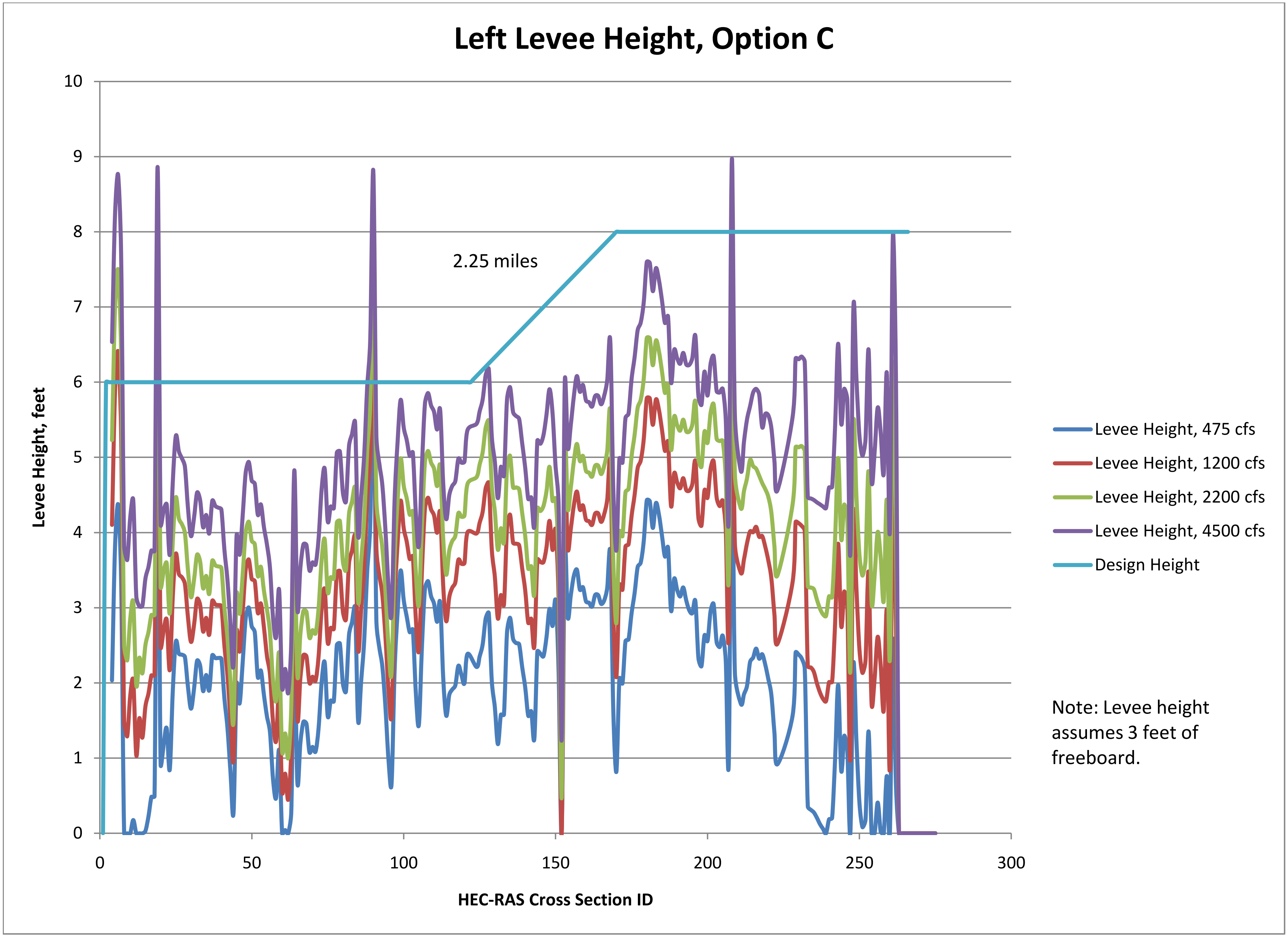

Right Levee Setback Option B
Elevation, feet
110
105
100
95
90
85
80
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation



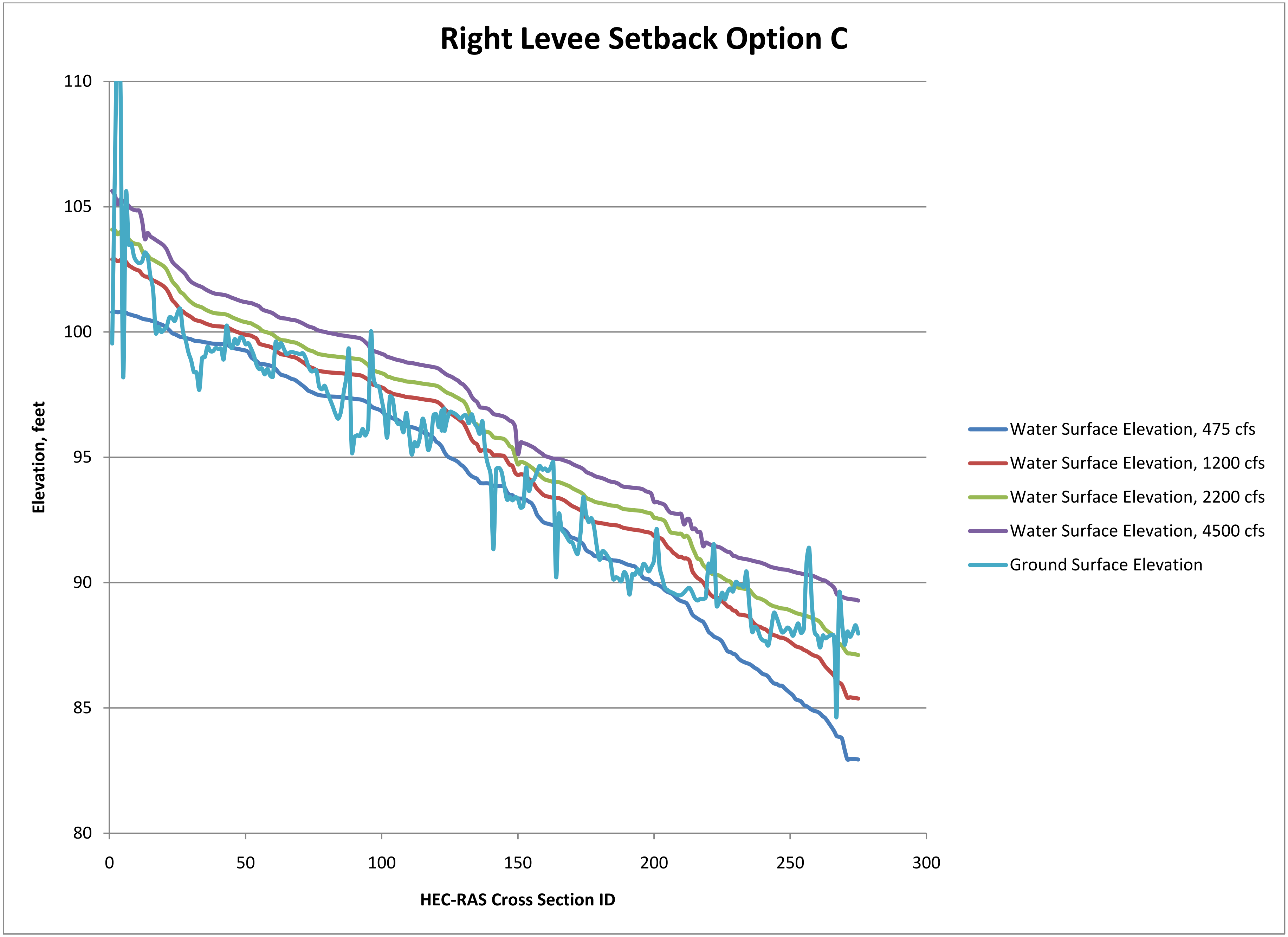
Right Levee Height, Option B
Levee Height, feet
HEC-RAS Cross Section ID
0
1
2
3
4
5
6
7
8
9
10
0
50
100
150
200
250
300
1 mile
2.75 miles
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

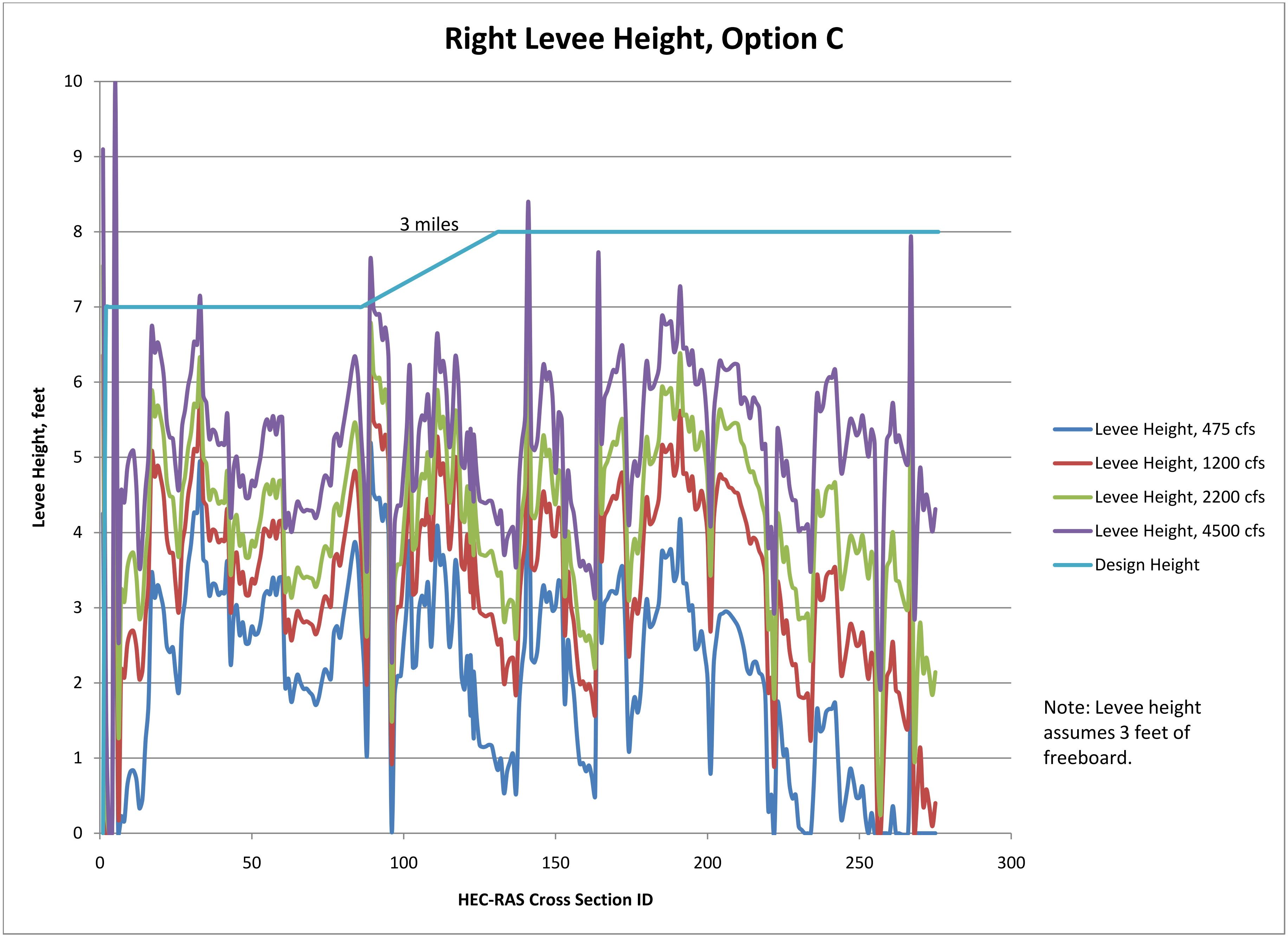


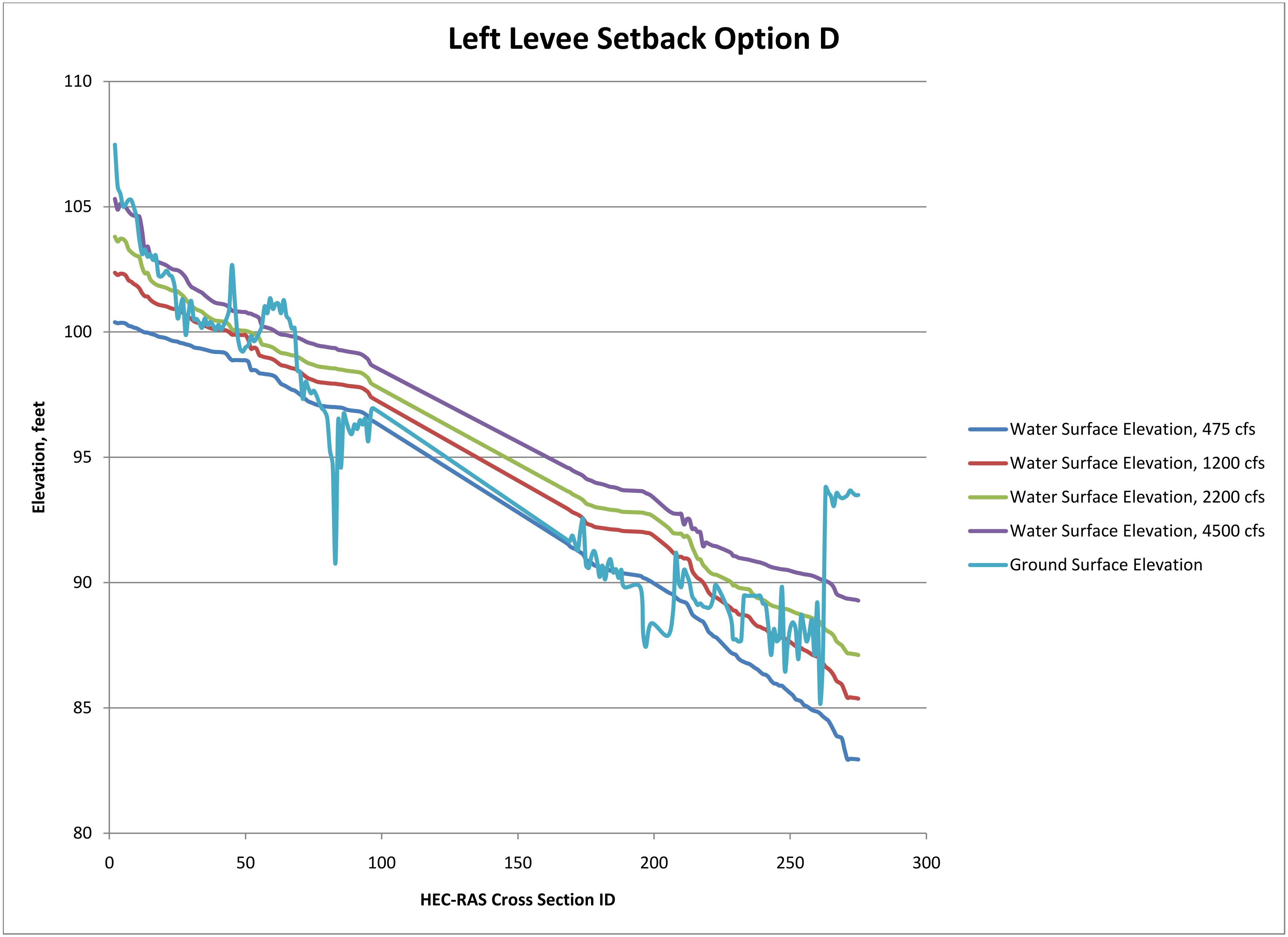
Left Levee Setback Option C
110
105
100
95
90
85
80
Elevation, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation

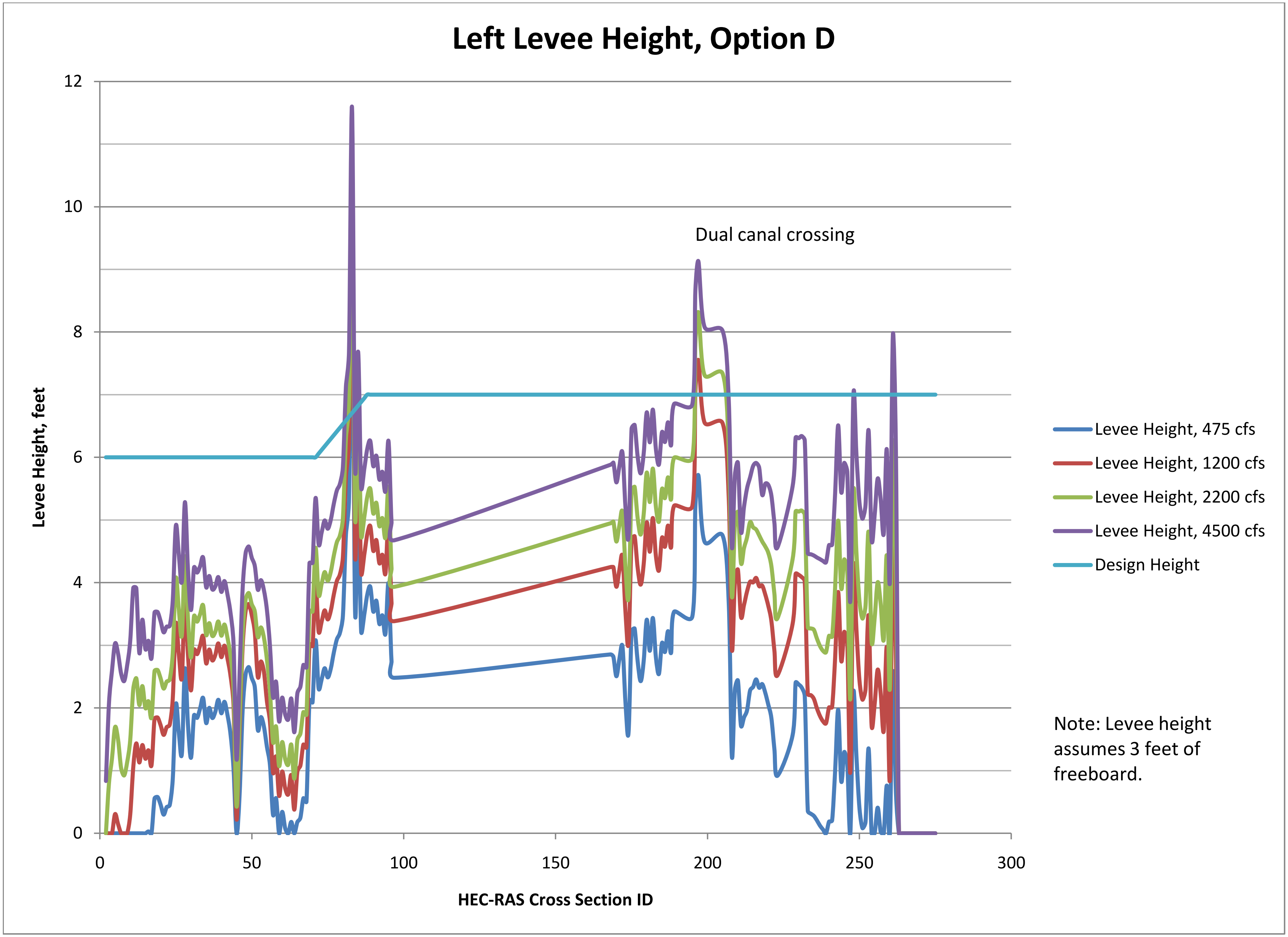


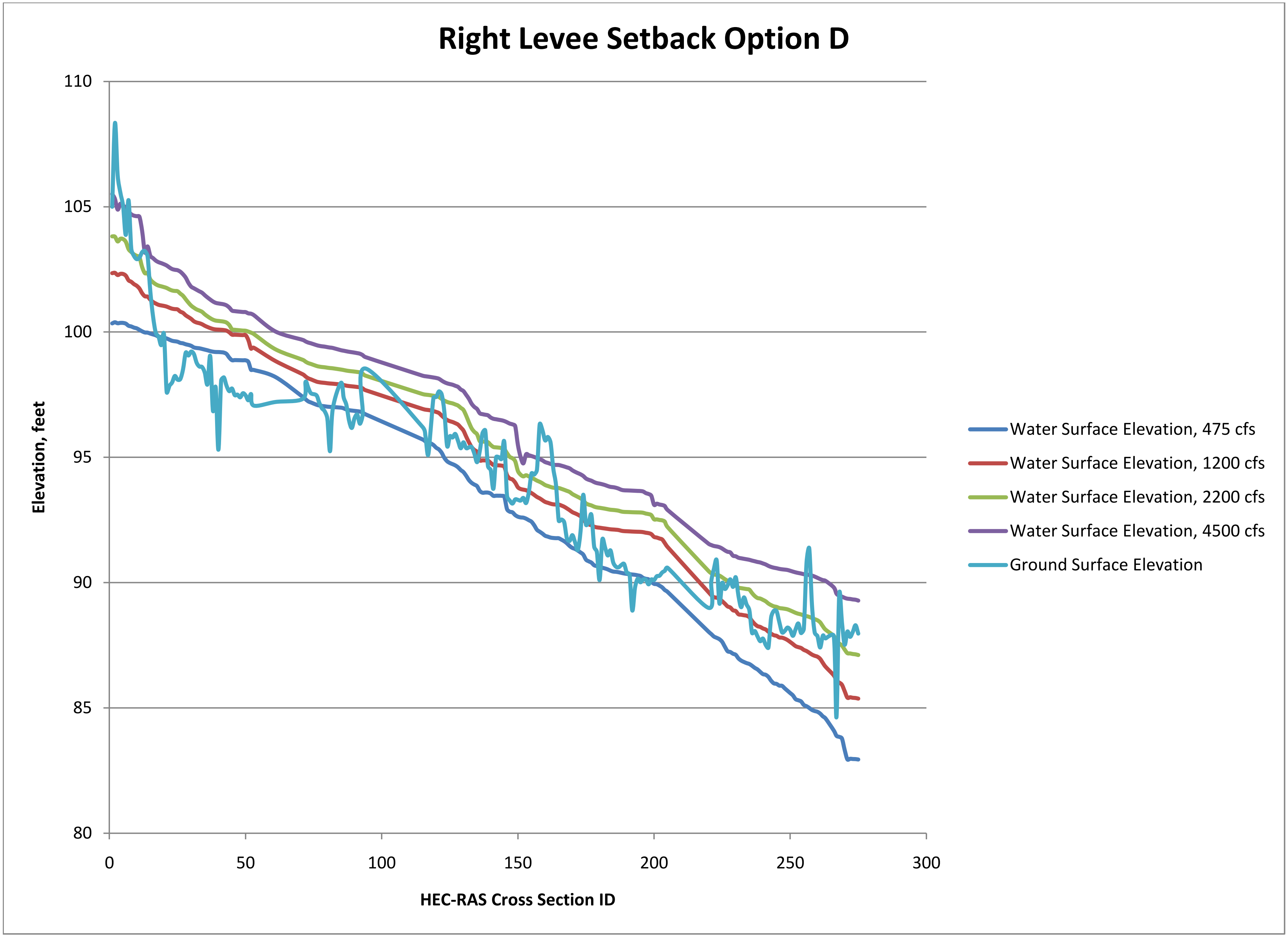
Left Levee Height, Option C
10
9
8
7
6
5
4
3
2
1
0
0
50
100
150
200
250
300
2.25 miles
Levee Height, feet
HEC-RAS Cross Section ID
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

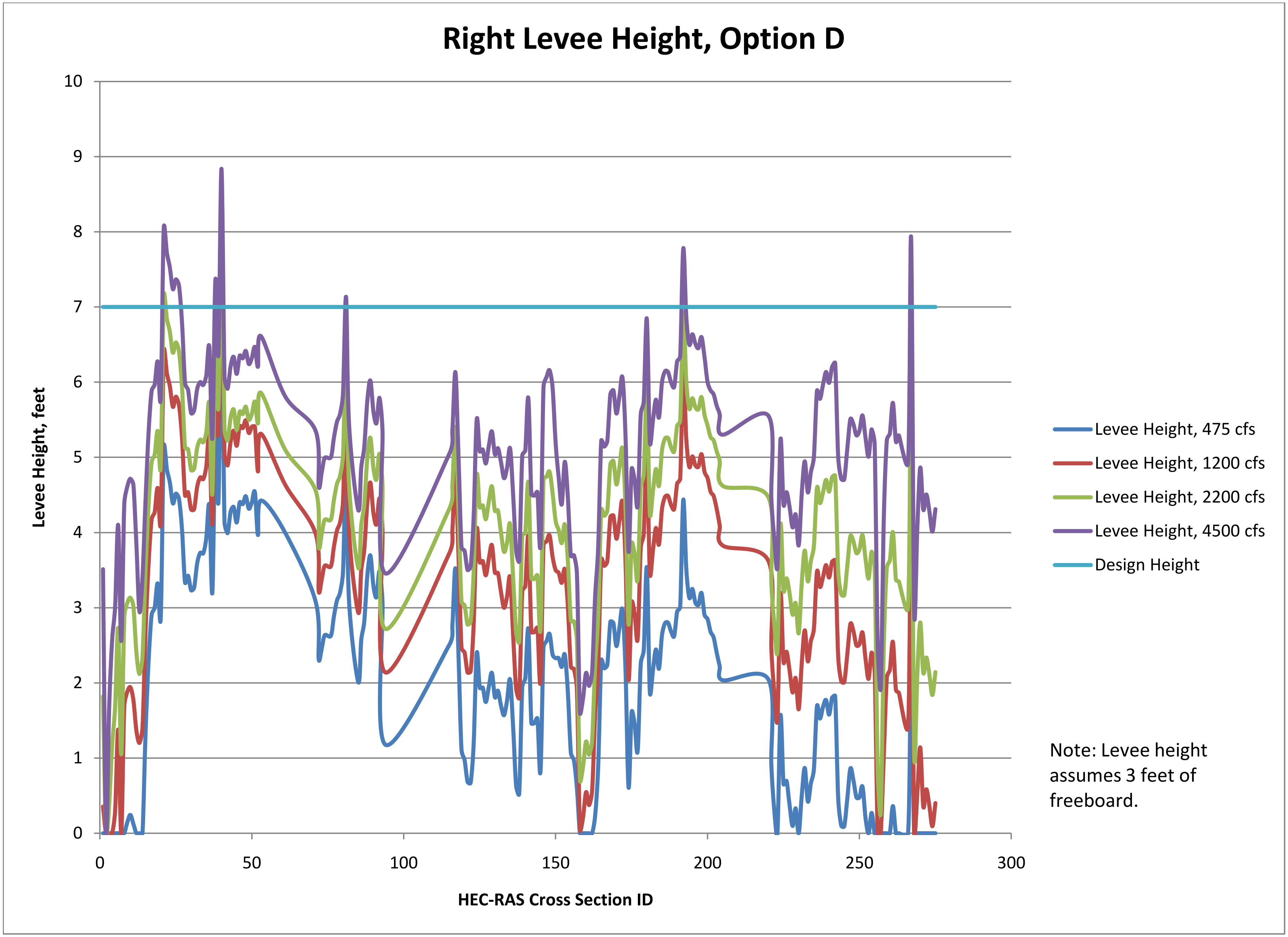

Right Levee Setback Option C
110
105
100
95
90
85
80
0
50
100
150
200
250
300
Elevation, feet
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation


Right Levee Height, Option C
Levee Height, feet
HEC-RAS Cross Section ID
3 miles
0
1
2
3
4
5
6
7
8
9
10
0
50
100
150
200
250
300
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.


Left Levee Setback Option D
Elevation, feet
110
105
100
95
90
85
80
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation


Left Levee Height, Option D
Levee Height, feet
HEC-RAS Cross Section ID
0
2
4
6
8
10
12
0
50
100
150
200
250
300
Dual canal crossing
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

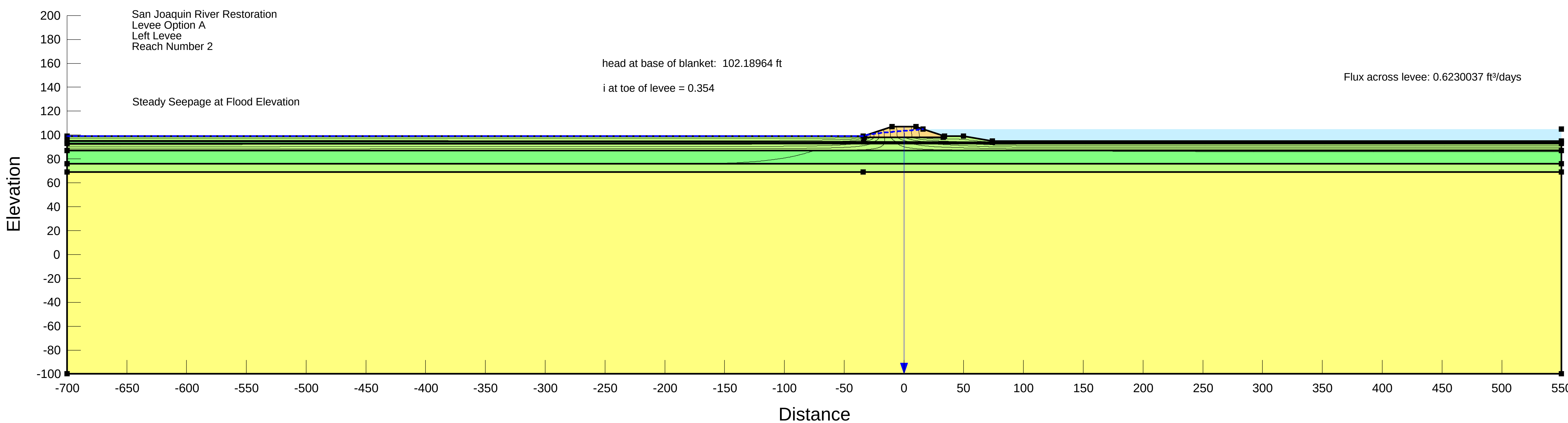

Right Levee Setback Option D
Elevation, feet
HEC-RAS Cross Section ID
110
105
100
95
90
85
80
0
50
100
150
200
250
300
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation

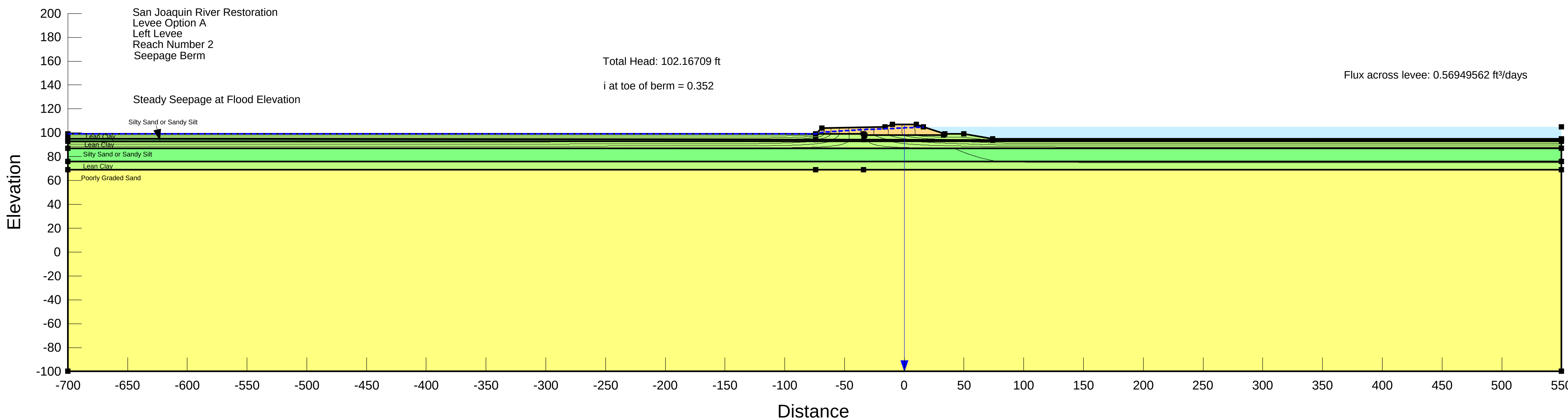


Right Levee Height, Option D
Levee Height, feet
10
9
8
7
6
5
4
3
2
1
0
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

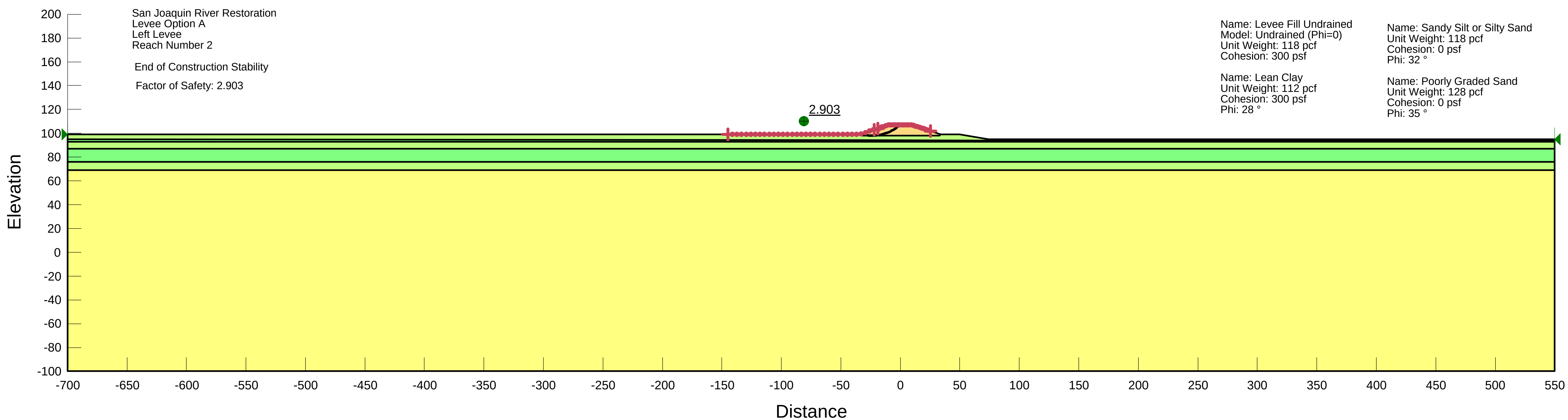
Attachment B

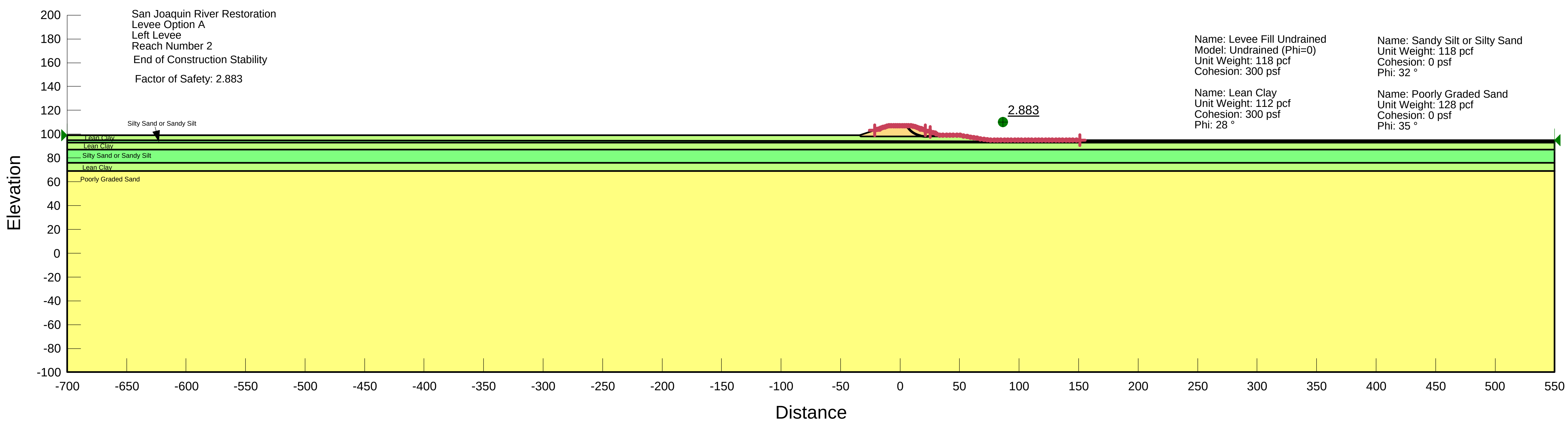
Levee Slope Stability Sections


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Steady Seepage at Flood Elevation
head at base of blanket: 102.18964 ft
i at toe of levee = 0.354
Flux across levee: 0.6230037 ft³/days
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

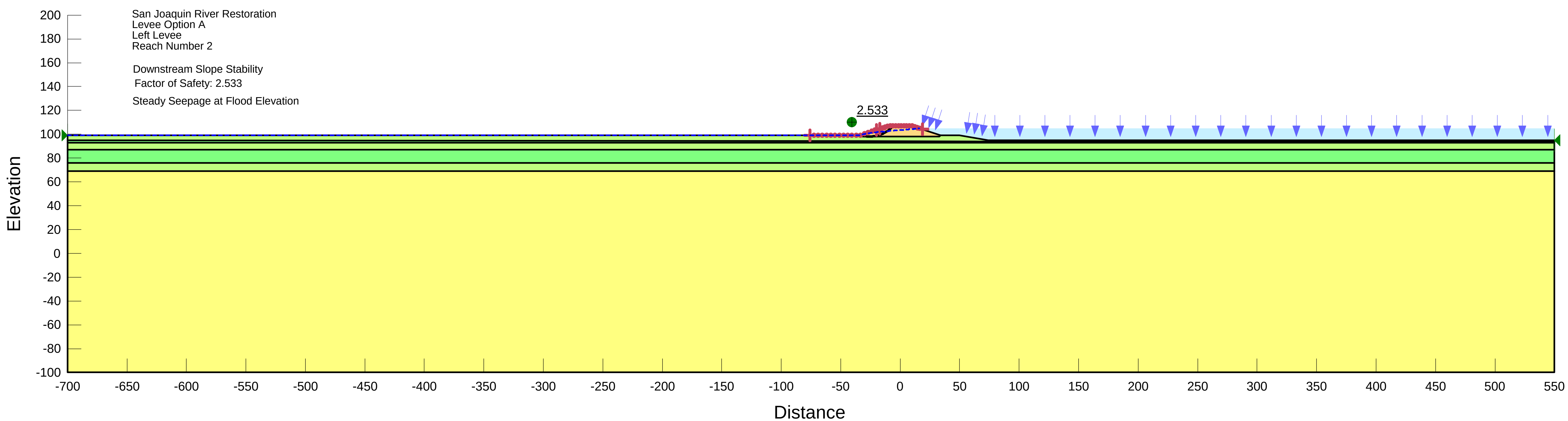


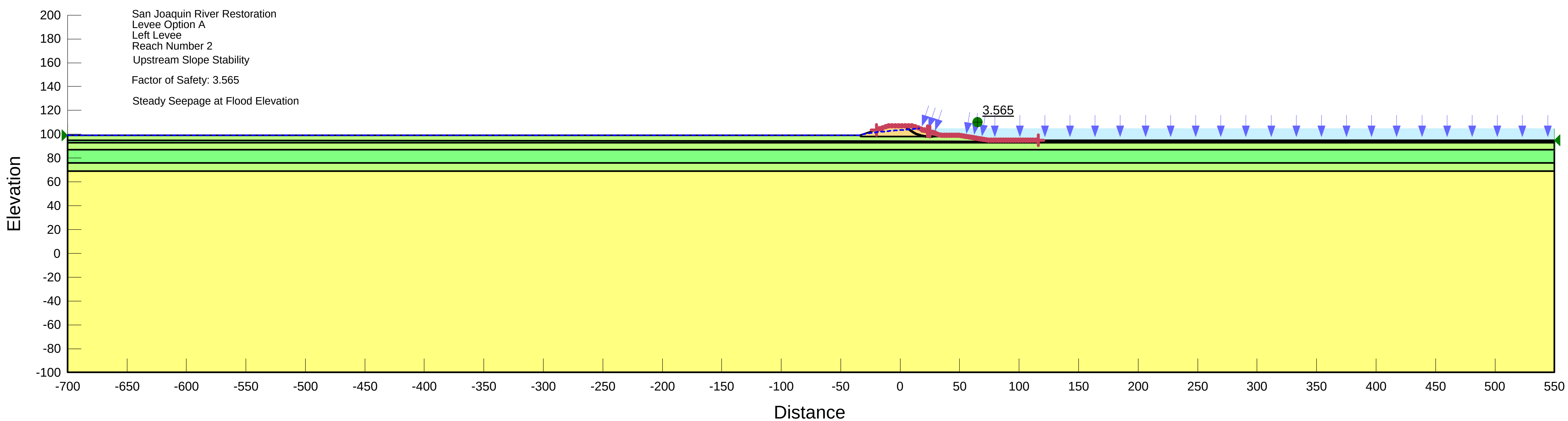
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Seepage Berm
Steady Seepage at Flood Elevation
Total Head: 102.16709 ft
i at toe of berm = 0.352
Flux across levee: 0.56949562 ft³/days
Silty Sand or Sandy Silt
Lean Clay
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

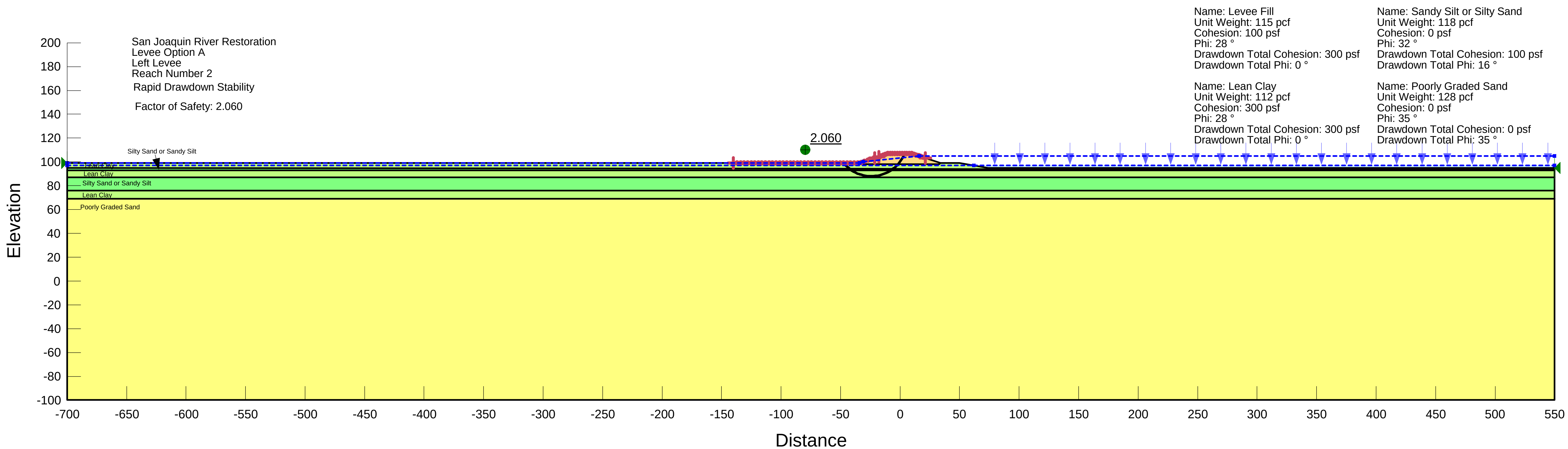

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
End of Construction Stability
Factor of Safety: 2.903
2.903
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Elevation
Distance

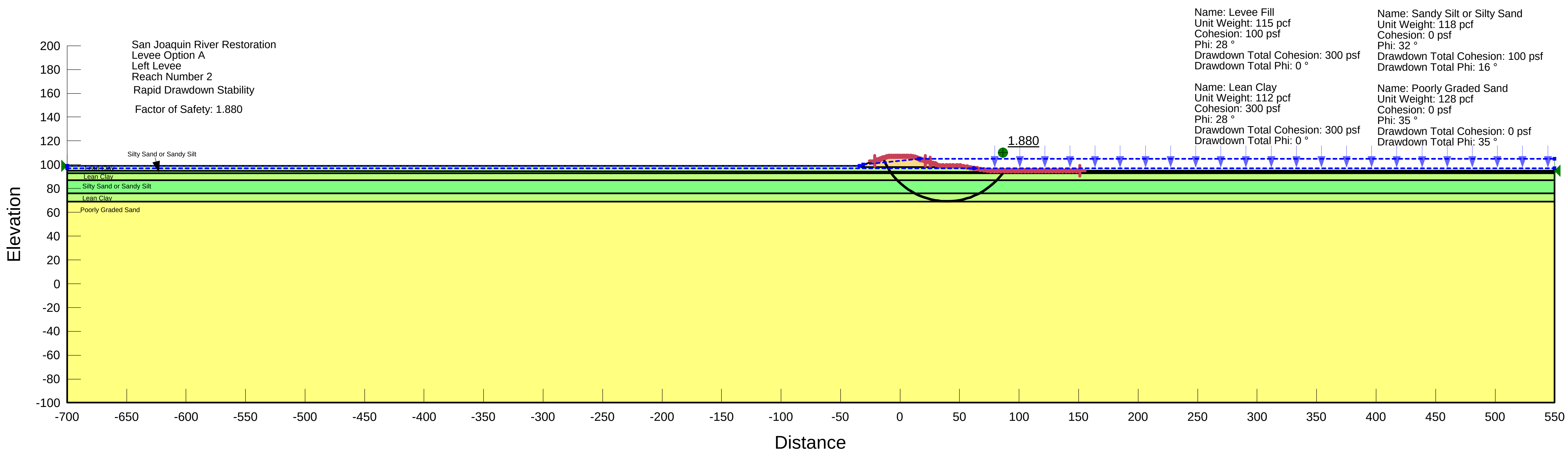


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
End of Construction Stability
Factor of Safety: 2.883
2.883
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance

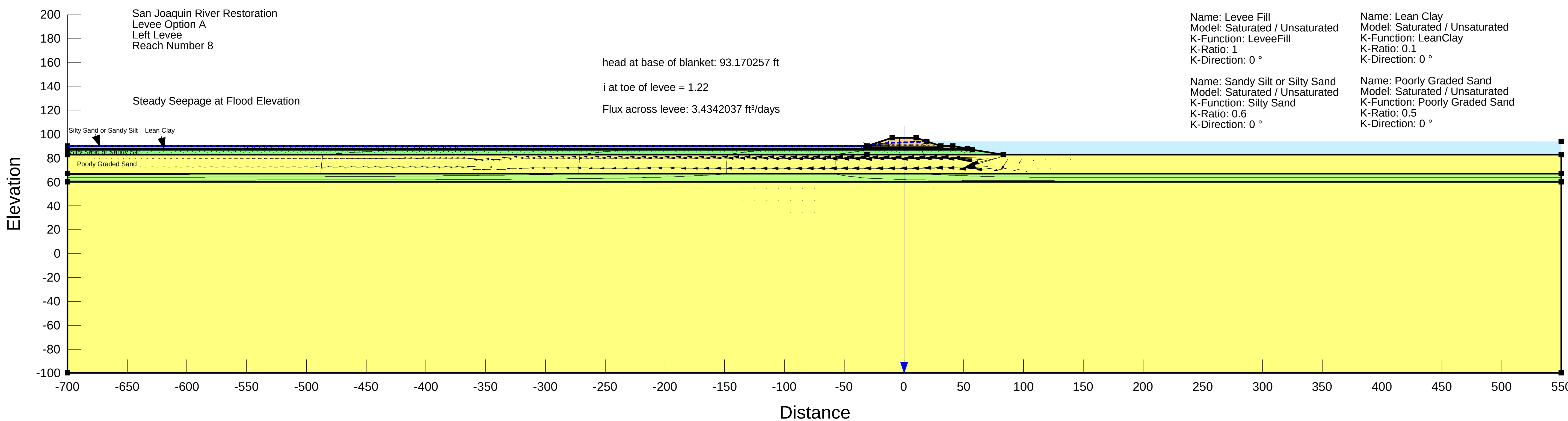

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Downstream Slope Stability
Factor of Safety: 2.533
Steady Seepage at Flood Elevation
2.533
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Upstream Slope Stability
Factor of Safety: 3.565
Steady Seepage at Flood Elevation
3.565
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550
Distance

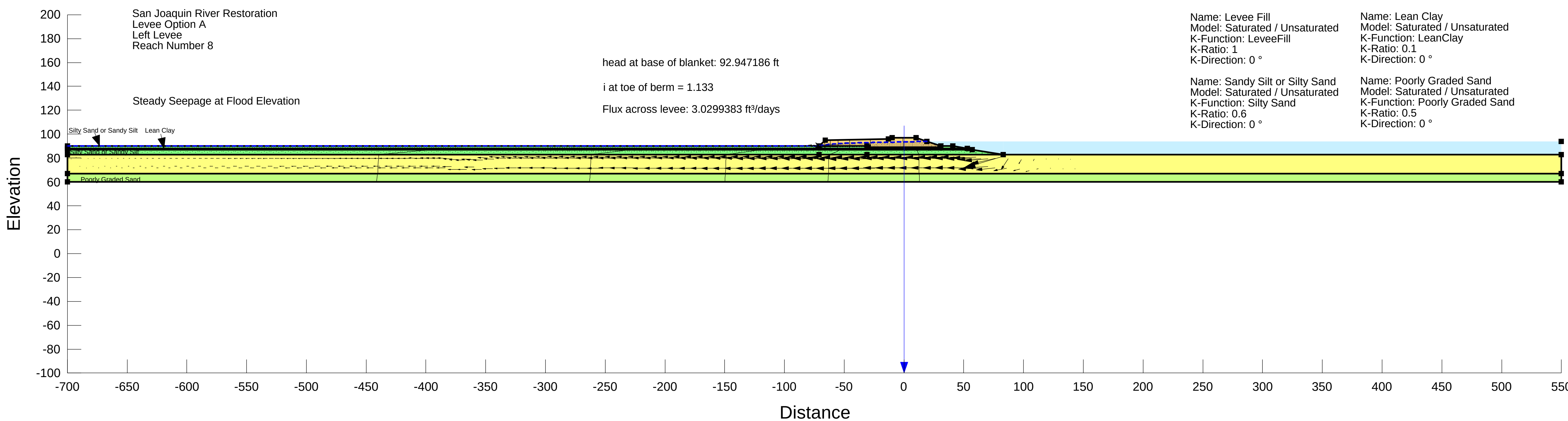

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Rapid Drawdown Stability
Factor of Safety: 2.060
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
2.060
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550
Distance

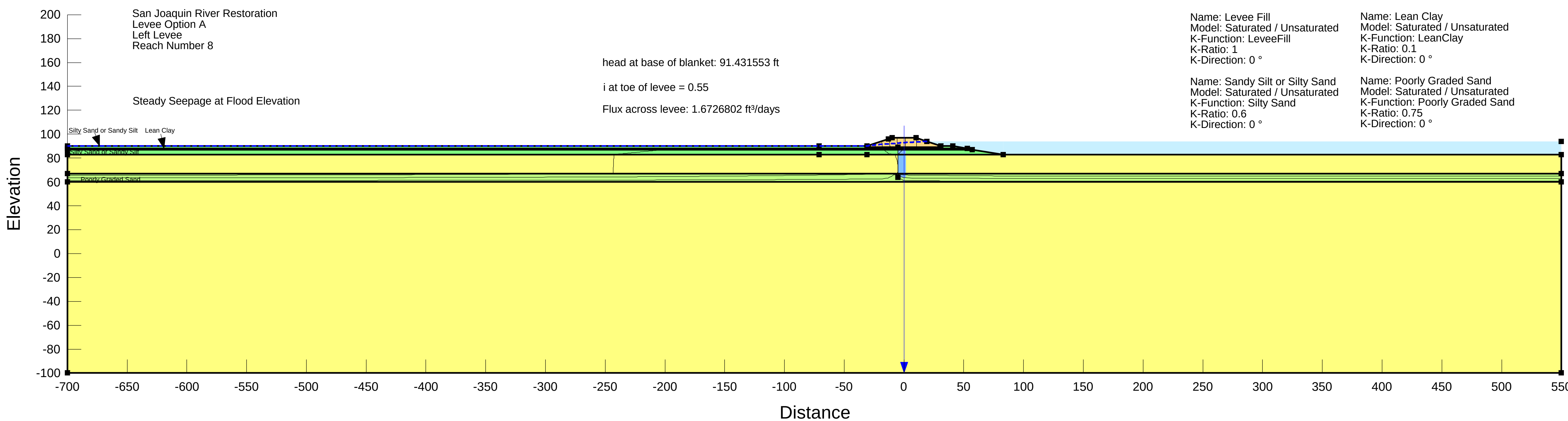


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Rapid Drawdown Stability
Factor of Safety: 1.880
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
1.880
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
Distance
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

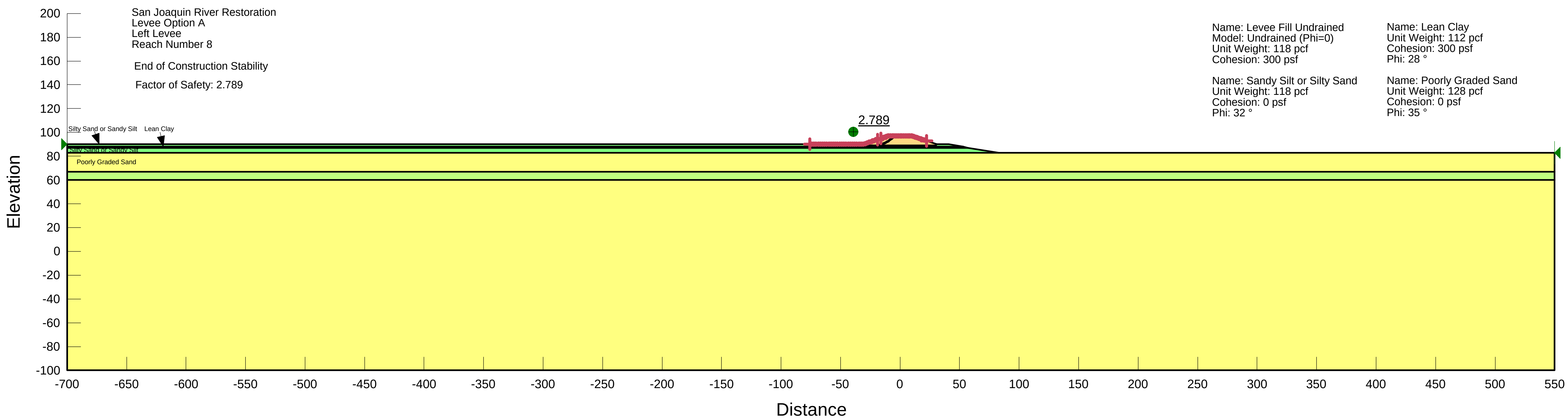


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Steady Seepage at Flood Elevation
head at base of blanket: 93.170257 ft
i at toe of levee = 1.22
Flux across levee: 3.4342037 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
K-Direction: 0 °
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
K-Direction: 0 °
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
K-Direction: 0 °
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
K-Direction: 0 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700 -650 -600 -550 -500 -450 -400 -350 -300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450 500 550
Distance

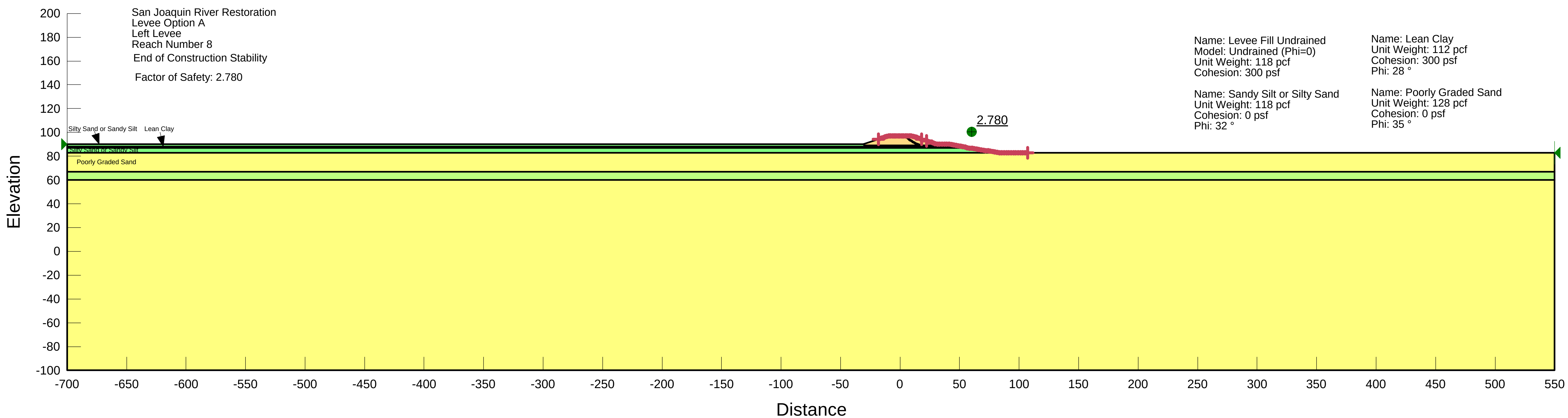

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Steady Seepage at Flood Elevation
head at base of blanket: 92.947186 ft
i at toe of berm = 1.133
Flux across levee: 3.0299383 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
K-Direction: 0 °
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
K-Direction: 0 °
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
K-Direction: 0 °
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
K-Direction: 0 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

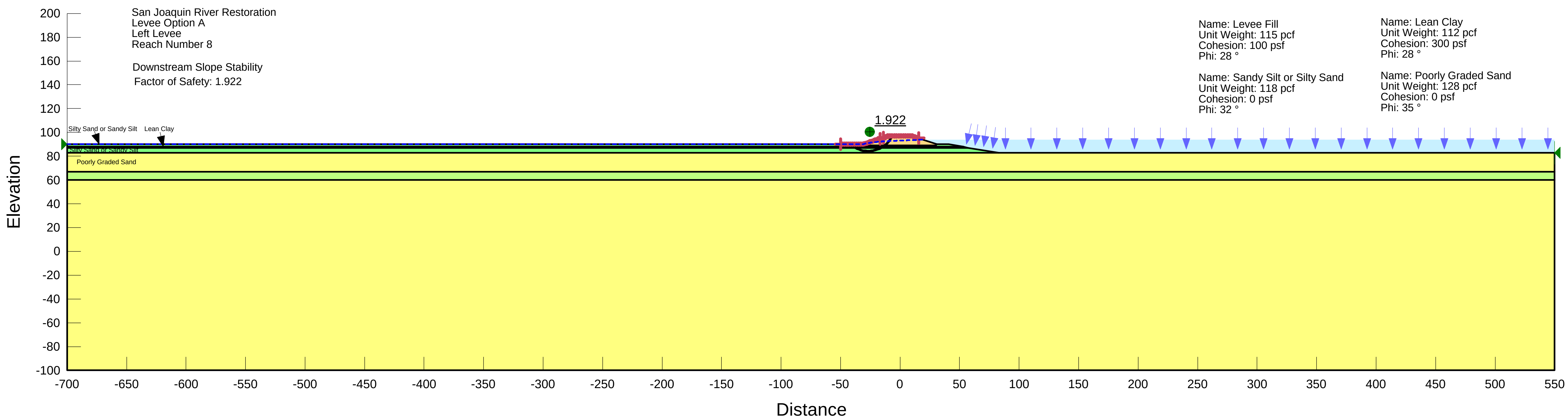


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Steady Seepage at Flood Elevation
head at base of blanket: 91.431553 ft
i at toe of levee = 0.55
Flux across levee: 1.6726802 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
K-Direction: 0 °
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
K-Direction: 0 °
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
K-Direction: 0 °
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.75
K-Direction: 0 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance

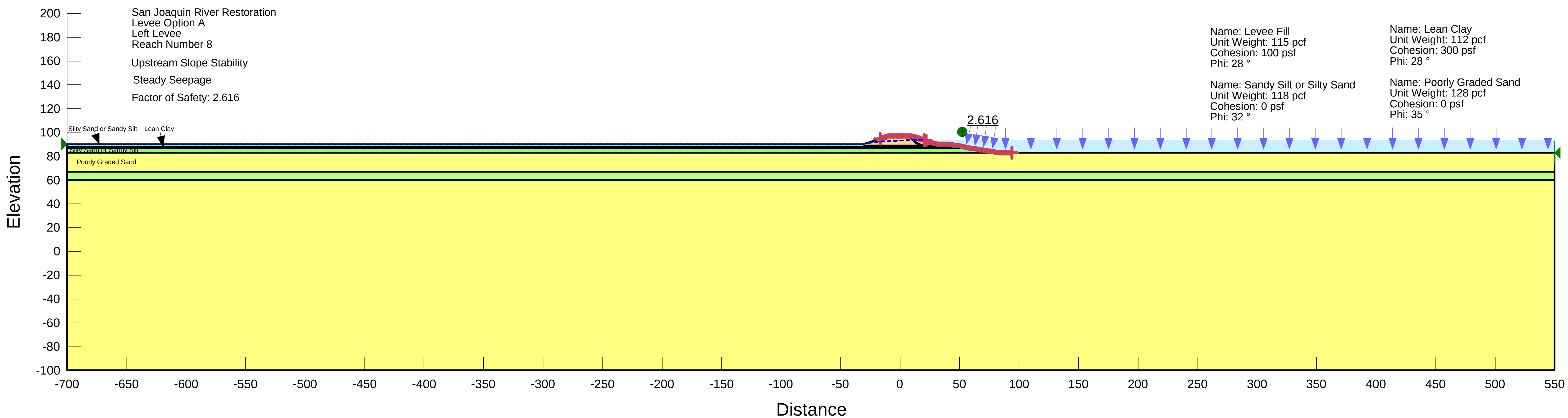


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
End of Construction Stability
Factor of Safety: 2.789
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
2.789
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

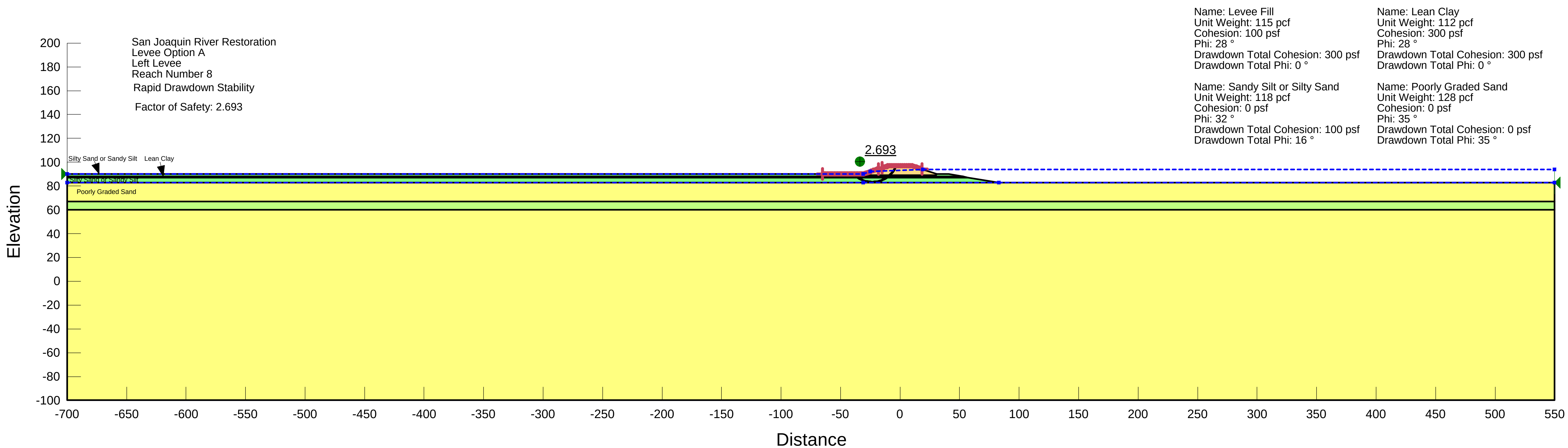

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
End of Construction Stability
Factor of Safety: 2.780
2.780
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance



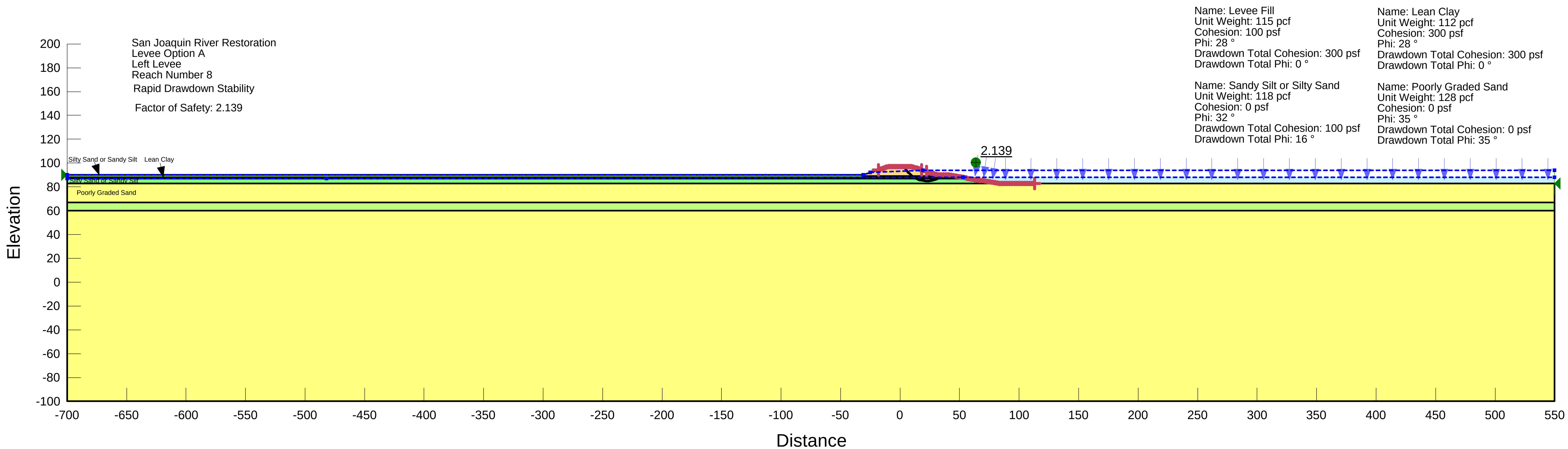
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Downstream Slope Stability
Factor of Safety: 1.922
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
1.922
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550
Distance



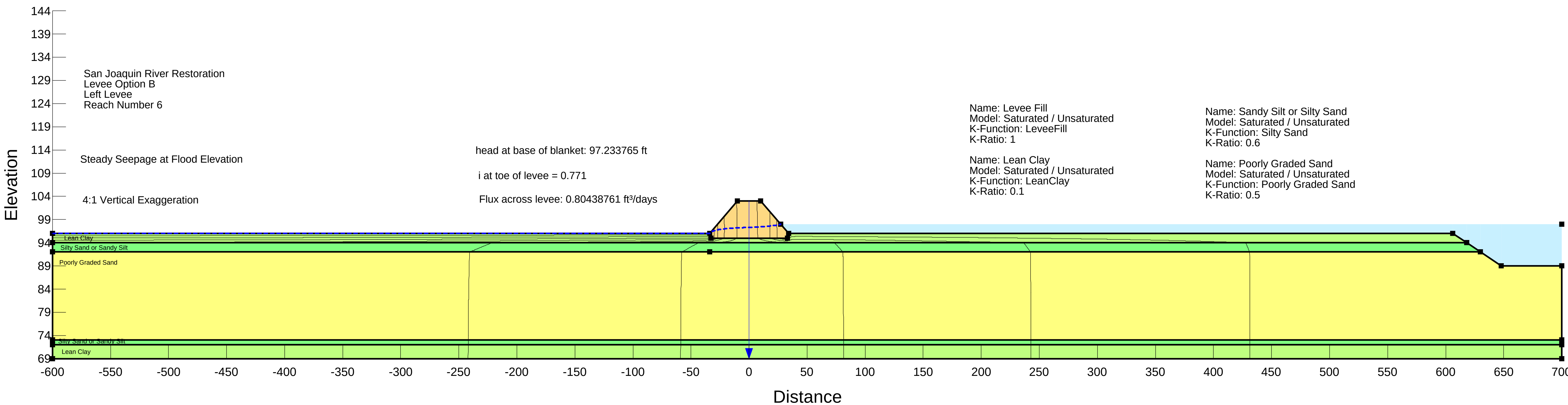
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Upstream Slope Stability
Steady Seepage
Factor of Safety: 2.616
2.616
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
Distance



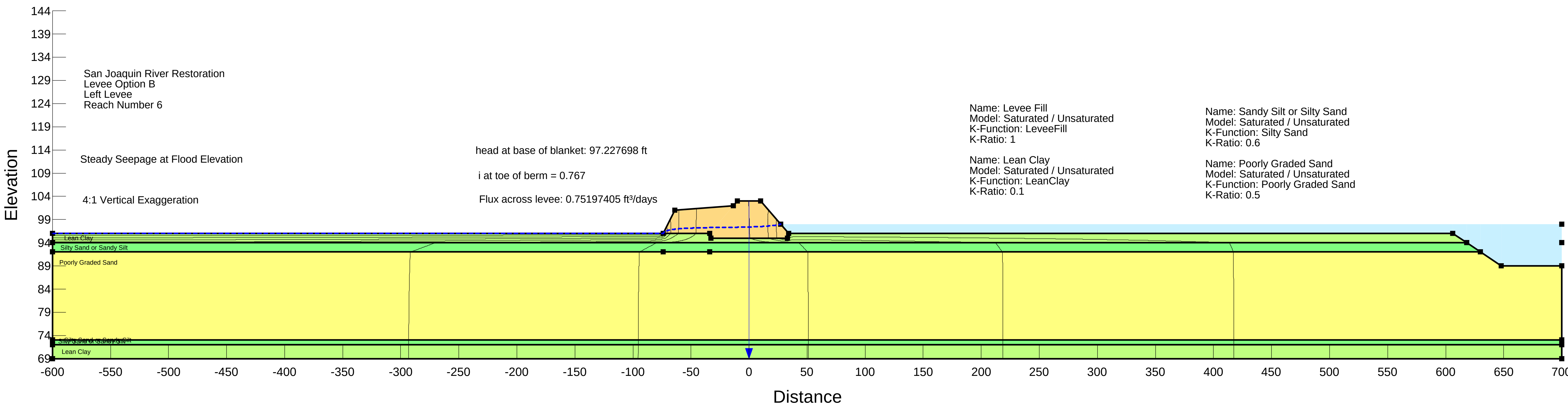
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Rapid Drawdown Stability
Factor of Safety: 2.693
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
2.693
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550



San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Rapid Drawdown Stability
Factor of Safety: 2.139
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
2.139
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700 -650 -600 -550 -500 -450 -400 -350 -300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450 500 550
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 97.233765 ft
i at toe of levee = 0.771
Flux across levee: 0.80438761 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 97.227698 ft
i at toe of berm = 0.767
Flux across levee: 0.75197405 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
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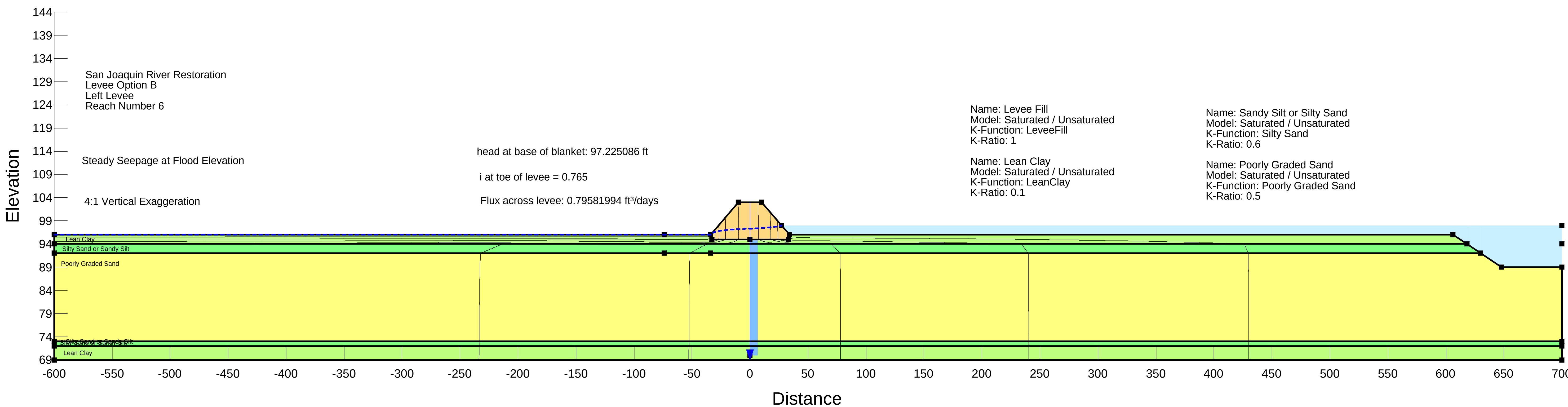
350
400
450
500
550
600
650
700


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 97.225086 ft
i at toe of levee = 0.765
Flux across levee: 0.79581994 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
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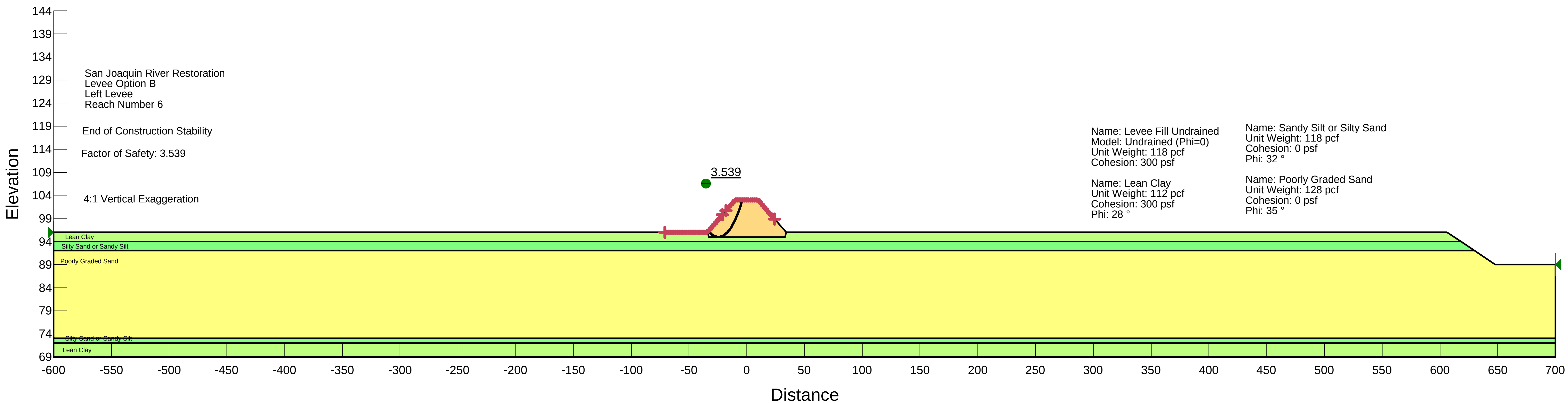
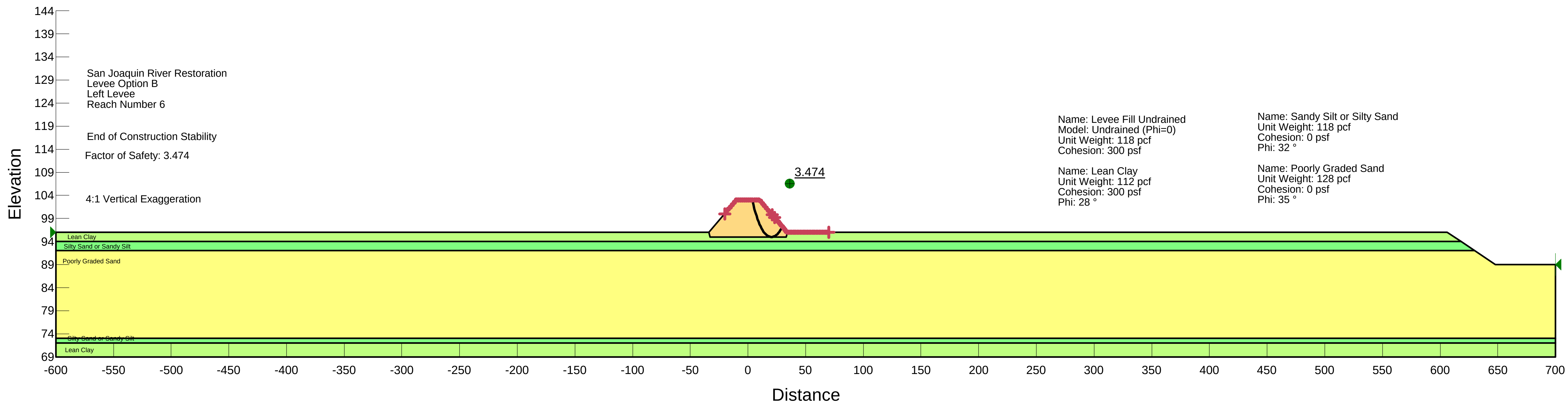
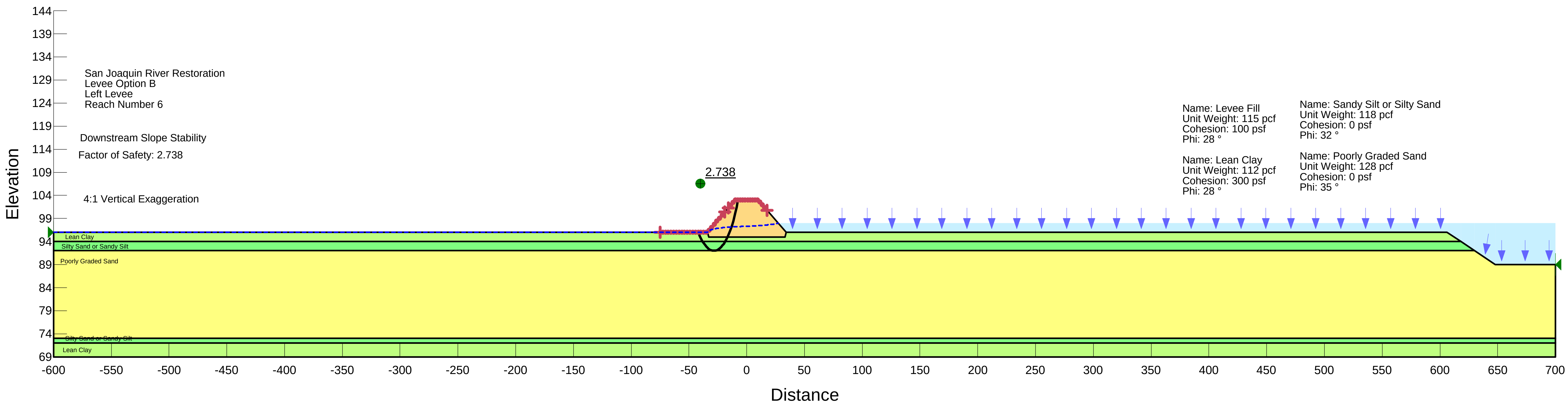
150
200
250
300
350
400
450
500
550
600
650
700

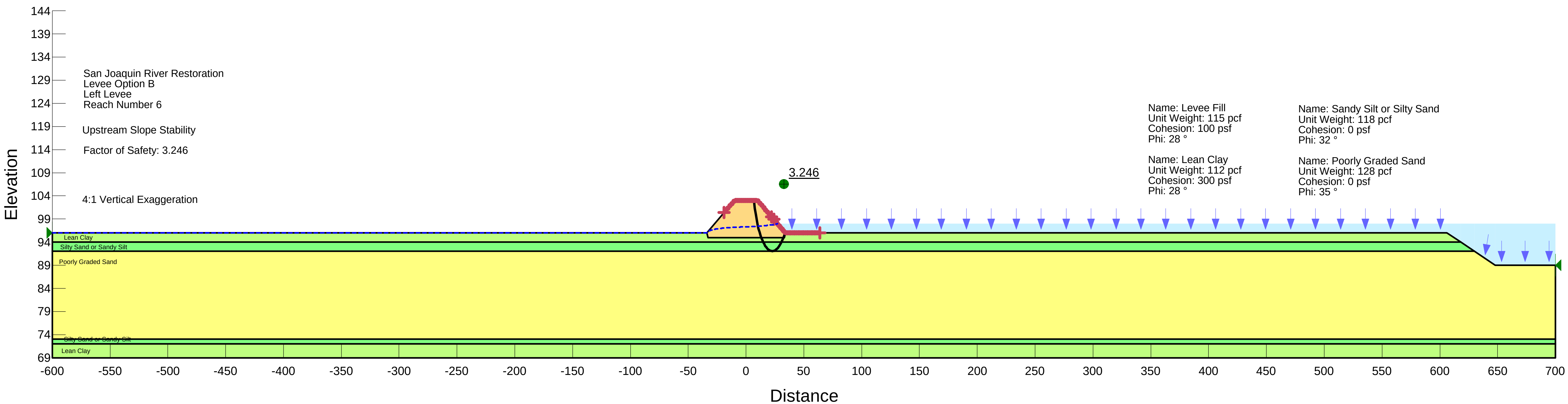

San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
End of Construction Stability
Factor of Safety: 3.539
4:1 Vertical Exaggeration
3.539
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
End of Construction Stability
Factor of Safety: 3.474
4:1 Vertical Exaggeration
3.474
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Downstream Slope Stability
Factor of Safety: 2.738
4:1 Vertical Exaggeration
2.738
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Upstream Slope Stability
Factor of Safety: 3.246
4:1 Vertical Exaggeration
3.246
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
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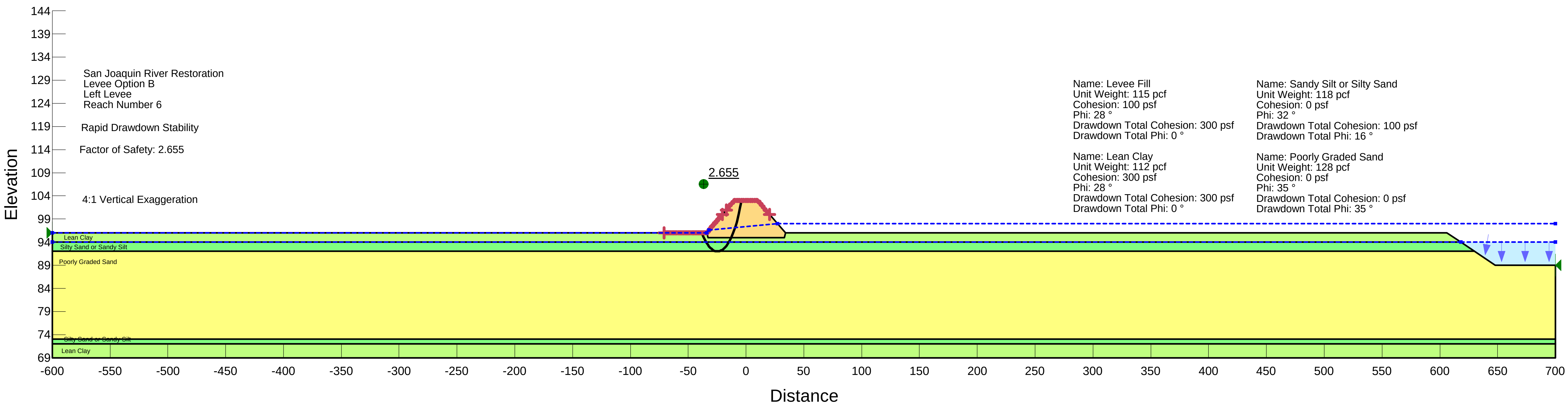
100
150
200
250
300
350
400
450
500
550
600
650
700



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Rapid Drawdown Stability
Factor of Safety: 2.655
4:1 Vertical Exaggeration
2.655
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
Distance
-600
-550
-500
-450
-400
-350
-300
-250
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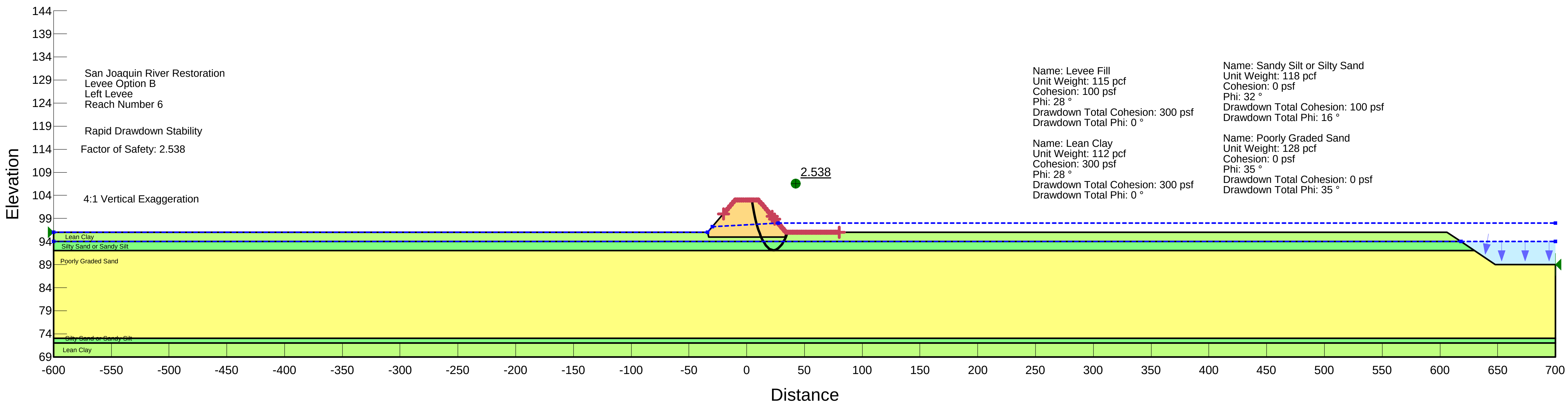
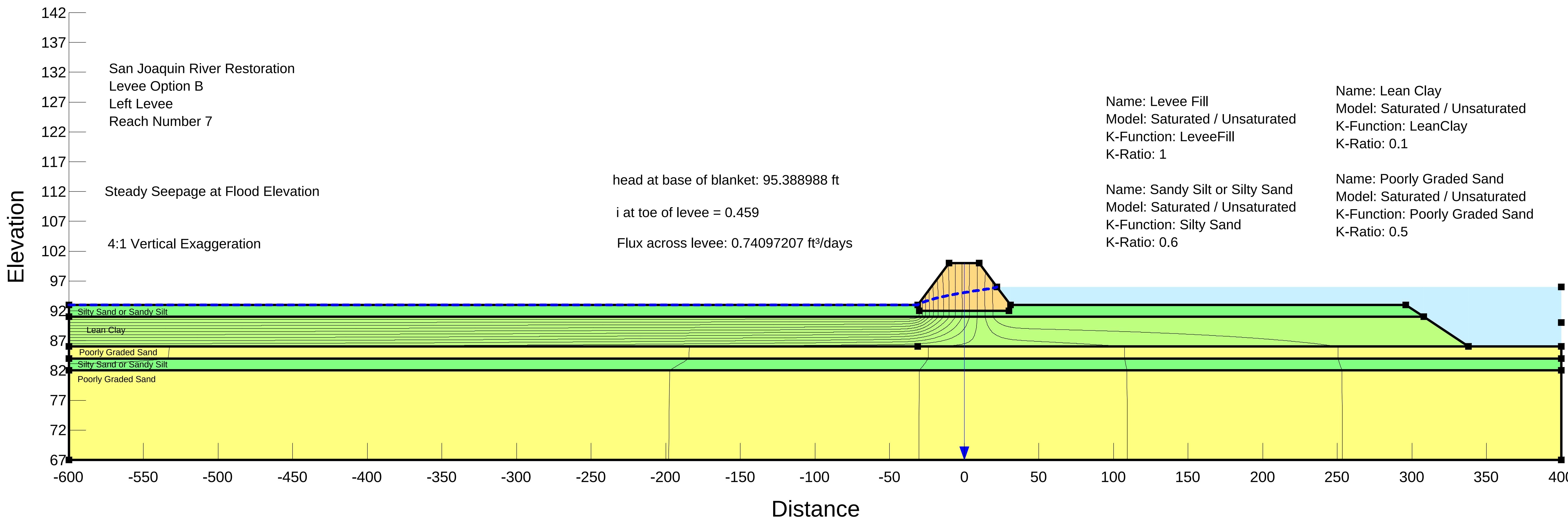
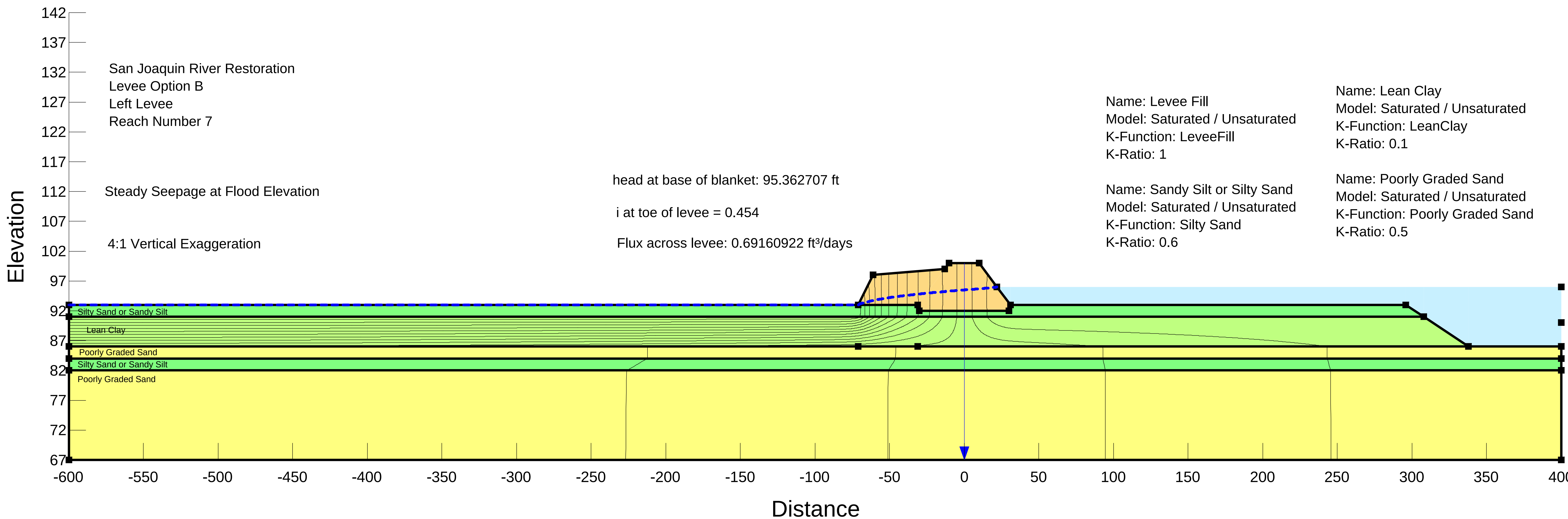
700


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Rapid Drawdown Stability
Factor of Safety: 2.538
4:1 Vertical Exaggeration
2.538
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 95.388988 ft
i at toe of levee = 0.459
Flux across levee: 0.74097207 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 95.362707 ft
i at toe of levee = 0.454
Flux across levee: 0.69160922 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
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50
100
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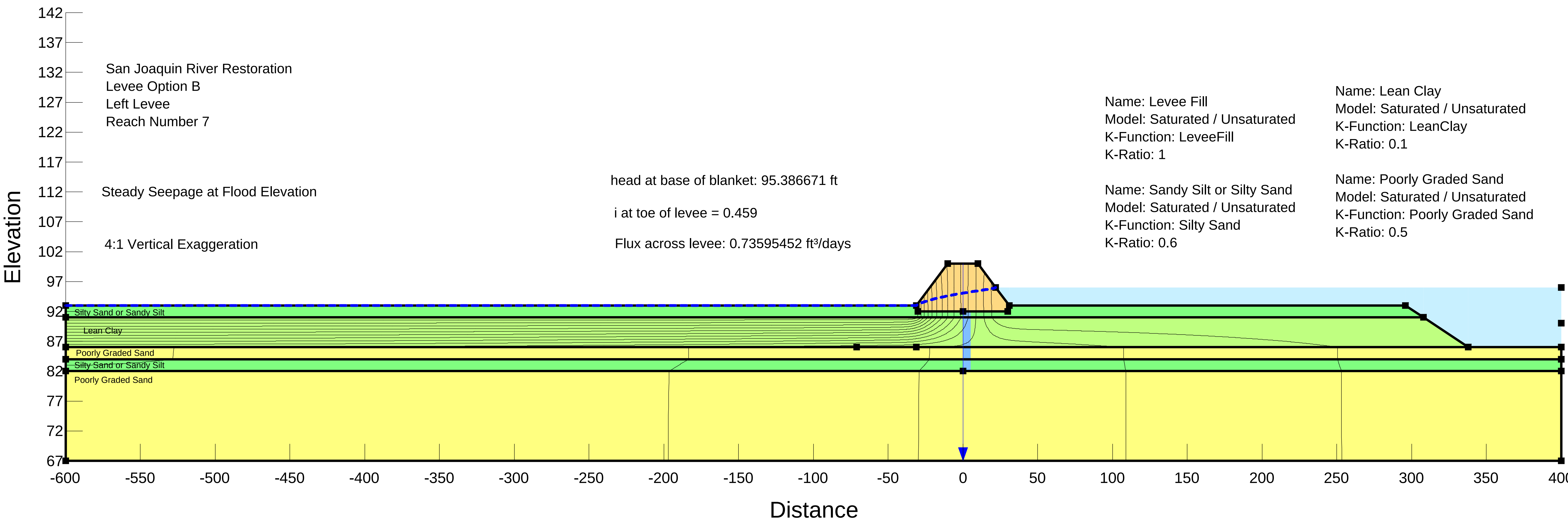
200
250
300
350
400


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 95.386671 ft
i at toe of levee = 0.459
Flux across levee: 0.73595452 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
-600
-550
-500
-450
-400
-350
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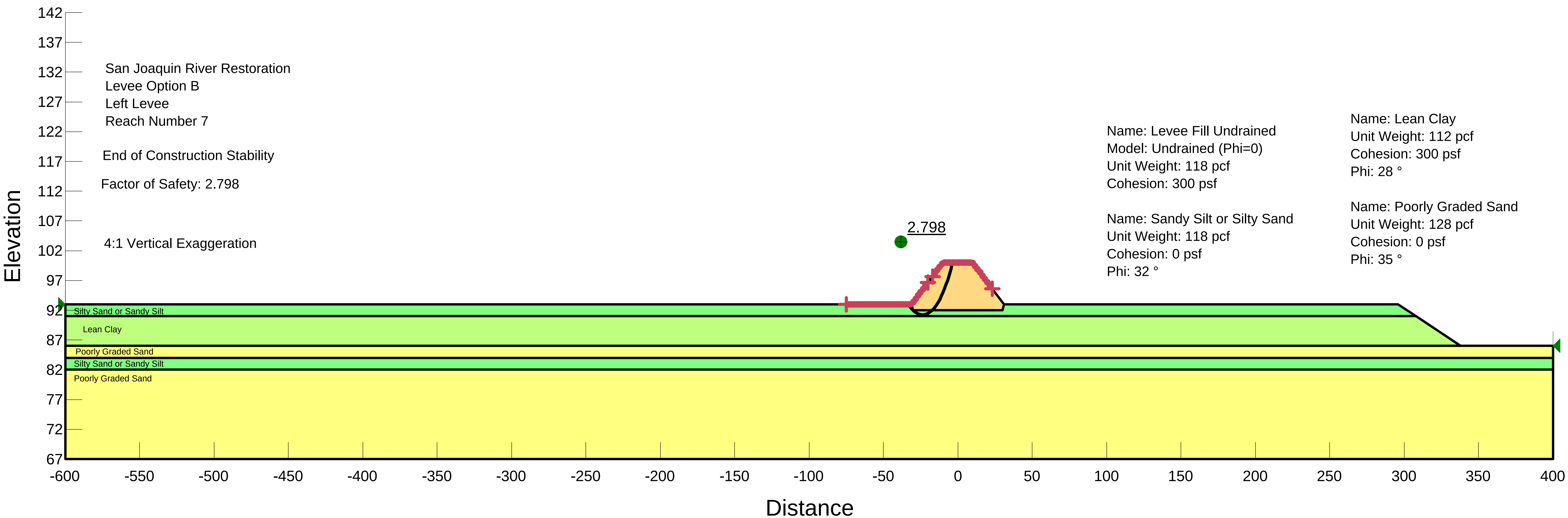
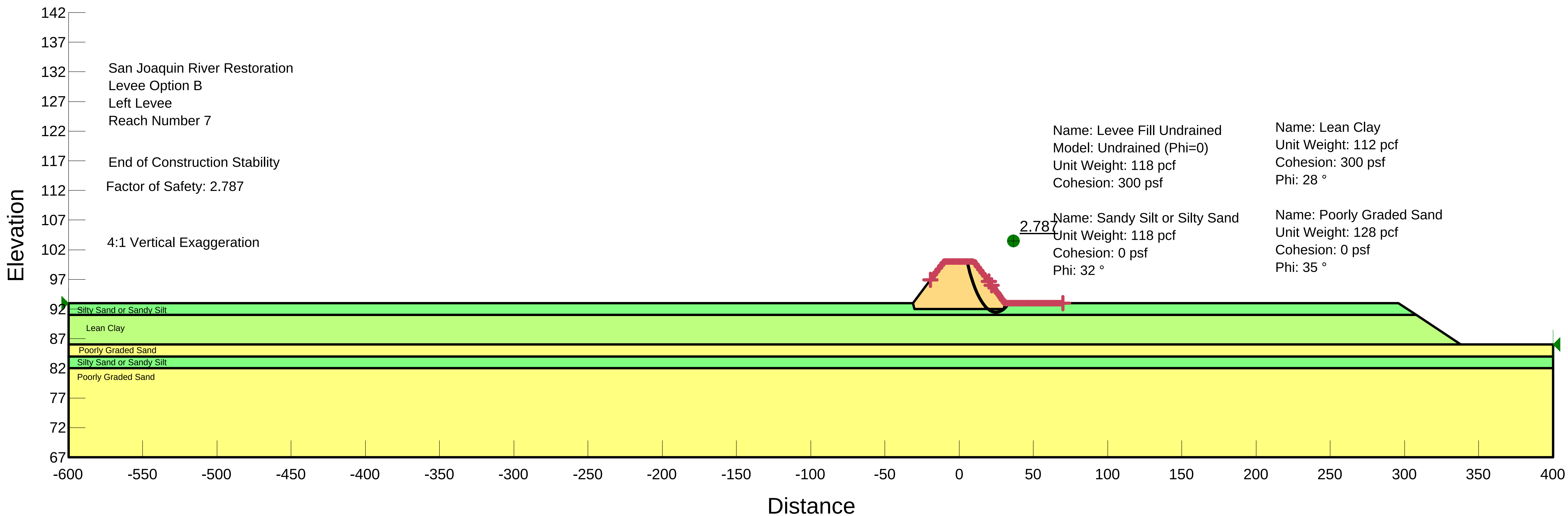
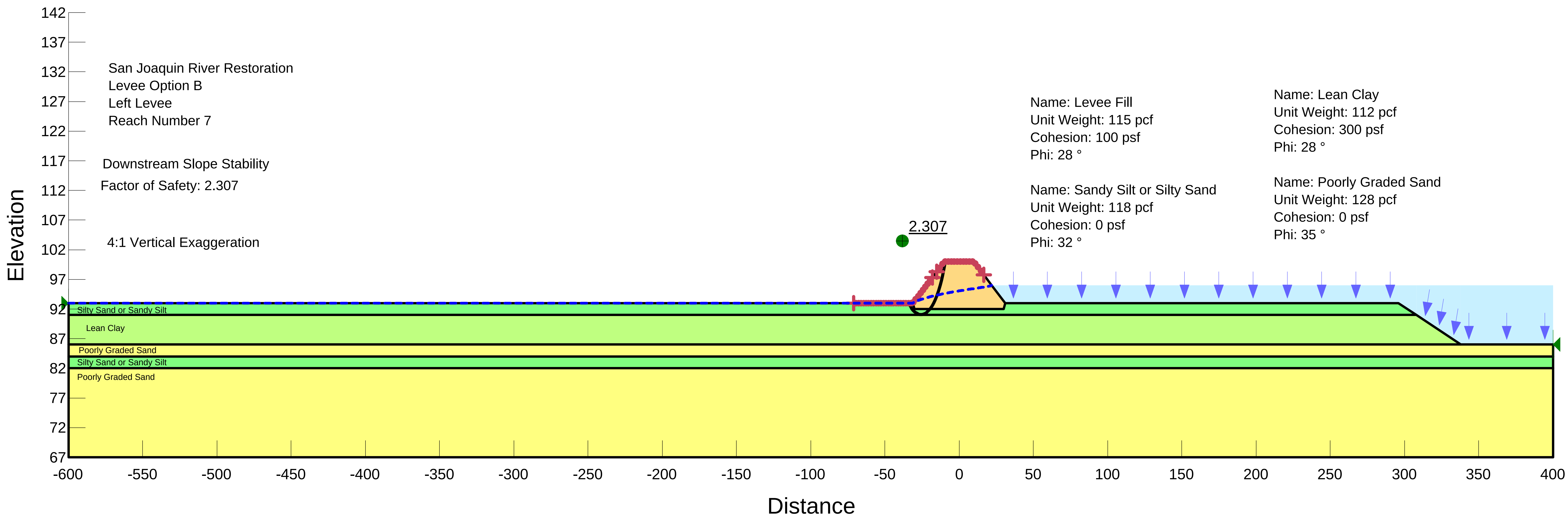
-100
-50
0
50
100
150
200
250
300
350
400
Distance

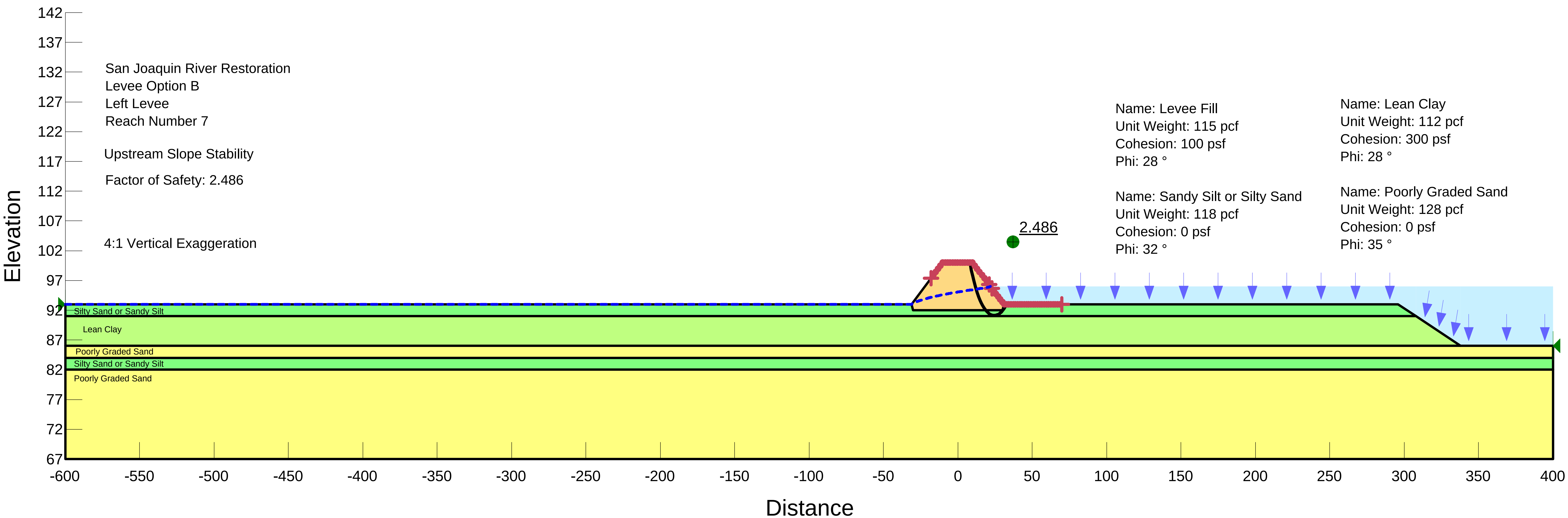


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
End of Construction Stability
Factor of Safety: 2.798
4:1 Vertical Exaggeration
2.798
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400

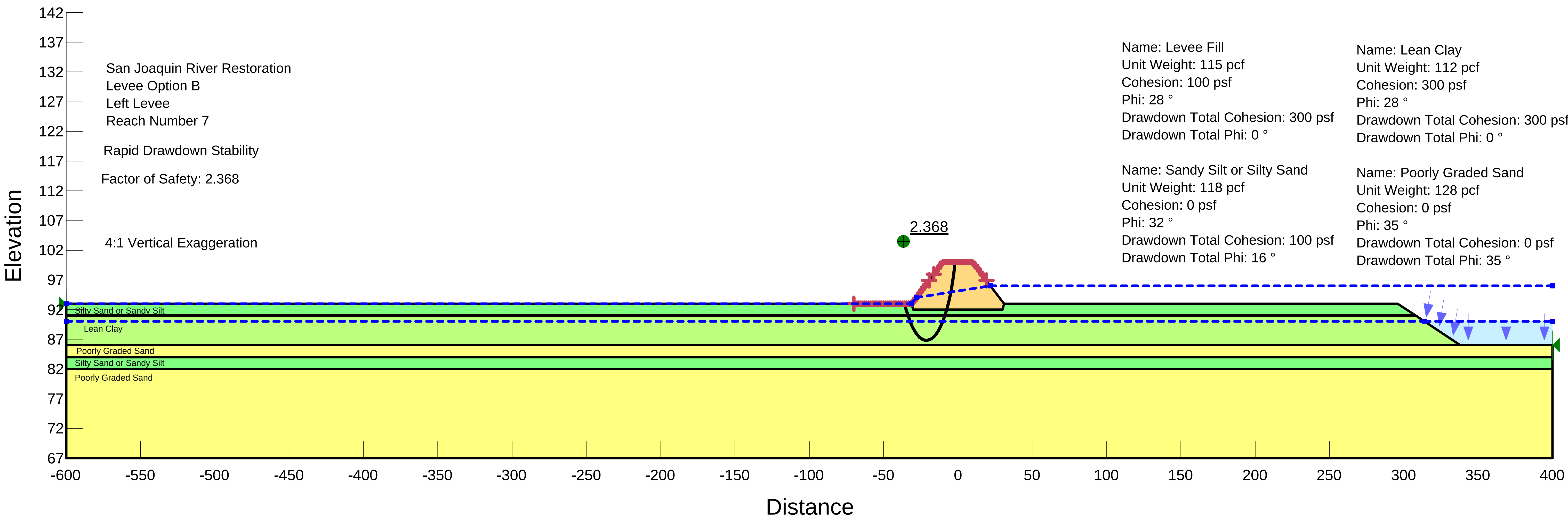

San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
End of Construction Stability
Factor of Safety: 2.787
4:1 Vertical Exaggeration
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
2.787
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400



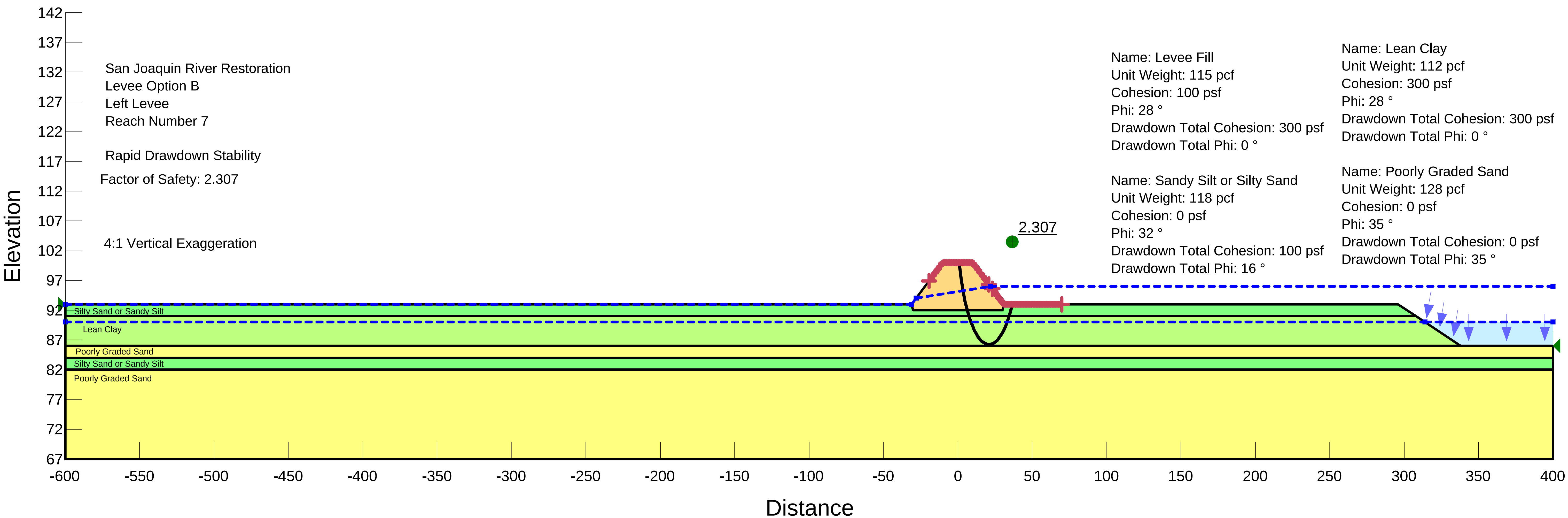
San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Downstream Slope Stability
Factor of Safety: 2.307
4:1 Vertical Exaggeration
2.307
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
Distance



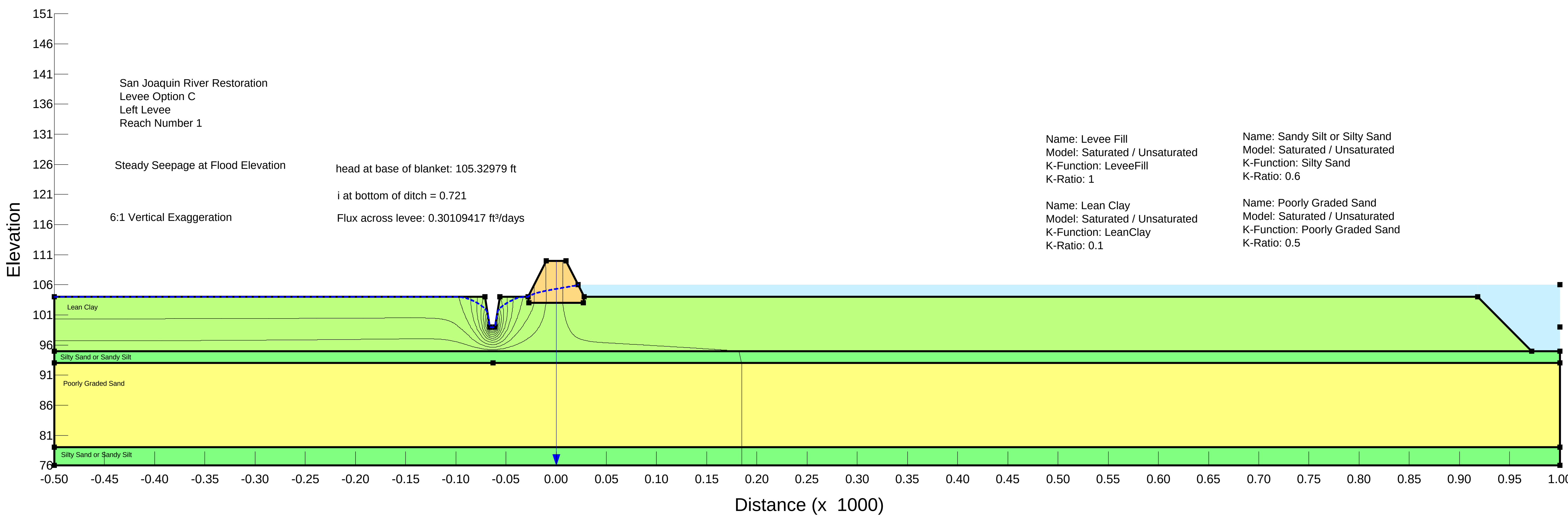
San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Upstream Slope Stability
Factor of Safety: 2.486
4:1 Vertical Exaggeration
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
2.486
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
Distance

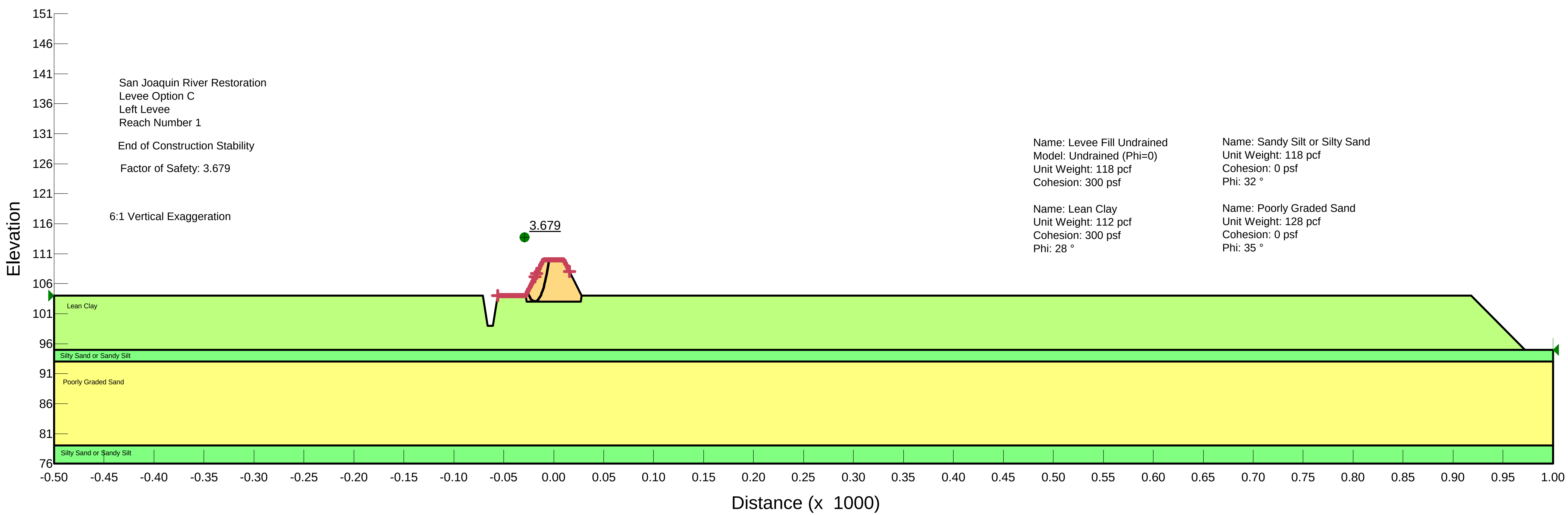


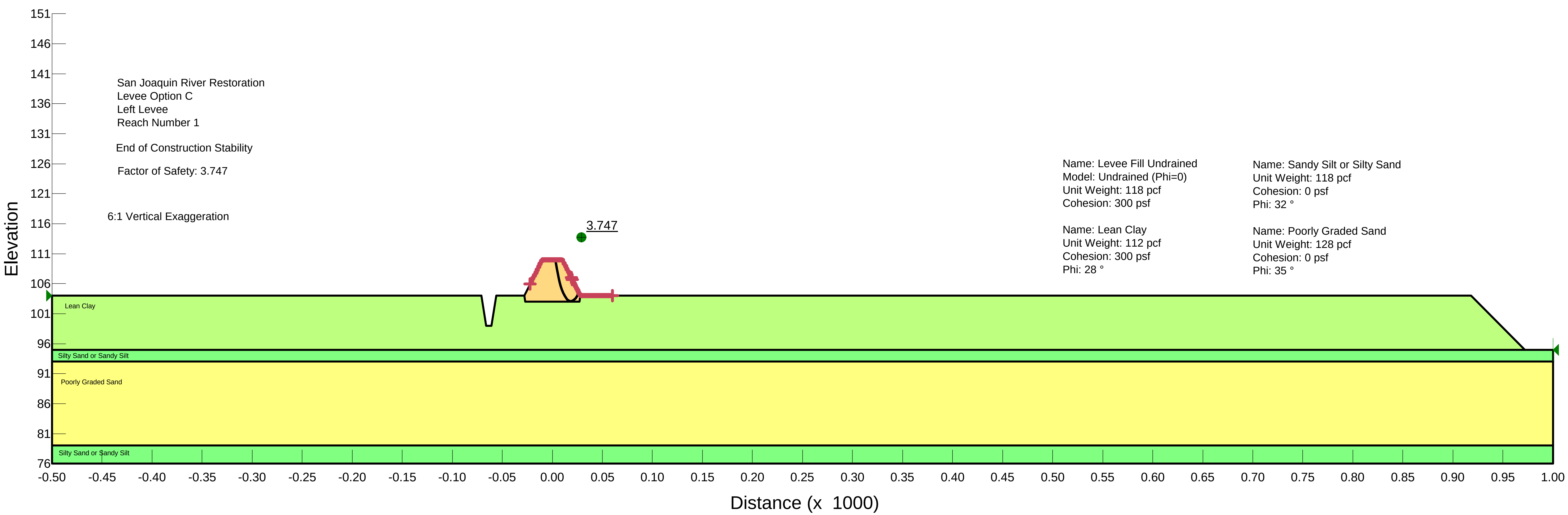
San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Rapid Drawdown Stability
Factor of Safety: 2.368
4:1 Vertical Exaggeration
2.368
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400

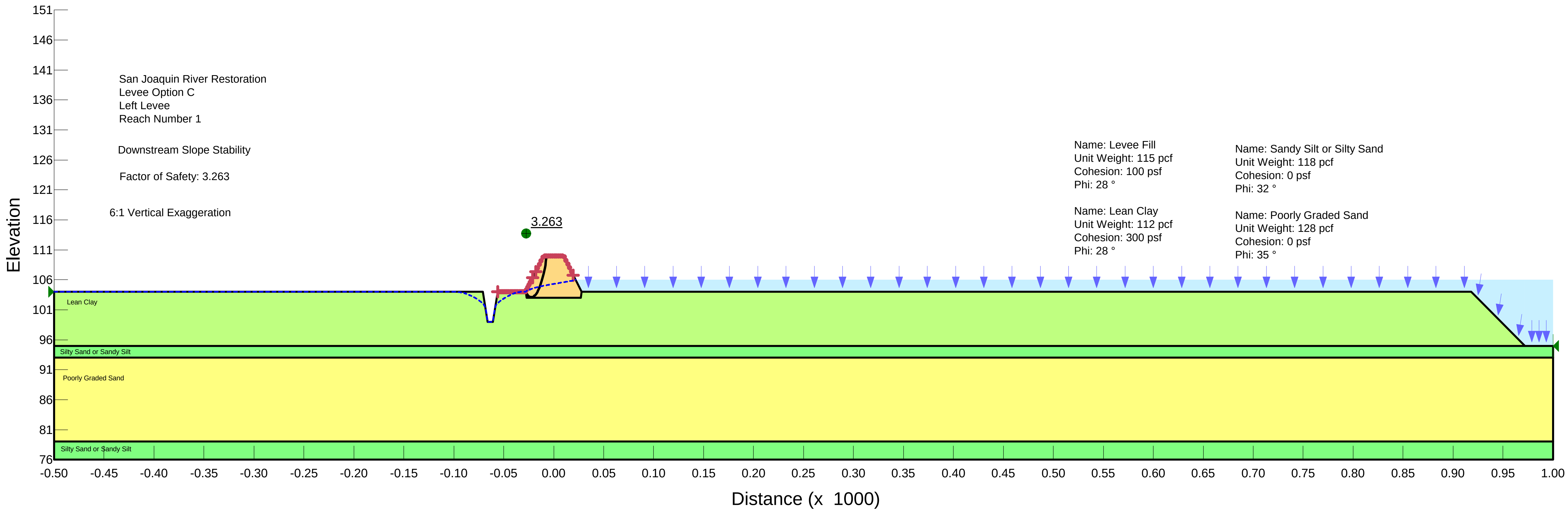


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Rapid Drawdown Stability
Factor of Safety: 2.307
4:1 Vertical Exaggeration
2.307
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400

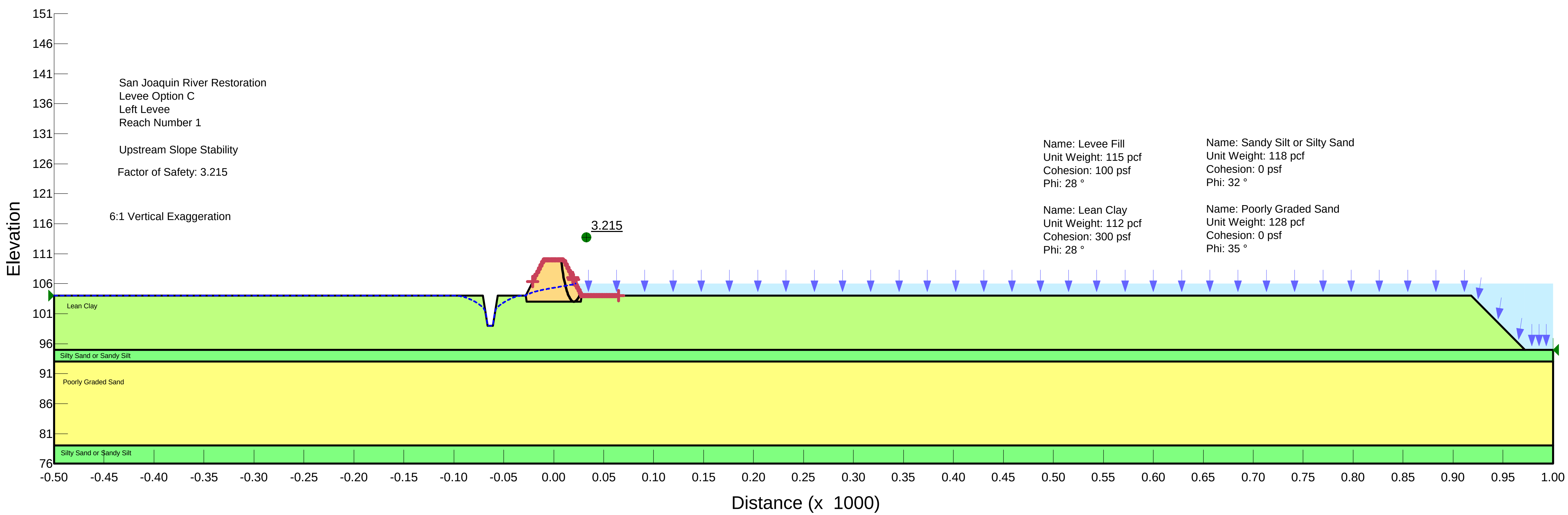

San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Steady Seepage at Flood Elevation
6:1 Vertical Exaggeration
head at base of blanket: 105.32979 ft
i at bottom of ditch = 0.721
Flux across levee: 0.30109417 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00
Distance (x 1000)


San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
End of Construction Stability
Factor of Safety: 3.679
6:1 Vertical Exaggeration
3.679
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50 -0.45 -0.40 -0.35 -0.30 -0.25 -0.20 -0.15 -0.10 -0.05 0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65 0.70 0.75 0.80 0.85 0.90 0.95 1.00
Distance (x 1000)

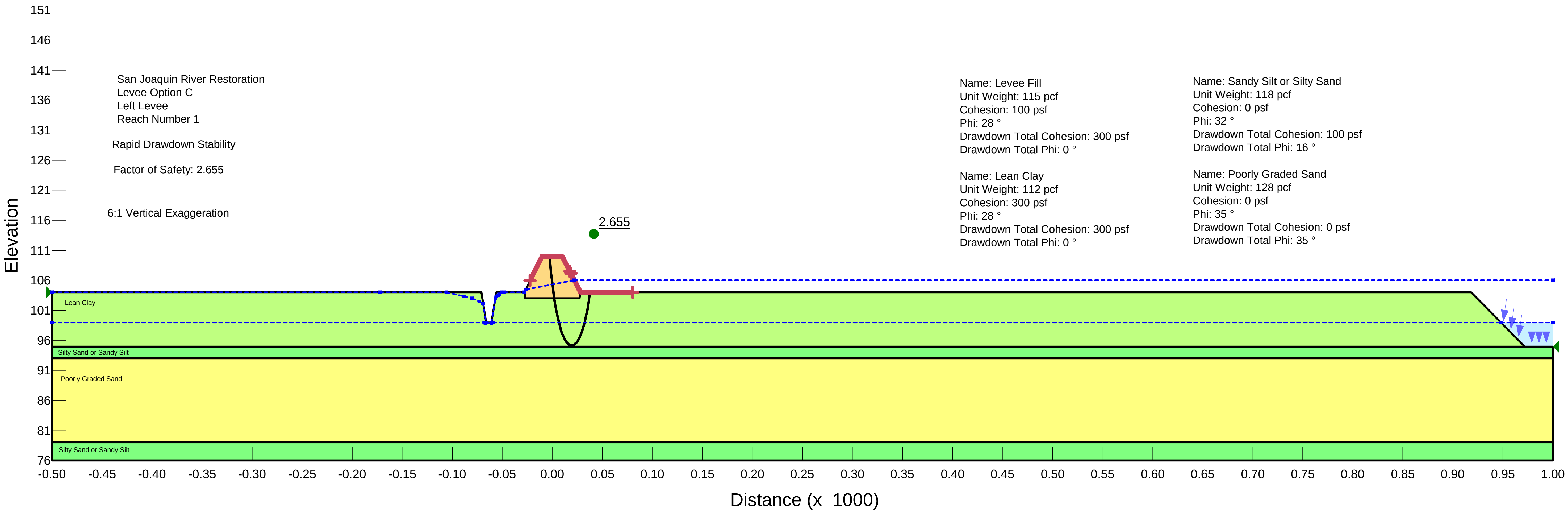

San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
End of Construction Stability
Factor of Safety: 3.747
6:1 Vertical Exaggeration
3.747
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00
Distance (x 1000)

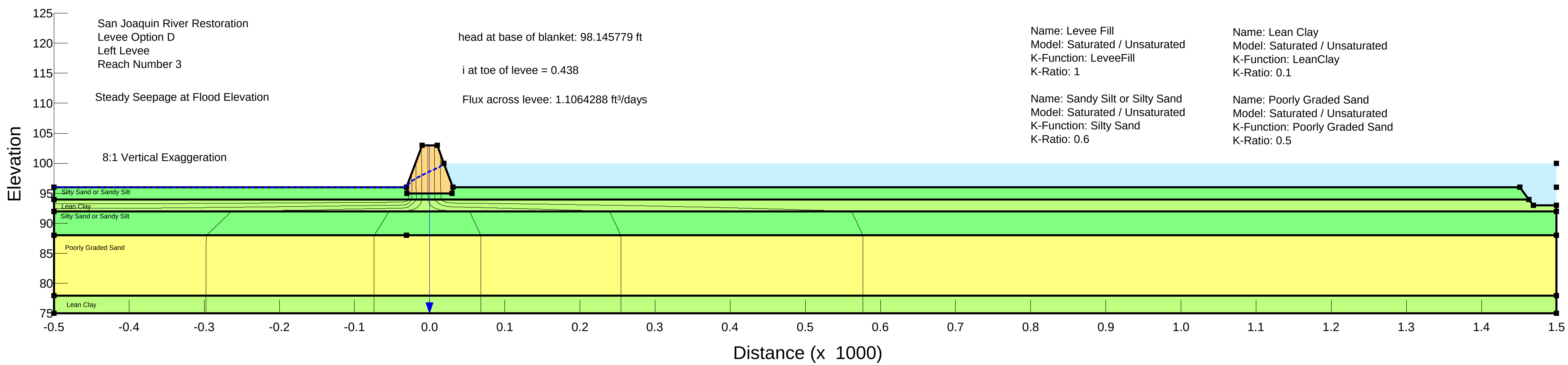


San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Downstream Slope Stability
Factor of Safety: 3.263
6:1 Vertical Exaggeration
3.263
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
Distance (x 1000)

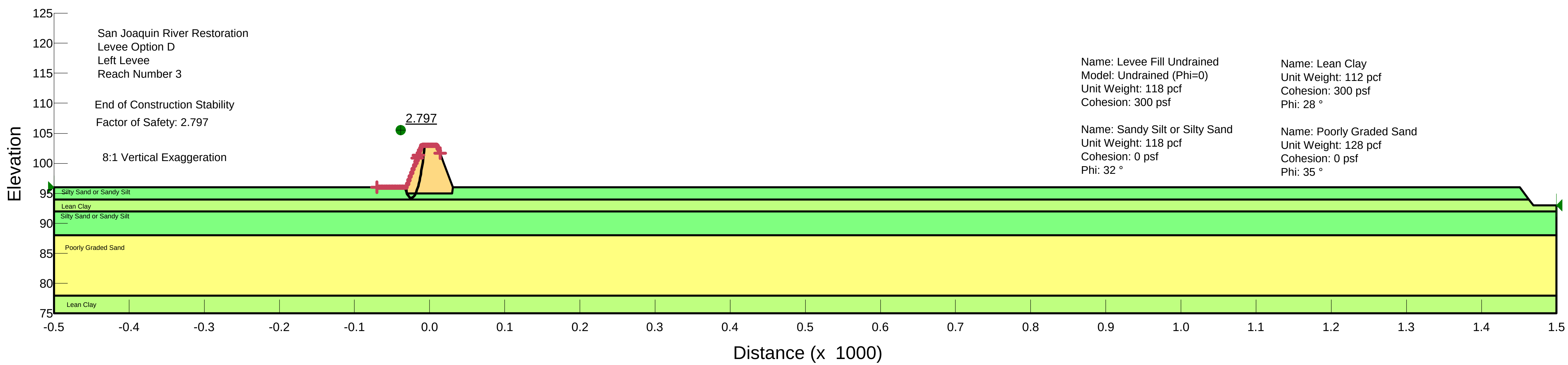


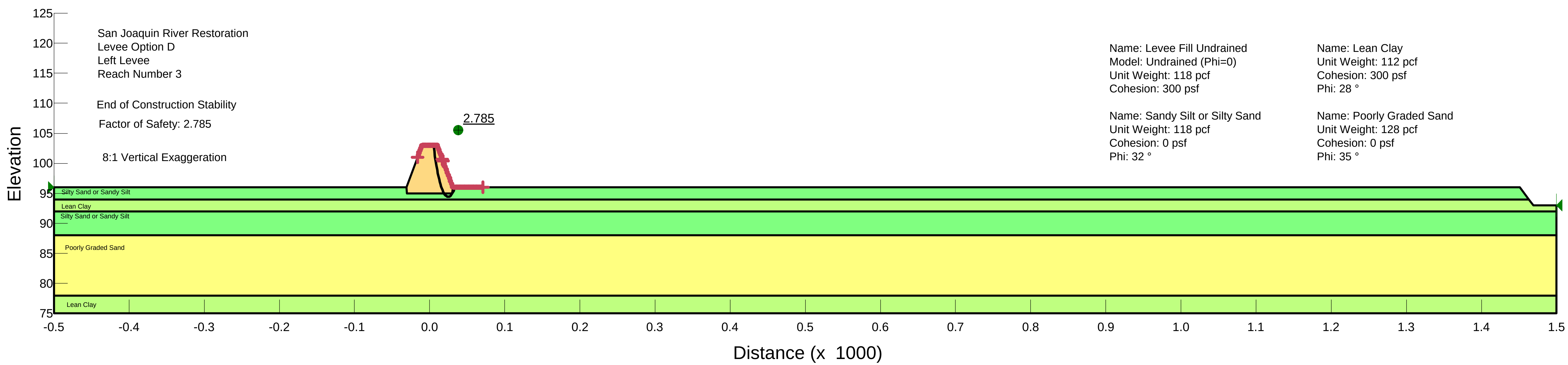
San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Upstream Slope Stability
Factor of Safety: 3.215
6:1 Vertical Exaggeration
3.215
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00
Distance (x 1000)


San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Rapid Drawdown Stability
Factor of Safety: 2.655
6:1 Vertical Exaggeration
2.655
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00
Distance (x 1000)

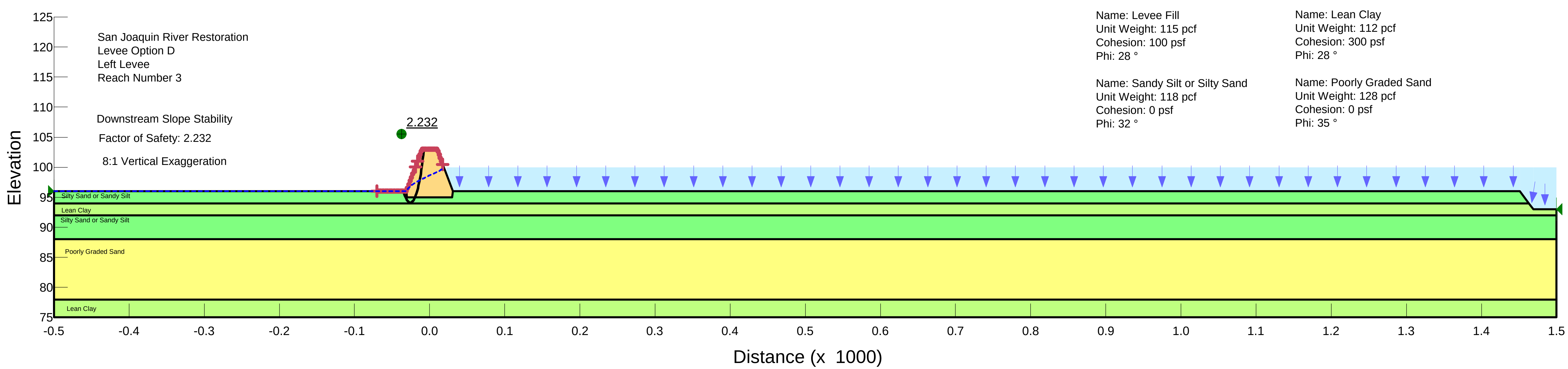


San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Steady Seepage at Flood Elevation
8:1 Vertical Exaggeration
head at base of blanket: 98.145779 ft
i at toe of levee = 0.438
Flux across levee: 1.1064288 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
Distance (x 1000)

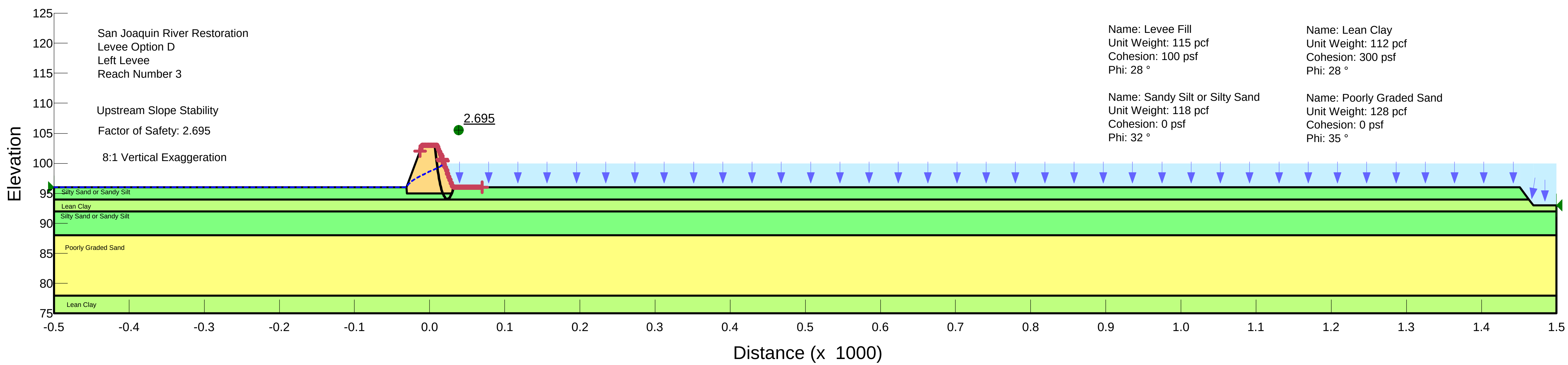

San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
End of Construction Stability
Factor of Safety: 2.797
8:1 Vertical Exaggeration
2.797
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
Distance (x 1000)

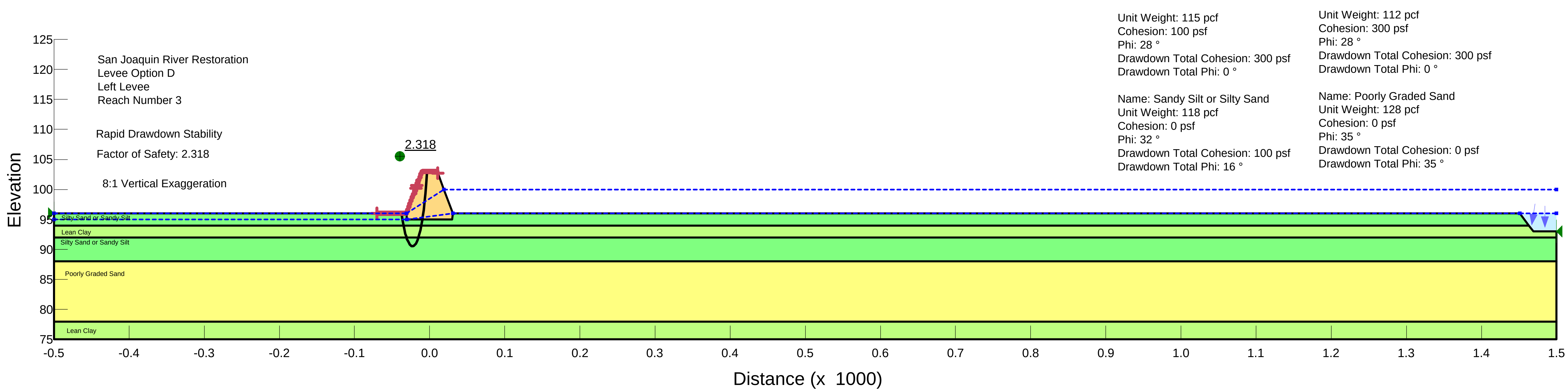


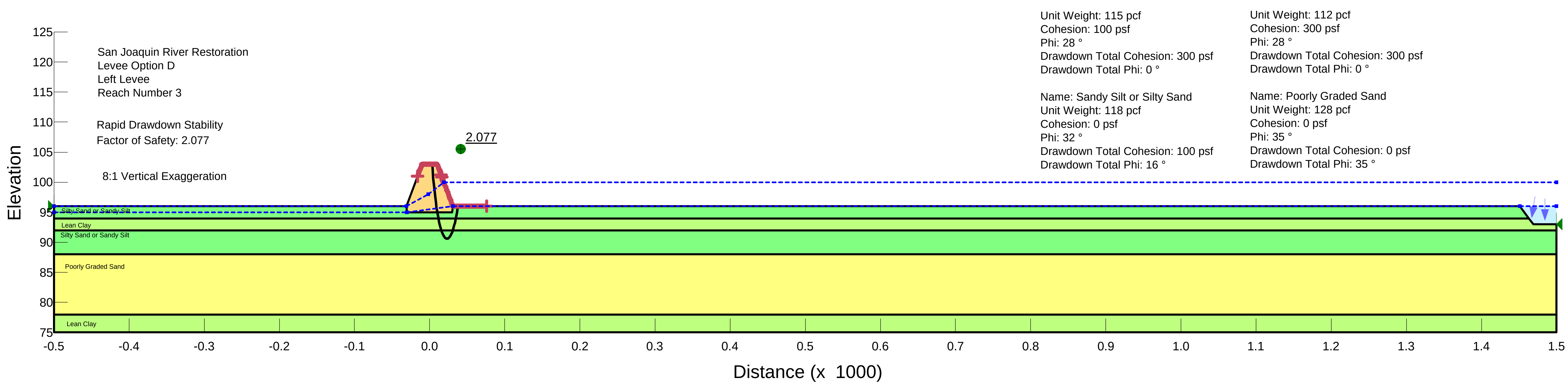
San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
End of Construction Stability
Factor of Safety: 2.785
8:1 Vertical Exaggeration
2.785
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
Distance (x 1000)



San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Downstream Slope Stability
Factor of Safety: 2.232
8:1 Vertical Exaggeration
2.232
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
Distance (x 1000)


San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Upstream Slope Stability
Factor of Safety: 2.695
8:1 Vertical Exaggeration
2.695
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
Distance (x 1000)


San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Rapid Drawdown Stability
Factor of Safety: 2.318
8:1 Vertical Exaggeration
2.318
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)



Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Rapid Drawdown Stability
Factor of Safety: 2.077
8:1 Vertical Exaggeration
2.077
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)

Attachment C

Levee Seepage Calculations

And

Seepage Berm and Slurry Wall Design

Project:	Left Levee Option A																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	9.997884	10	56	65.99788	105	2	102	102	3	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	2.572239	0.285804
MW 10-93																										
2	5242+49	5430+83	95	1.8	CL	15.99572	16	56	71.99572	103.9	2	99	99	4.9	5.8	CL/ML	0.02835	14.17	110	499.8236	0.001770848	564.7012		8	4.345923	0.54324
MW 10-98																										
3	5430+83	5550+65	93	0	CL	28.60243	30	68	96.60243	100.1	7	96	96	4.1	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.831256	0.373726
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	49.97314	50	56	105.9731	99	2	96	96	3	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99		19.6	2.764672	0.141055
MW 10-108																										
5	5641+96	5768+50	88	0	ML/CL	59.84051	60	56	115.8405	100	2	97	97	3	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	2.558232	0.224406
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	56.18928	100	62	118.1893	99.1	7	96	96	3.1	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.049089	0.617111
MW 10-106																										
7	5901+47	5983+69	86	0	CH/CL	138.2671	140	62	200.2671	96	2	93	93	3	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	2.347931	0.451525
MW 11-140																										
8	5983+69	6238+39	83	0	SM/CL	9.976258	10	62	71.97626	93.8	7	90	90	3.8	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	2.362728	0.908742
MW 10-110																										

			Project:		Left Levee Option A																					
	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_l with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49		No Berm Needed																						
MW 10-93																										
2	5242+49	5430+83	0.5	0.5	1	6.764961	4	4.141525	0.09435	0.010625	19.63842		0.6125	0.127493	31.6	0.055959	5	2	6.25	13	0.318579		35	6.25	5.375	1:40
MW 10-98			Low excessive gradient values indicate using a minimum berm																							
3	5430+83	5550+65		No Berm Needed																						
MW 10-113																										
4	5550+65	5641+96		No Berm Needed																						
MW 10-108																										
5	5641+96	5768+50		No Berm Needed																						
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	17.72967	0.85	0.90244	0.03496	0.099245	3.621371		1.823529	1.954944	24.4	0.403595	5	2	6.25	6.7	0.134693		25	6.25	5.625	1:40
MW 10-106																							Minimum berm			
7	5901+47	5983+69	0.5	0.5	1	7.666323	2.6	2.537152	-0.0419	0.008321	-17.6468		0.576923	0.277721	24	0.033282	5	2	6.25	10.2	0.24874		25	6.25	5.625	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																				Minimum berm			
8	5983+69	6238+39	0.5	0.5	1	9.649862	1.3	1.65079	0.23386	0.050709	28.49627		1.461538	0.60831	27.2	0.229882	5	2	6.25	7.6	0.217209		300	6.25	5.375	1:40
MW 10-110			Design indicates using minimum berm																				Based on geostudios model			

				Project:	Left Levee Option A				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	28	110	25%	127.9957	3.99458382	0.499322977
	MW 10-98								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	21	21.5	98%	160.1893	0.84939473	0.499643959
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	230.2671	2.27389337	0.437287186
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6238+39	78	100	78%	227.9763	1.29836803	0.49937232
	MW 10-110								

Project:			Right Levee Option A																							
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	59.547	60	62	121.547	106.4	2	103	103	3.4	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	2.602832	0.289204
MW10-93																										
2	5242+49	5430+83	96	1	SC	61.00864	122	62	123.0086	103.3	7	99	99	4.3	4	SC	0.567	28.35	20.3	50	0.015694121	63.71813	20	4	0.601362	0.150341
MW 10-97																										
Ditch																										
3	5430+83	5550+65	92	0	CL	9.945534	10	74	83.94553	102.1	7	97	97	5.1	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435	620	4.9	2.455963	0.501217
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	39.97631	40	74	113.9763	99	2	96	96	3	9	CL/CH	0.002835	2.835	100	1000	0.001054093	948.6833		10.5	2.678233	0.25507
MW 10-108																										
5	5641+96	5768+50	88	0	ML/CL	39.95266	40	56	95.95266	101	2	97	97	4	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	3.499447	0.306969
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	19.30099	20	56	75.30099	98.2	7	95	95	3.2	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.425048	0.838264
MW 10-106																										
7	5901+47	5983+69	88	0	CH/CL	548.7265	720	56	604.7265	95	2	92	92	3	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.631672	0.313783
MW 11-140																										
8	5983+69	6119+04	82	0	SM/CL	16.88398	17	56	72.88398	94.1	7	91	91	3.1	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	1.918338	0.737822
MW 10-110																										

Project: Right Levee Option A

	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-97																										
Ditch																										
3	5430+83	5550+65	0.5	0.5	1	12.45947	2.45	2.452535	0.00169	0.076948	0.080633		1.040816	1.076579	32.4	0.415521	5	2	6.25	9.9	0.247731		35	6.25	5.375	1:40
MW 10-113			Design indicates using minimum berm																							
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	13.47323	0.85	1.010458	0.106972	0.099245	10.5007		1.882353	1.245538	24.8	0.410212	5	2	6.25	6.7	0.150815		25	6.25	5.625	1:40
MW 10-106			Design indicates using minimum berm																							
7	5901+47	5983+69	0.4	0.4	1	11.03163	2.08	1.969337	-0.07904	0.008321	-39.4442		0.576923	0.838605	24	0.033282	5	2	6.25	10.2	0.193072		25	6.25	5.625	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6119+04	0.5	0.5	1	9.695892	1.3	1.463218	0.108812	0.050709	14.02442		1.192308	0.615982	24.4	0.206218	5	2	6.25	7.6	0.192529		25	6.25	5.625	1:40
MW 10-110			Design indicates using minimum berm																							

			Project:	Right Levee Option A				
	Levee Station		Estimated Slurry Cutoff Depth					
Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
1	5217+38	5242+49	No cutoff required					
MW10-93								
2	5242+49	5430+83	No cutoff required					
MW 10-97								
Ditch								
3	5430+83	5550+65	15.2	15.2	100%	114.3455	2.067749	0.42199
MW 10-113								
4	5550+65	5641+96	No cutoff required					
MW 10-108								
5	5641+96	5768+50	No cutoff required					
MW 10-105								
6	5768+50	5901+47	24.5	21.5	114%	124.301	1.047108	0.615946
MW 10-106								
7	5901+47	5983+69	15	100	15%	634.7265	1.595569	0.30684
MW 11-140			Marginal Reach, use minimum cutoff wall					
8	5983+69	6119+04	46	100	46%	164.884	1.295161	0.498139
MW 10-110								

Project:	Left Levee Option B																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	6.7	SC/CL	243.6071	250	62	305.6071	106.4	2	103	103	3.4	15.8	CL/SC	0.02835	14.17	100	499.8236	0.001125286	888.6627	350	19.8	1.815111	0.091672
MW 10-91																										
2	5242+49	5430+83	97	10	CL	233.4643	250	62	295.4643	107.9	2	102	102	5.9	5.8	CL/ML	0.0567	28.35	100	500	0.001856953	538.5165	245	8	2.674552	0.334319
MW 10-98																										
3	5430+83	5550+65	93	0	CL	77.97433	610	62	139.9743	100.2	7	96	96	4.2	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435	1000	4.9	1.502612	0.306655
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	299.0414	305	62	361.0414	99.9	2	96	96	3.9	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99		19.6	3.023267	0.154248
MW 10-108																										
5	5641+96	5768+50	88	0	ML/CL	321.3558	350	62	383.3558	100.6	2	97	97	3.6	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	2.290844	0.200951
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	60.4566	575	62	122.4566	100	7	96	96	4	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.322083	0.777696
MW 10-106																										
7	5901+47	5983+69	86	0	CH/CL	253.6818	265	62	315.6818	97	2	93	93	4	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	2.782083	0.535016
MW 11-140																										
8	5983+69	5995+37	83	0	SM/CL	117.2671	320	62	179.2671	93.8	7	90	90	3.8	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	1.510884	0.581109
MW 10-110																										

Project: Left Levee Option B

Project Segment	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-91																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-98																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	1.016558	0.111039	0.099245	10.86941		2.352941	2.025529	28	0.463142	5	2	6.25	6.7	0.151725		30	6.25	5.5	1:40
MW 10-106			Design Values indicate using minimum berm																							
7	5901+47	5983+69	0.5	0.5	1	8.626631	2.6	2.660906	0.040604	0.008321	16.69906		0.769231	0.437772	28	0.038829	5	2	6.25	10.2	0.260873		30	6.25	5.5	1:40
MW 11-140			Design Values indicate using minimum berm																							
8	5983+69	5995+37	0.5	0.5	1	15.0905	1.3	1.367793	0.045195	0.050709	6.017261		1.461538	1.515083	27.2	0.229882	5	2	6.25	7.6	0.179973		30	6.25	5.5	1:40
MW 10-110			Design Values indicate using minimum berm																							

				Project:	Left Levee Option B				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-91								
	2	5242+49	5430+83	No cutoff required					
	MW 10-98								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	24.5	21.5	114%	171.4566	1.042745	0.61338
	MW 10-106								
	7	5901+47	5983+69	37	100	37%	389.6818	2.596743	0.499374
	MW 11-140								
	8	5983+69	5995+37	25	100	25%	229.2671	1.293546	0.497518
	MW 10-110								

Project:	Right Levee Option B																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	59.547	60	68	127.547	107.5	2	103	103	4.5	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	3.405509	0.37839
MW 10-93																										
2	5242+49	5430+83	96	1	SC	62.71221	154	68	130.7122	104.8	7	99	99	5.8	4	SC	0.567	28.35	20.3	50	0.015694121	63.71813		4	1.900759	0.47519
MW 10-97																										
3	5430+83	5550+65	92	0	CL	77.2636	210	74	151.2636	102.7	7	97	97	5.7	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.938832	0.39568
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	870.584	1078	68	938.584	100.1	2	96	96	4.1	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99		19.6	2.337662	0.119268
MW 10-108																										
5	5641+96	5768+50	88	0	ML/CL	264.7978	280	62	326.7978	101.2	2	97	97	4.2	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	2.824172	0.247734
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	60.43837	266	62	122.4384	98	7	95	95	3	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	0.991661	0.58333
MW 10-106																										
7	5901+47	5983+69	88	0	CH/CL	548.7265	720	62	610.7265	95.6	2	92	92	3.6	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.949185	0.374843
MW 11-140																										
8	5983+69	6119+04	82	0	SM/CL	16.88398	17	62	78.88398	94	7	91	91	3	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	1.799973	0.692297
MW 10-111																										

Project: Right Levee Option B

	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-97																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	18.15137	0.85	0.885902	0.023935	0.099245	2.501812		1.764706	2.025228	24	0.396979	5	2	6.25	6.7	0.132224		30	6.25	5.5	1:40
MW 10-106			Design indicates using minimum berm																							
7	5901+47	5983+69	0.5	0.5	1	11.08155	2.6	2.408261	-0.12783	0.008321	-55.2991		0.692308	0.846925	26.4	0.03661	5	2	6.25	10.2	0.236104		30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6119+04	0.5	0.5	1	10.00015	1.3	1.427268	0.084845	0.050709	11.06599		1.153846	0.666691	24	0.202837	5	2	6.25	7.6	0.187798		30	6.25	5.5	1:40
MW 10-111			Design indicates using minimum berm																							

				Project:	Right Levee Option B				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-97								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	16	21.5	74%	154.4384	0.843993	0.496466
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	640.7265	1.906247	0.366586
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6119+04	38	100	38%	154.884	1.299259	0.499715
	MW 10-111								

Project:	Left Levee Option C																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95		CL	298.4144	890	56	354.4144	109.8	7	104	104	5.8	9	CL/SM	0.2835	28.35	100	100	0.003333333	300	28	9	0.42467	0.047186
MW 10-92																										
2	5242+49	5430+83	95	10	CL	308.4958	950	56	364.4958	106.9	7	101	101	5.9	9.6	CL/SM	0.2835	28.35	100	100	0.003227486	309.8387		9.6	2.710892	0.282385
MW 10-100																										
3	5430+83	5550+65	93	0	CL	77.97435	750	56	133.9744	101.8	7	96	96	5.8	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	2.133777	0.435465
MW 10-113																										
4	5550+65	5641+96	92	0	CL/SM	289.0293	305	56	345.0293	99	2	96	96	3	11.1	CL/ML	0.0567	28.35	100	500	0.001342312	744.9832		11.1	2.050389	0.18472
MW 10-109																										
5	5641+96	5768+50	88	0	ML/CL	561.3538	812	56	617.3538	99.2	2	96	96	3.2	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	1.666409	0.146176
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	60.4566	658	62	122.4566	100.1	7	96	96	4.1	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566	310	1.7	1.355135	0.797138
MW 10-106																										
7	5901+47	5983+69	86	0	CH/CL	640.6653	1020	68	708.6653	95.6	2	91	91	4.6	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103	265	5.2	1.25197	0.240764
MW 11-140																										
8	5983+69	6238+39	83	0	SM/CL	314.4501	705	68	382.4501	95	7	89	89	6	10.4	SM/CL	0.2835	28.35	100	100	0.003100868	322.4903		18.8	2.74483	0.146002
MW 10-111																										

Project: Left Levee Option C

Project Segment	Levee Station		Semi Pervious Berm Design Values									Semi Pervious Berm Design Values or Minimum Berm Design Values									Final Recommended Berm Dimensions			
	From	To	i_o with berm	i_l with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b	H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm	Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																					
MW 10-92																								
2	5242+49	5430+83	No Berm Needed																					
MW 10-100																								
3	5430+83	5550+65	No Berm Needed																					
MW 10-113																								
4	5550+65	5641+96	No Berm Needed																					
MW 10-109																								
5	5641+96	5768+50	No Berm Needed																					
MW 10-105																								
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	1.033591	0.122394	0.099245	11.88899	2.411765	2.025529	28.4	0.469759	5	2	6.25	6.7	0.154267	35	6.25	5.375	1:40
MW 10-106			Design indicates minimum berm																					
7	5901+47	5983+69	0.5	0.5	1	11.89645	2.6	2.493796	-0.0708	0.008321	-30.0833	0.884615	0.982742	30.4	0.042157	5	2	6.25	10.2	0.24449	35	6.25	5.375	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																					
8	5983+69	6238+39	No Berm Needed																					
MW 10-111																								

				Project:	Left Levee Option C				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-92								
	2	5242+49	5430+83	No cutoff required					
	MW 10-100								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-109								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	24.5	21.5	114%	171.4566	1.068814	0.628714
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	738.6653	2.272341	0.436989
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6238+39	No cutoff required					
	MW 10-111								

Project:	Right Levee Option C																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	394.9908	1200	62	456.9908	110	2	103	103	7	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627	250	9	2.47528	0.275031
MW 10-93																										
2	5242+49	5430+83	95	3	sCL	123.3627	706	62	185.3627	103.1	7	99	99	4.1	8.9	CL/SM	0.2835	28.35	17.1	100	0.008106006	123.3653	1000	8.9	1.638328	0.184082
MW 10-96																										
3	5430+83	5550+65	92	0	CL	77.97435	895	62	139.9744	101.6	7	97	97	4.6	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435	10	4.9	0.306719	0.062596
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	1105.465	1758	62	1167.465	99.9	2	96	96	3.9	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99	624	19.6	1.358441	0.069308
MW 10-108																										
5	5641+96	5768+50	88	0	SM/CL	173.205	1350	68	241.205	98.3	7	95	95	3.3	3	SM/CL	0.2835	28.35	100	100	0.005773503	173.2051		11.1	1.379254	0.124257
MW 10-103																										
6	5768+50	5901+47	89	0	CL/SM	60.4566	1084	68	128.4566	100.4	7	95	95	5.4	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.728125	1.016544
MW 10-106																										
7	5901+47	5983+69	88	0	CH/CL	701.2468	1540	68	769.2468	95.9	2	92	92	3.9	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.887018	0.362888
MW 11-140																										
8	5983+69	6119+04	82	0	CL/ML	731.4194	880	68	799.4194	95.9	2	91	91	4.9	12.2	CL/ML	0.02835	28.35	100	1000	0.000905357	1104.536		14.3	2.842623	0.198785
MW 11-137																										

Project: Right Levee Option C

Project Segment	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
	From	To	i_o with berm	i_l with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-96																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-103																										
6	5768+50	5901+47	0.5	0.5	1	18.74864	0.85	1.299755	0.299836	0.099245	26.278		3.176471	2.124774	33.6	0.555771	5	2	6.25	6.7	0.193993		35	6.25	5.375	1:40
MW 10-106			Design indicates minimum berm																							
7	5901+47	5983+69	0.5	0.5	1	12.40052	2.6	2.373853	-0.15076	0.008321	-65.7162		0.75	1.066753	27.6	0.038274	5	2	6.25	10.2	0.232731		30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6119+04	No Berm Needed																							
MW 11-137																										

				Project:	Right Levee Option C				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-96								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-103								
	6	5768+50	5901+47	24.5	21.5	114%	177.4566	1.372205	0.807179
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	799.2468	1.849783	0.355727
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6119+04	No cutoff required					
	MW 11-137								

Project:	Left Levee Option D																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	0	CL/CH	393.3555	1075	56	449.3555	107	2	104	104	3	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	1.406952	0.156328
MW 10-93																										
2	5242+49	5430+83	95	10	CL	309.2798	1086	56	365.2798	104	7	101	101	3	9.6	CL/SM	0.2835	28.35	100	100	0.003227486	309.8387		9.6	1.376819	0.143419
MW 10-100																										
3	5430+83	5550+65	93	0	CL	77.97435	1420	62	139.9744	100.7	7	96	96	4.7	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.681494	0.343162
MW 10-113																										
4	5550+65	5641+96	92	0	CL/SM	938.0831	8100	62	1000.083	101.3	2	98	98	3.3	8.8	CL/SM	0.02835	28.35	100	1000	0.001066004	938.0832		10.6	1.597218	0.150681
MW 10-114																										
5	5641+96	5768+50	88	0	ML/CL	670.8201	5200	62	732.8201	99	2	96	96	3	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	1.433744	0.125767
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	60.4566	3055	62	122.4566	99.1	7	96	96	3.1	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.024614	0.602714
MW 10-106																										
7	5901+47	5983+69	86	0	CH/CL	720.2338	2670	62	782.2338	94.9	2	91	91	3.9	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.870716	0.359753
MW 11-140																										
8	5983+69	6238+39	83	0	SM/CL	314.4501	705	62	376.4501	95.1	7	89	89	6.1	10.4	SM/CL	0.2835	28.35	100	100	0.003100868	322.4903		18.8	2.814533	0.149709
MW 10-111																										

Project: Left Levee Option D

	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-100																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-114																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	0.895896	0.030597	0.099245	3.180717		1.823529	2.025529	24.4	0.403595	5	2	6.25	6.7	0.133716		30	6.25	5.5	1:40
MW 10-106			Design indicates using minimum berm																							
7	5901+47	5983+69	0.4	0.4	1	12.50858	2.08	2.012571	-0.04816	0.008321	-23.7686		0.75	1.084763	27.6	0.038274	5	2	6.25	10.2	0.197311		30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6238+39	No Berm Needed																							
MW 10-111																										

				Project:	Left Levee Option D				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-100								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-114								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	19	21.5	88%	160.4566	0.848367	0.499039
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	812.2338	1.834115	0.352714
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6238+39	No cutoff required					
	MW 10-111								

Project:	Right Levee Option D																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1 MW 10-93	5217+38	5242+49	95	2	SC	210.9072	235	62	272.9072	106	2	103	103	3	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627	1000	9	1.777608	0.197512
2 MW 10-96	5242+49	5430+83	95	4.3	CL	123.198	450	62	185.198	104	7	99	99	5	8.9	CL/SM	0.2835	28.35	17.1	100	0.008106006	123.3653		8.9	1.999028	0.22461
3 MW 10-113	5430+83	5550+65	92	0	CL	77.97435	1490	62	139.9744	101.1	7	97	97	4.1	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.466835	0.299354
4 MW 10-108	5550+65	5641+96	92	0	CL/CH	1227.014	3065	62	1289.014	99	2	96	96	3	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99	890	19.6	1.225325	0.062517
5 MW 10-103	5641+96	5768+50	88	0	SM/CL	173.2051	2020	62	235.2051	98.1	7	95	95	3.1	3	SM/CL	0.2835	28.35	100	100	0.005773503	173.2051		11.1	1.314697	0.118441
6 MW 10-106	5768+50	5901+47	89	0	CL/SM	60.4566	2383	62	122.4566	98.2	7	95	95	3.2	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.057666	0.622157
7 MW 11-140	5901+47	5983+69	88	0	CH/CL	719.9855	2580	62	781.9855	95.8	2	92	92	3.8	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.82305	0.350587
8 MW 11-137	5983+69	6119+04	82	0	CL/ML	824.1463	1065	62	886.1463	95.9	2	91	91	4.9	12.2	CL/ML	0.02835	28.35	100	1000	0.000905357	1104.536		14.3	2.71878	0.190124

Project: Right Levee Option D

	Levee Station		Semi Pervious Berm Design Values									Semi Pervious Berm Design Values or Minimum Berm Design Values									Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b	H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm	Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																					
MW 10-93																								
2	5242+49	5430+83	No Berm Needed																					
MW 10-96																								
3	5430+83	5550+65	No Berm Needed																					
MW 10-113																								
4	5550+65	5641+96	No Berm Needed																					
MW 10-108																								
5	5641+96	5768+50	No Berm Needed																					
MW 10-103																								
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	0.90656	0.037707	0.099245	3.897241	1.882353	2.025529	24.8	0.410212	5	2	6.25	6.7	0.135307	30	6.25	5.5	1:40
MW 10-106			Design indicates using minimum berm																					
7	5901+47	5983+69	0.5	0.5	1	12.50651	2.6	2.360314	-0.15979	0.008321	-69.8611	0.730769	1.084419	27.2	0.03772	5	2	6.25	10.2	0.231403	30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																					
8	5983+69	6119+04	No Berm Needed																					
MW 11-137																								

				Project:	Right Levee Option D				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-96								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-103								
	6	5768+50	5901+47	24.5	21.5	114%	171.4566	0.834196	0.490704
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	811.9855	1.787376	0.343726
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6119+04	No cutoff required					
	MW 11-137								

Figures

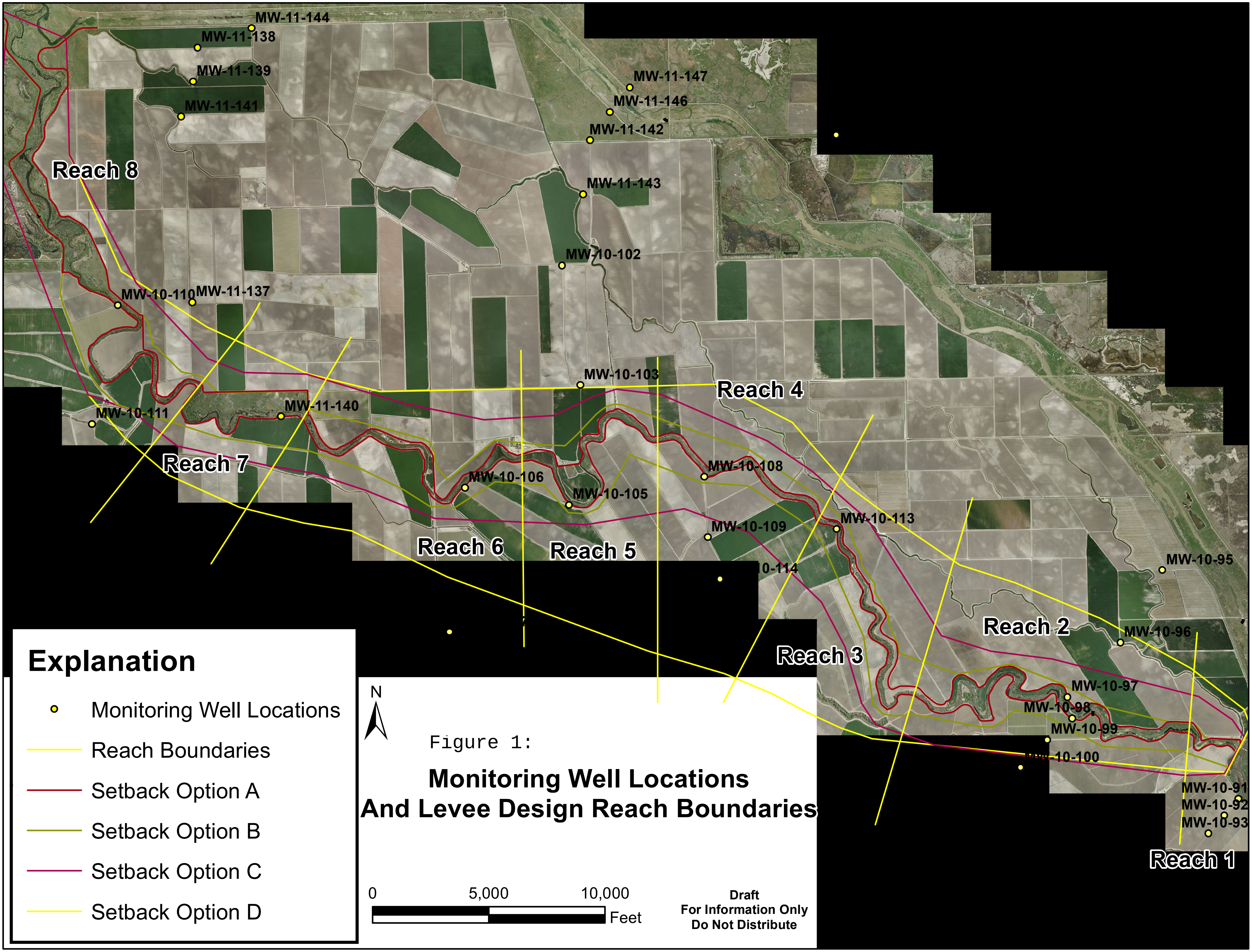


Figure 1:

Monitoring Well Locations And Levee Design Reach Boundaries

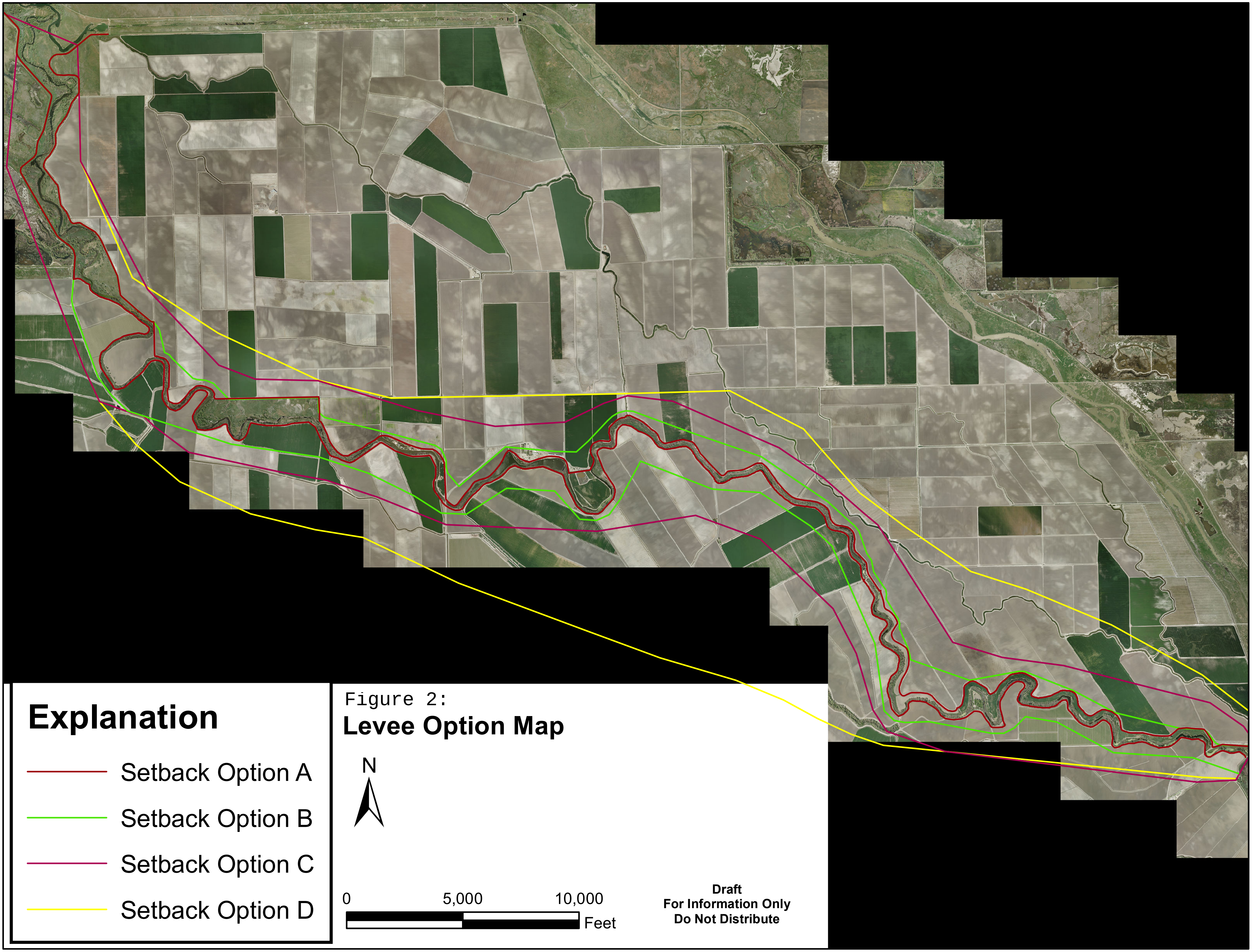


Figure 2:
Levee Option Map

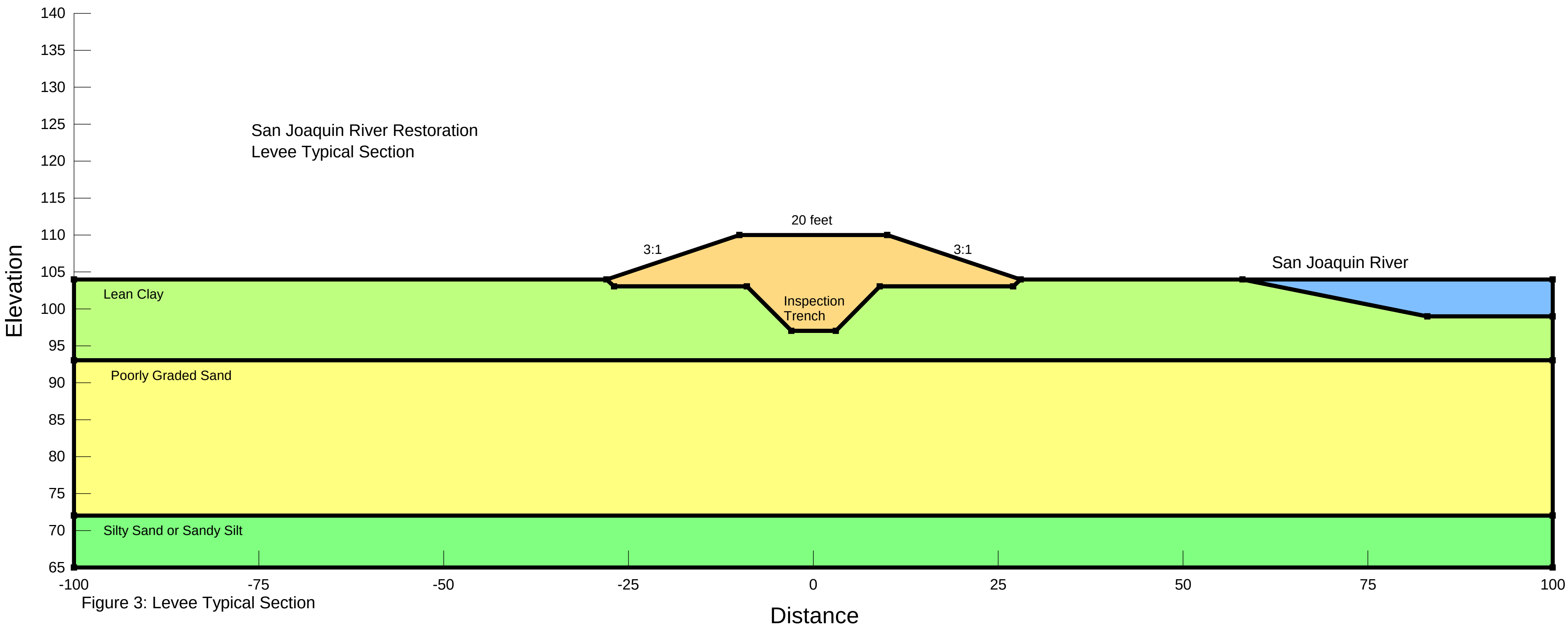


Figure 3: Levee Typical Section

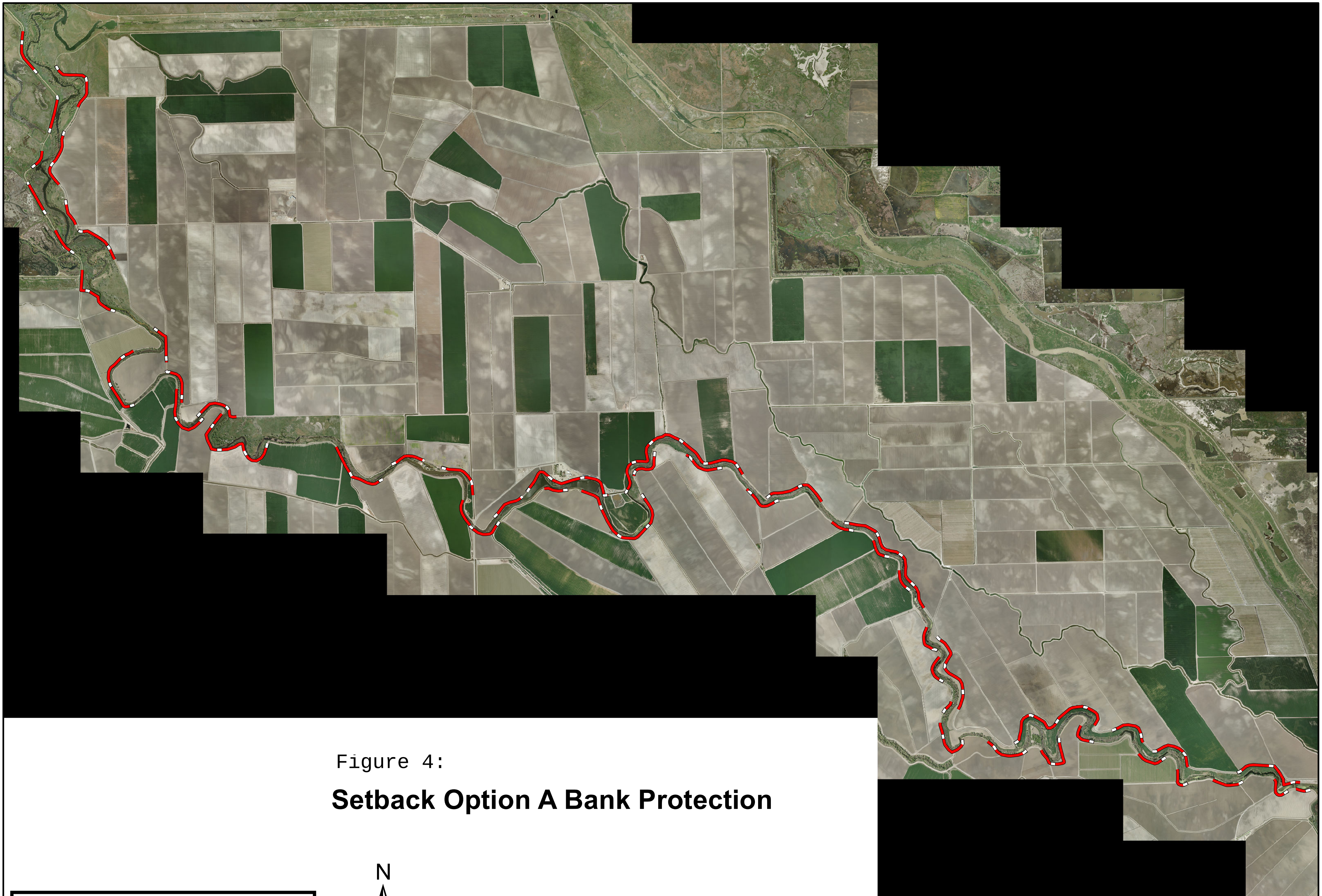


Figure 4:

Setback Option A Bank Protection

Explanation

Option A Bank Protection

N

0 5,000 10,000 Feet

Draft
For Information Only
Do Not Distribute

Figure 5:

Setback Option B Bank Protection

Explanation

Option B Bank Protection

N

0 5,000 10,000 Feet

Draft
For Information Only
Do Not Distribute

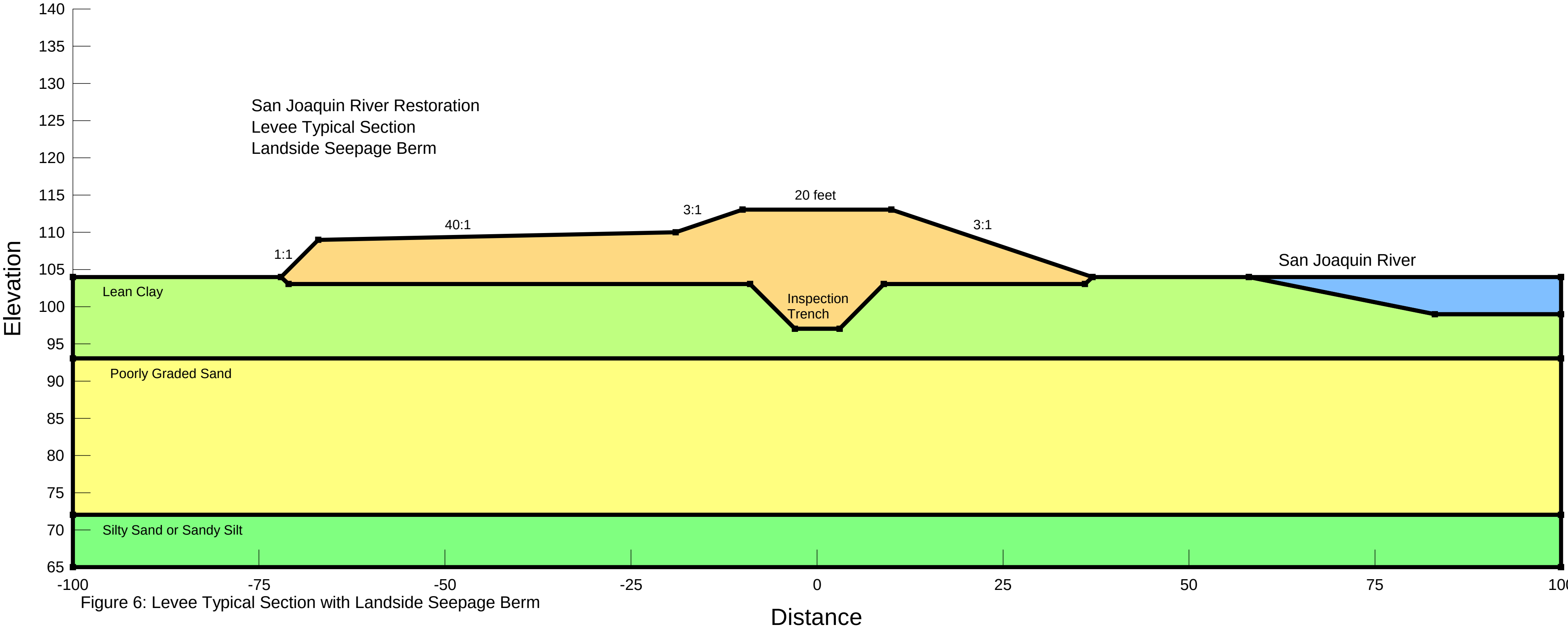


Figure 6: Levee Typical Section with Landside Seepage Berm

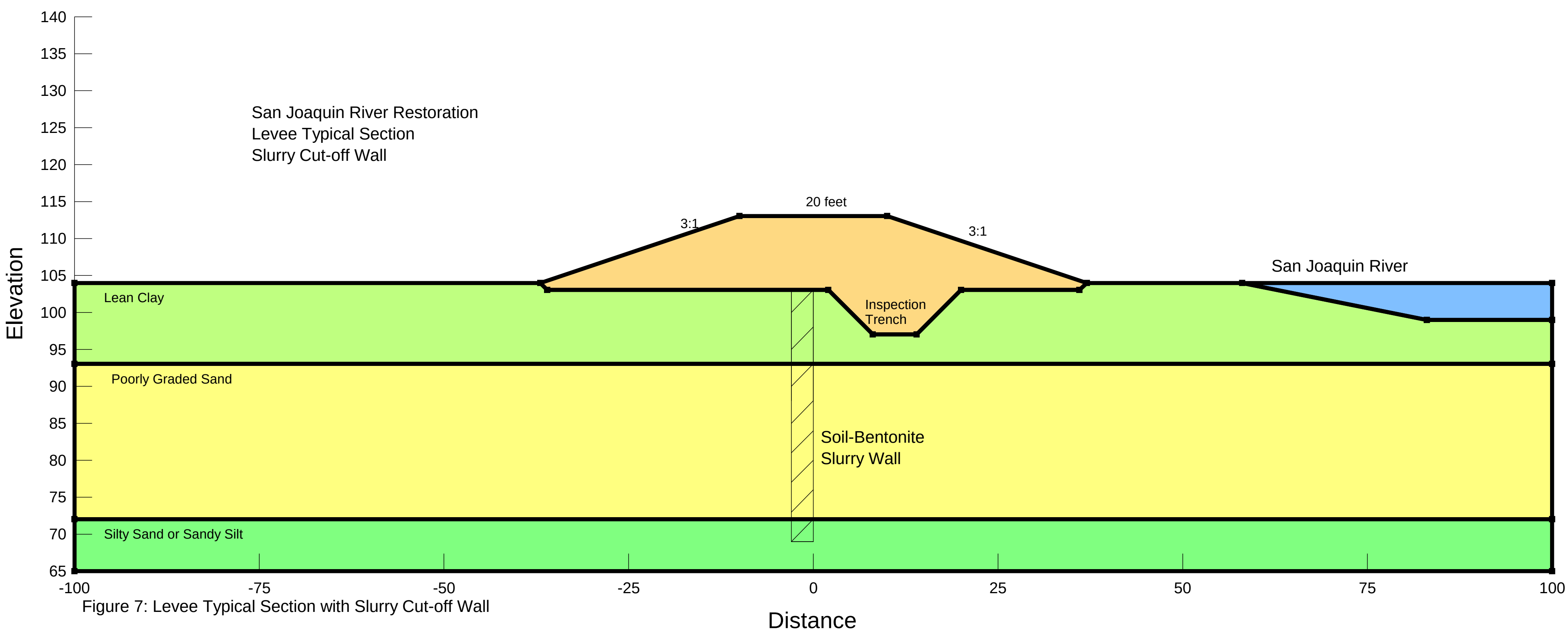


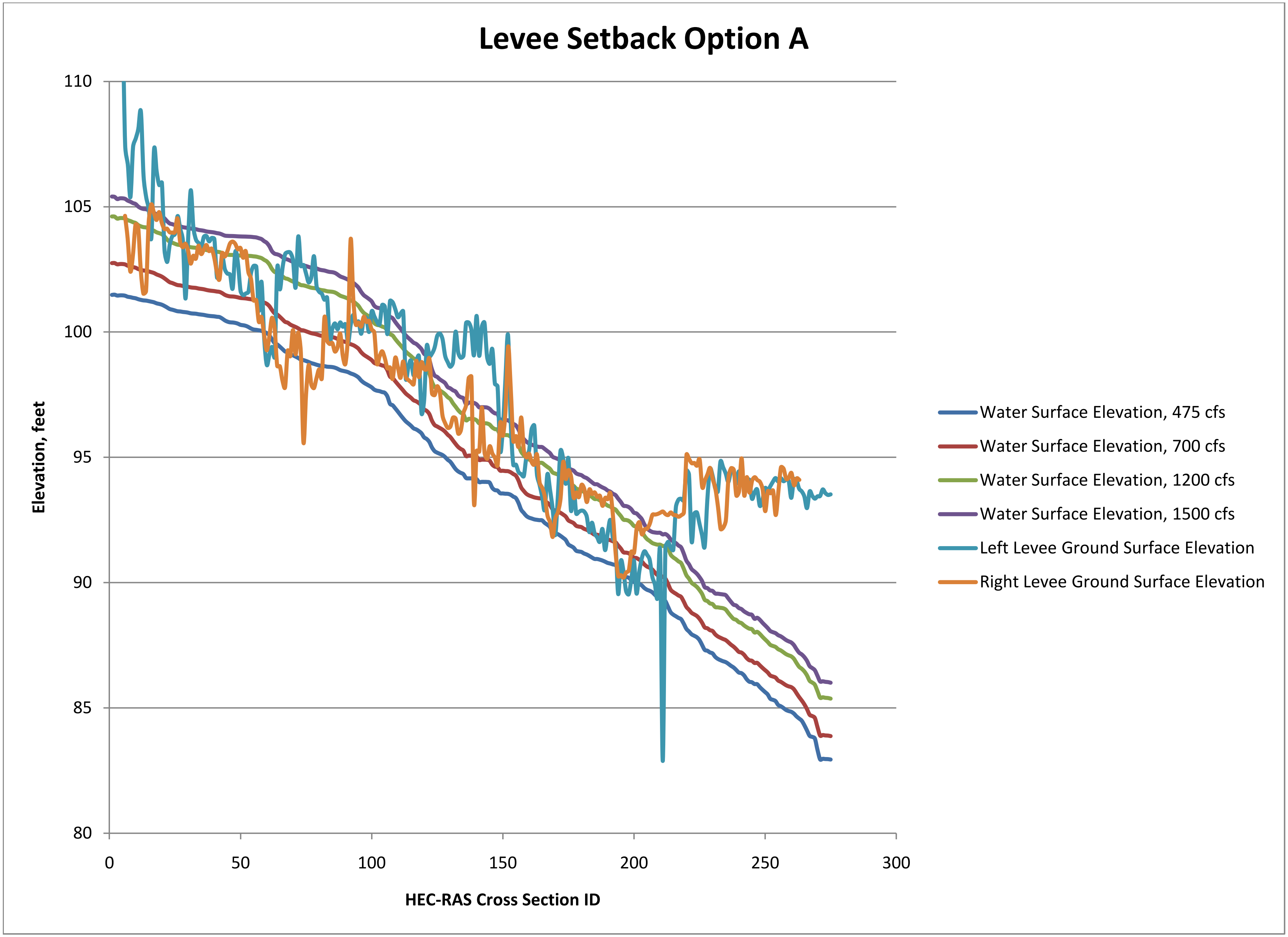
Figure 7: Levee Typical Section with Slurry Cut-off Wall

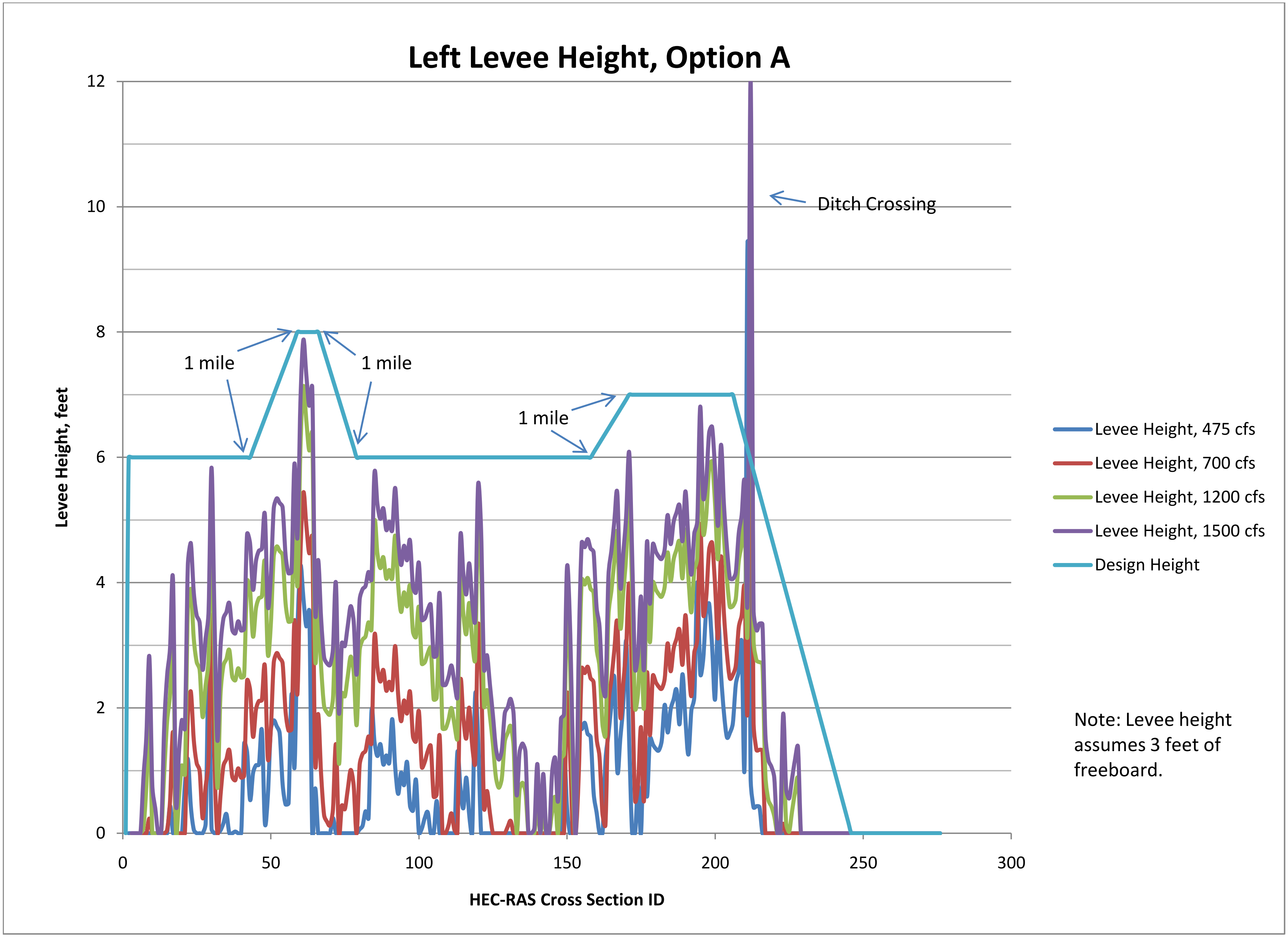
Attachment A

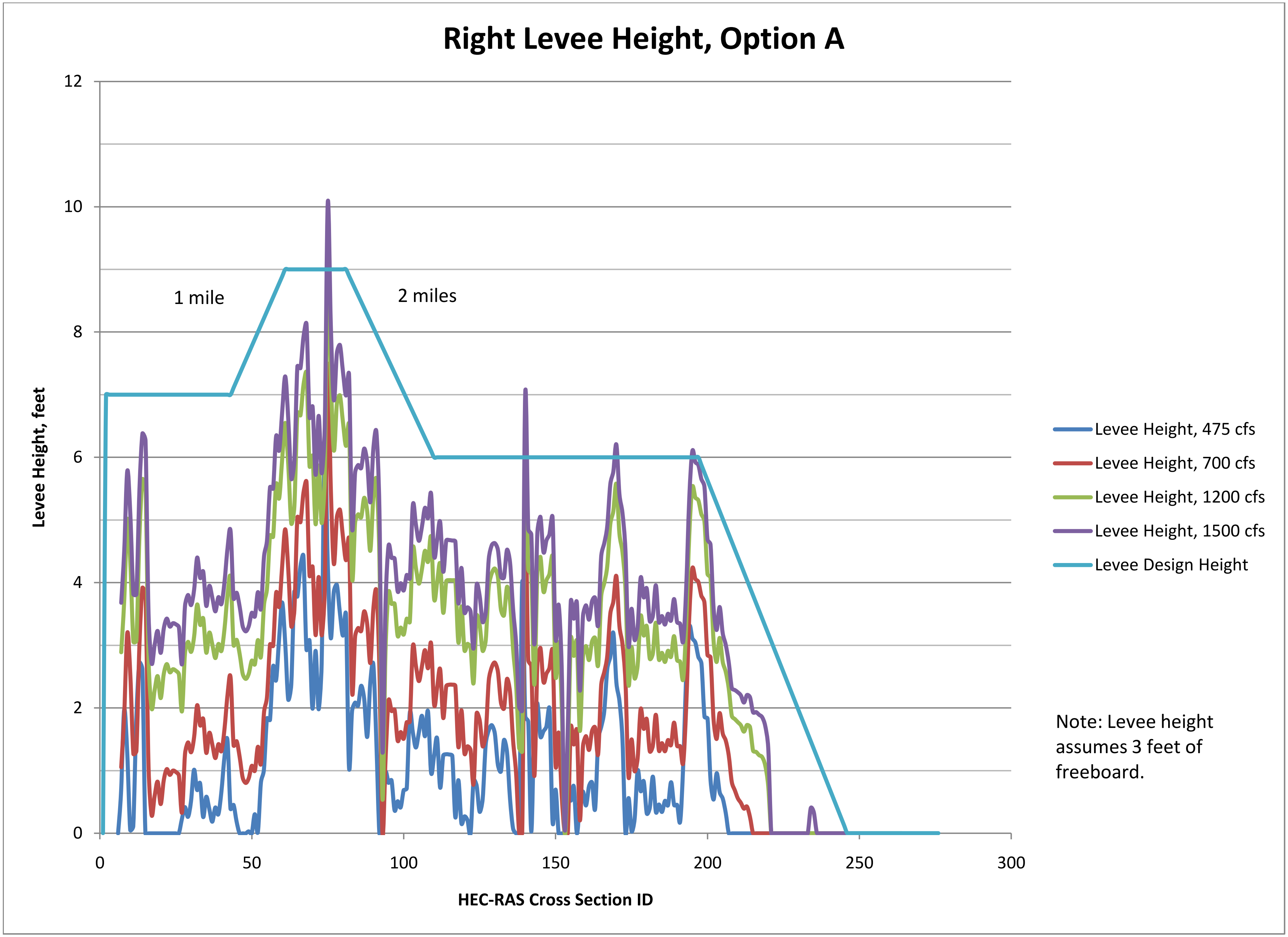
Water Elevation

And

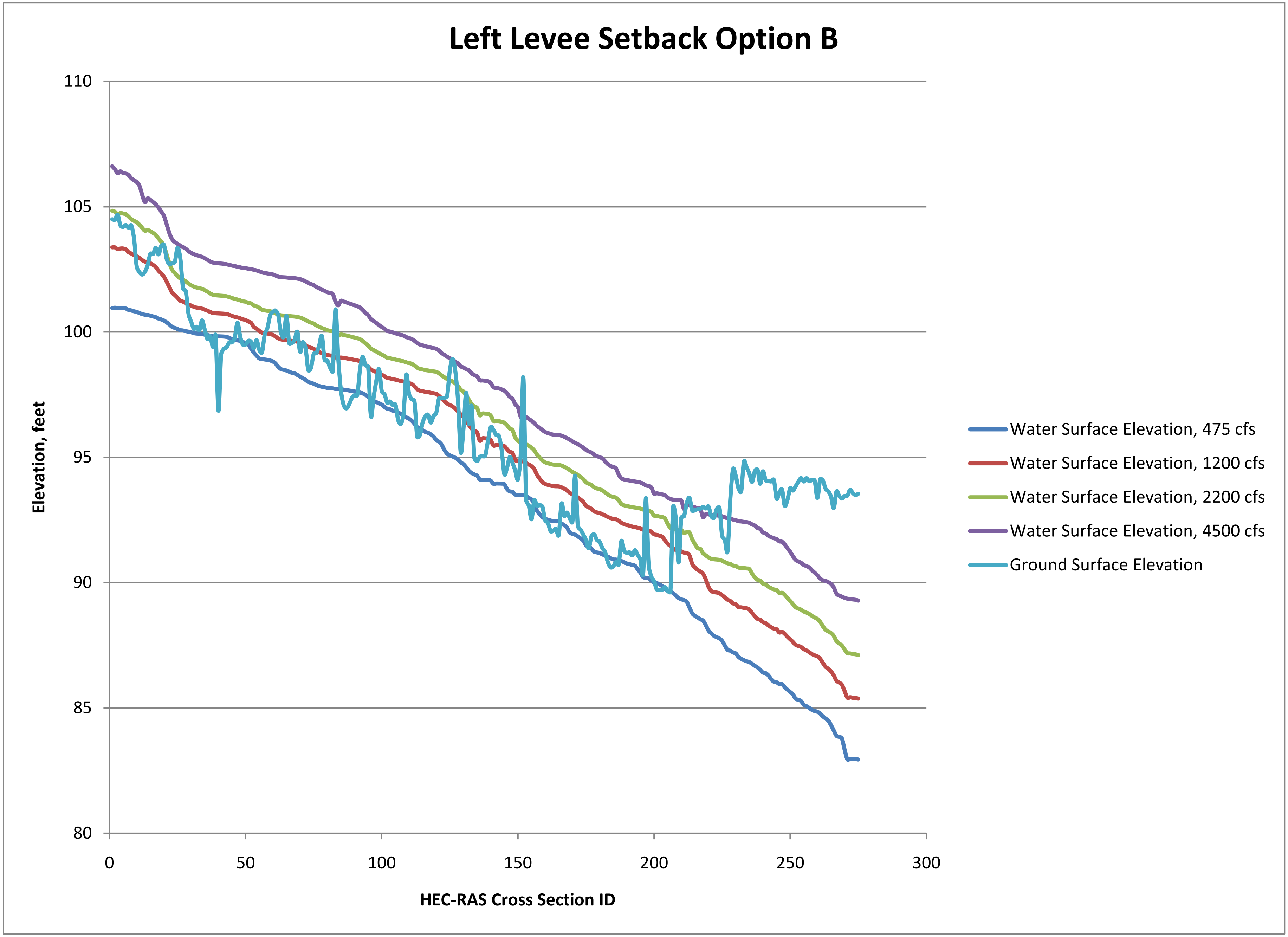
Levee Height

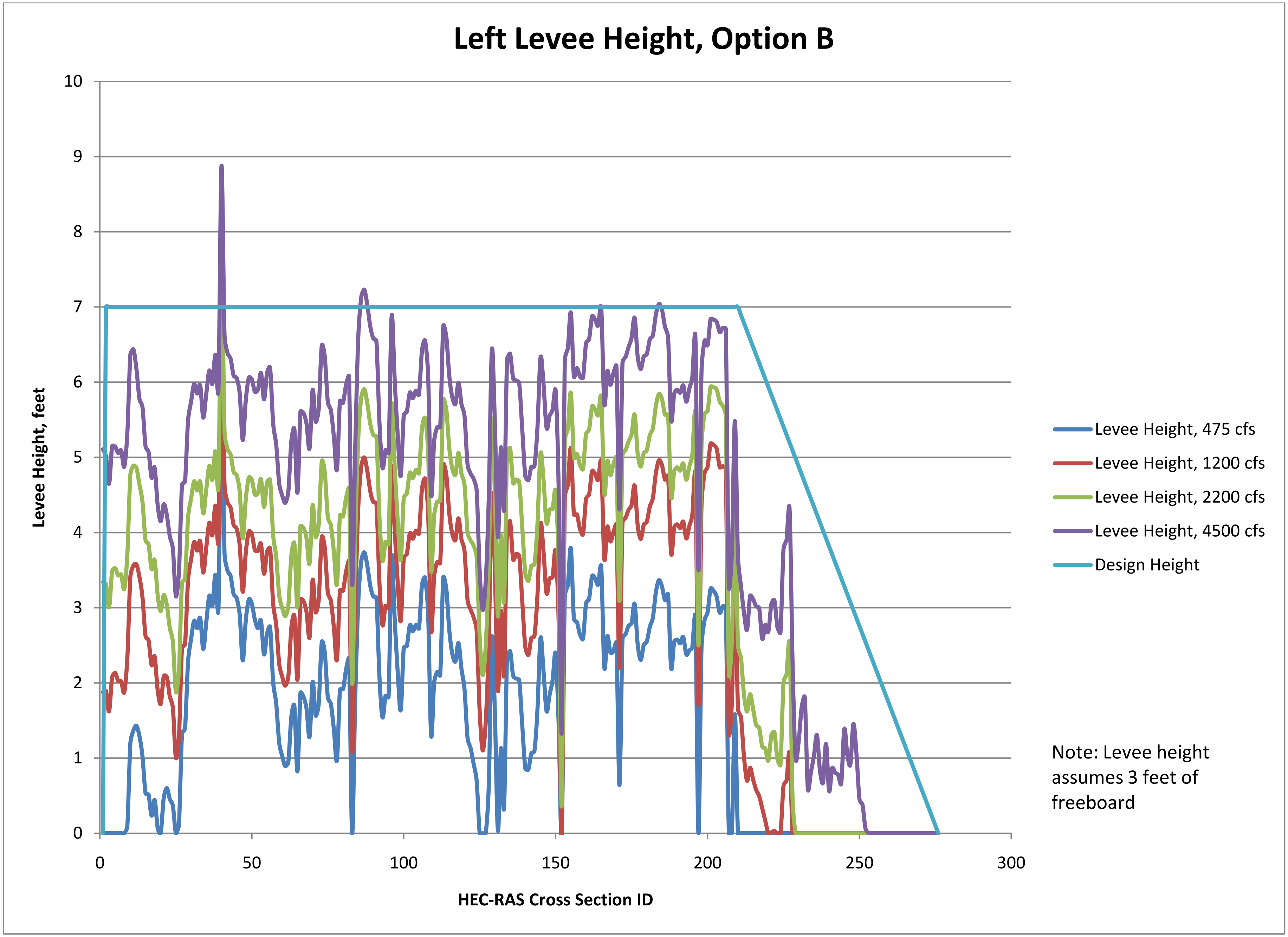

Levee Setback Option A
110
105
100
95
90
85
80
Elevation, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 700 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 1500 cfs
Left Levee Ground Surface Elevation
Right Levee Ground Surface Elevation


Left Levee Height, Option A
Levee Height, feet
HEC-RAS Cross Section ID
0
2
4
6
8
10
12
0
50
100
150
200
250
300
1 mile
1 mile
1 mile
Ditch Crossing
Levee Height, 475 cfs
Levee Height, 700 cfs
Levee Height, 1200 cfs
Levee Height, 1500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

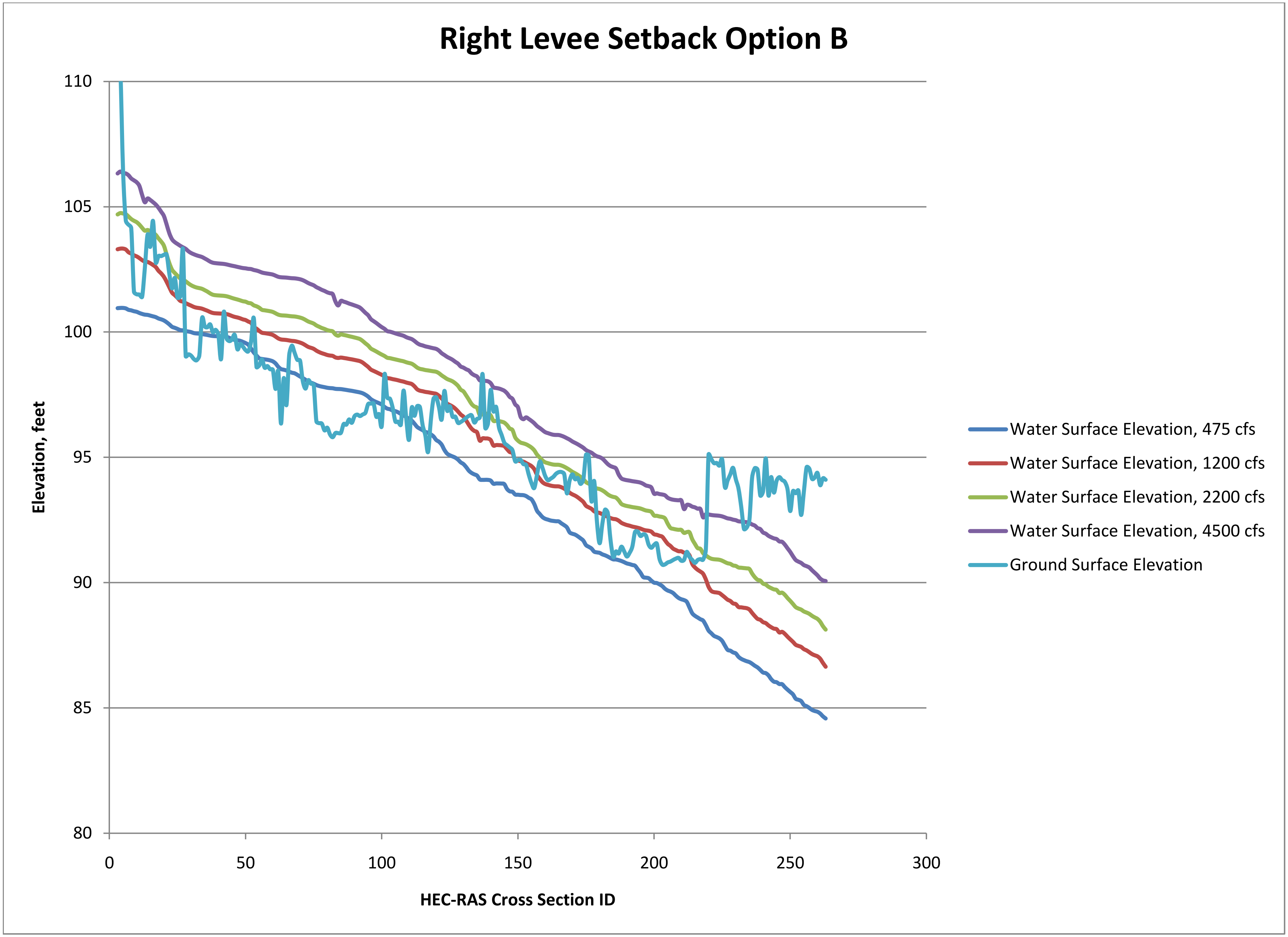


Right Levee Height, Option A
Levee Height, feet
HEC-RAS Cross Section ID
0
2
4
6
8
10
12
0
50
100
150
200
250
300
1 mile
2 miles
Levee Height, 475 cfs
Levee Height, 700 cfs
Levee Height, 1200 cfs
Levee Height, 1500 cfs
Levee Design Height
Note: Levee height assumes 3 feet of freeboard.

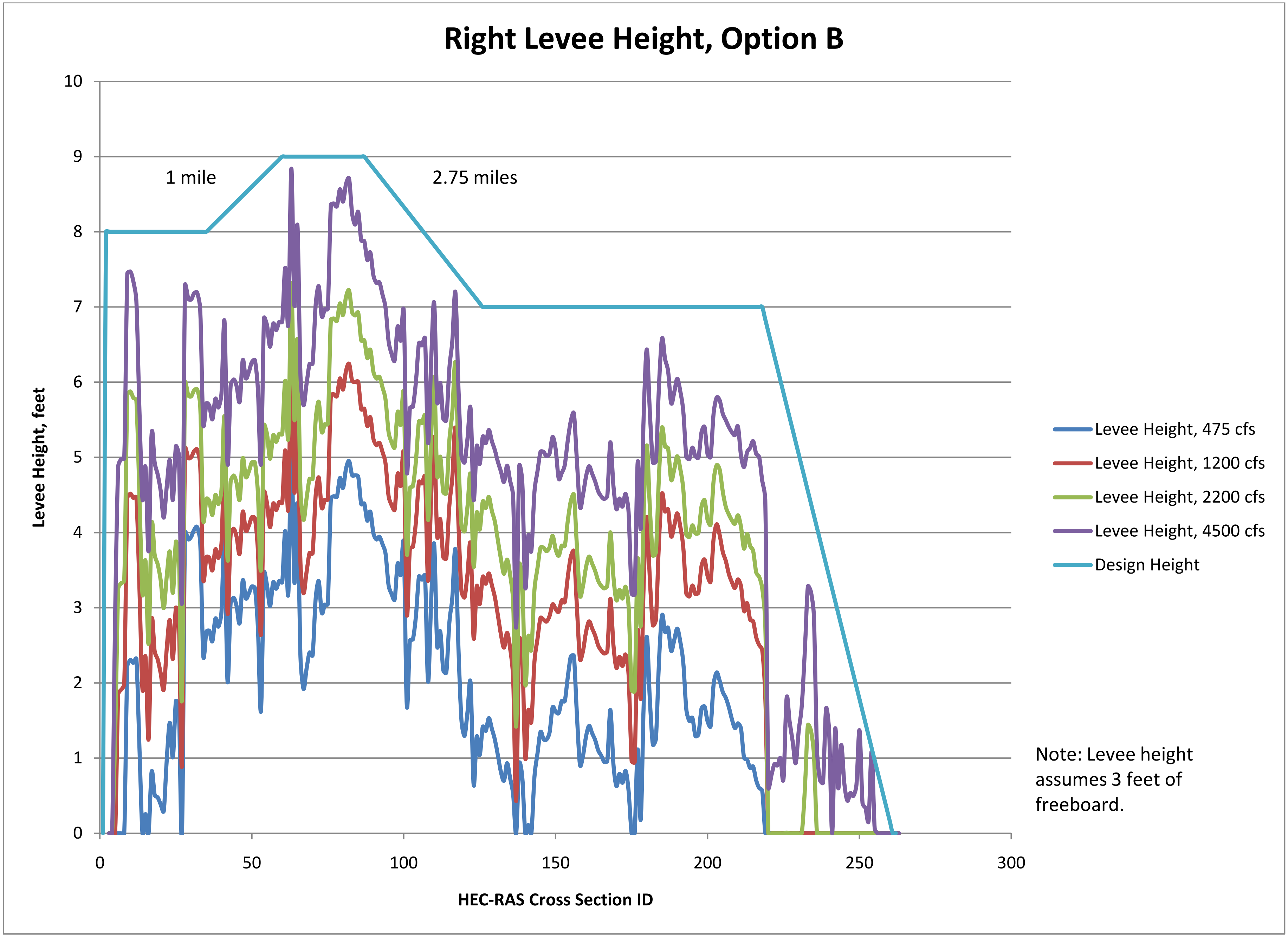

Left Levee Setback Option B
Elevation, feet
110
105
100
95
90
85
80
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation



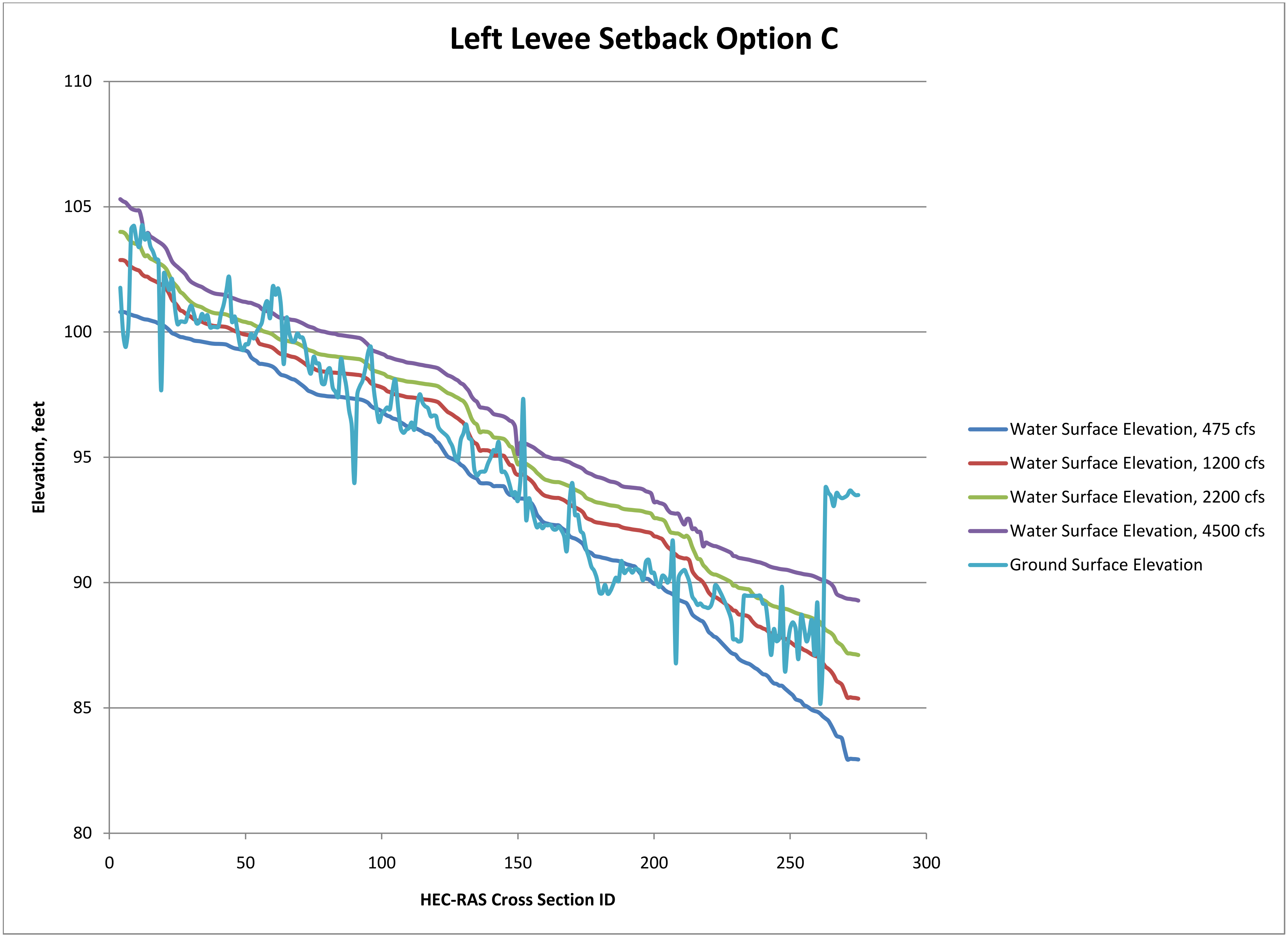
Left Levee Height, Option B
Levee Height, feet
HEC-RAS Cross Section ID
0
1
2
3
4
5
6
7
8
9
10
0
50
100
150
200
250
300
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard



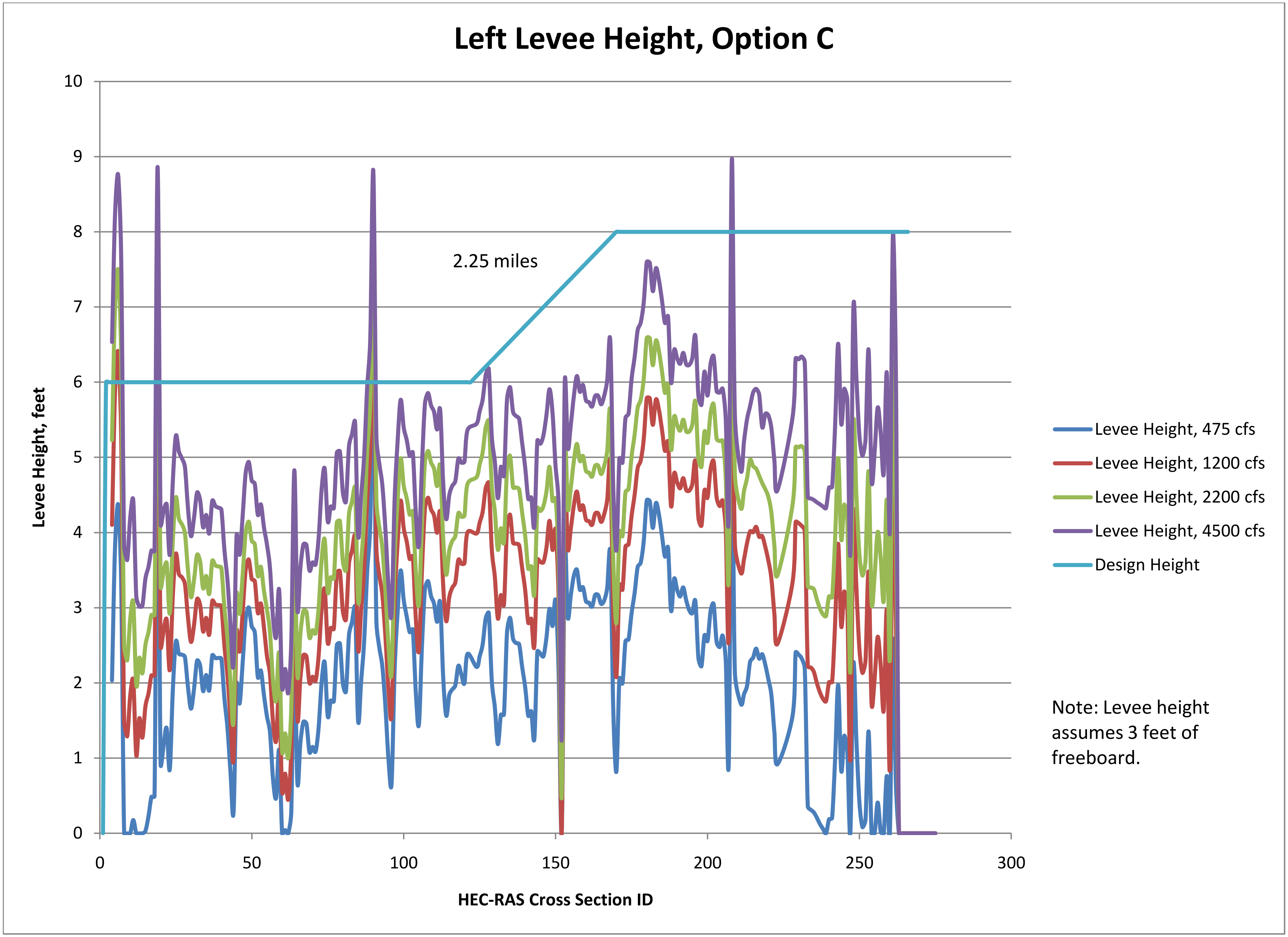
Right Levee Setback Option B
Elevation, feet
110
105
100
95
90
85
80
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation



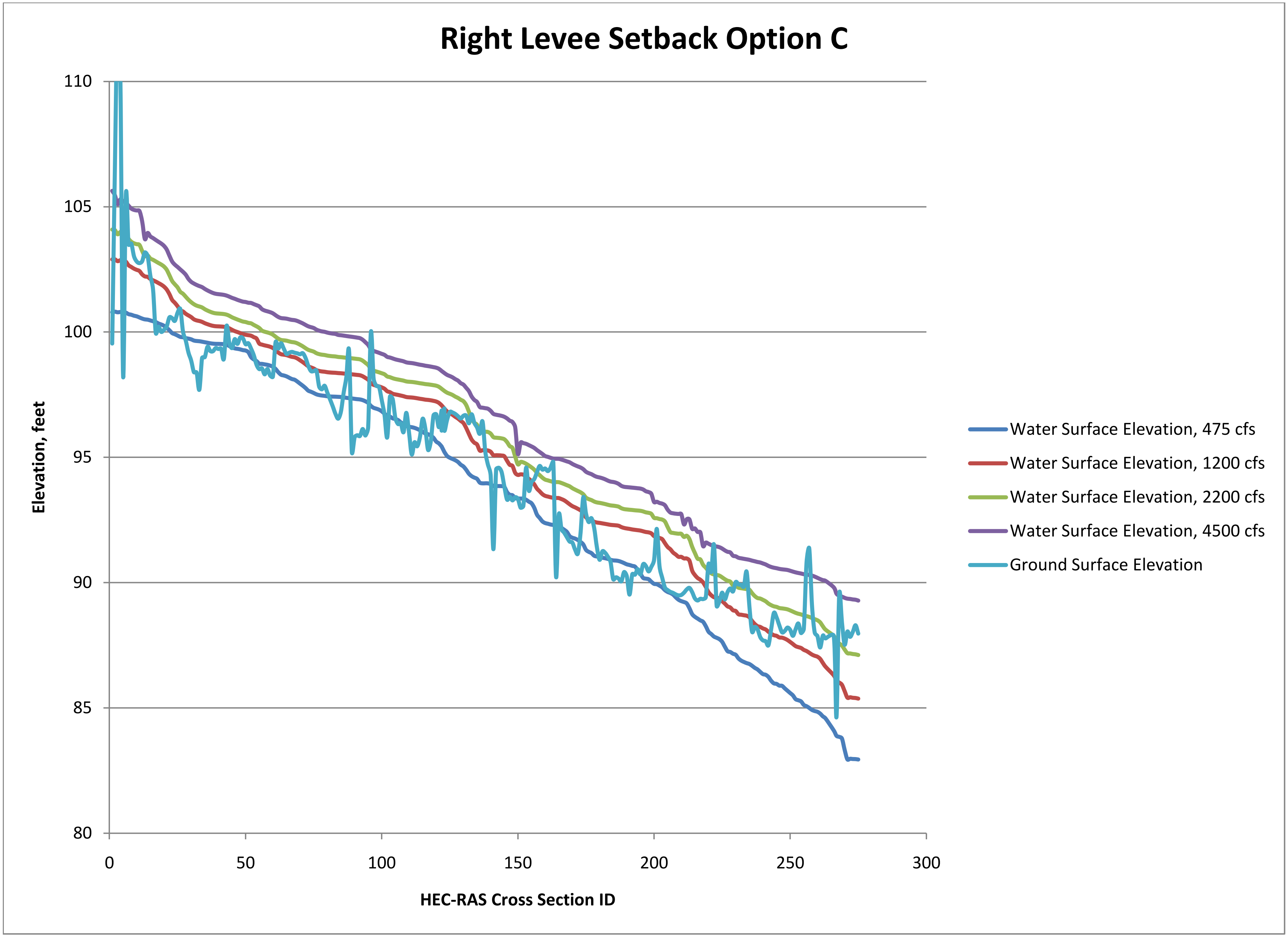
Right Levee Height, Option B
Levee Height, feet
HEC-RAS Cross Section ID
0
1
2
3
4
5
6
7
8
9
10
0
50
100
150
200
250
300
1 mile
2.75 miles
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.



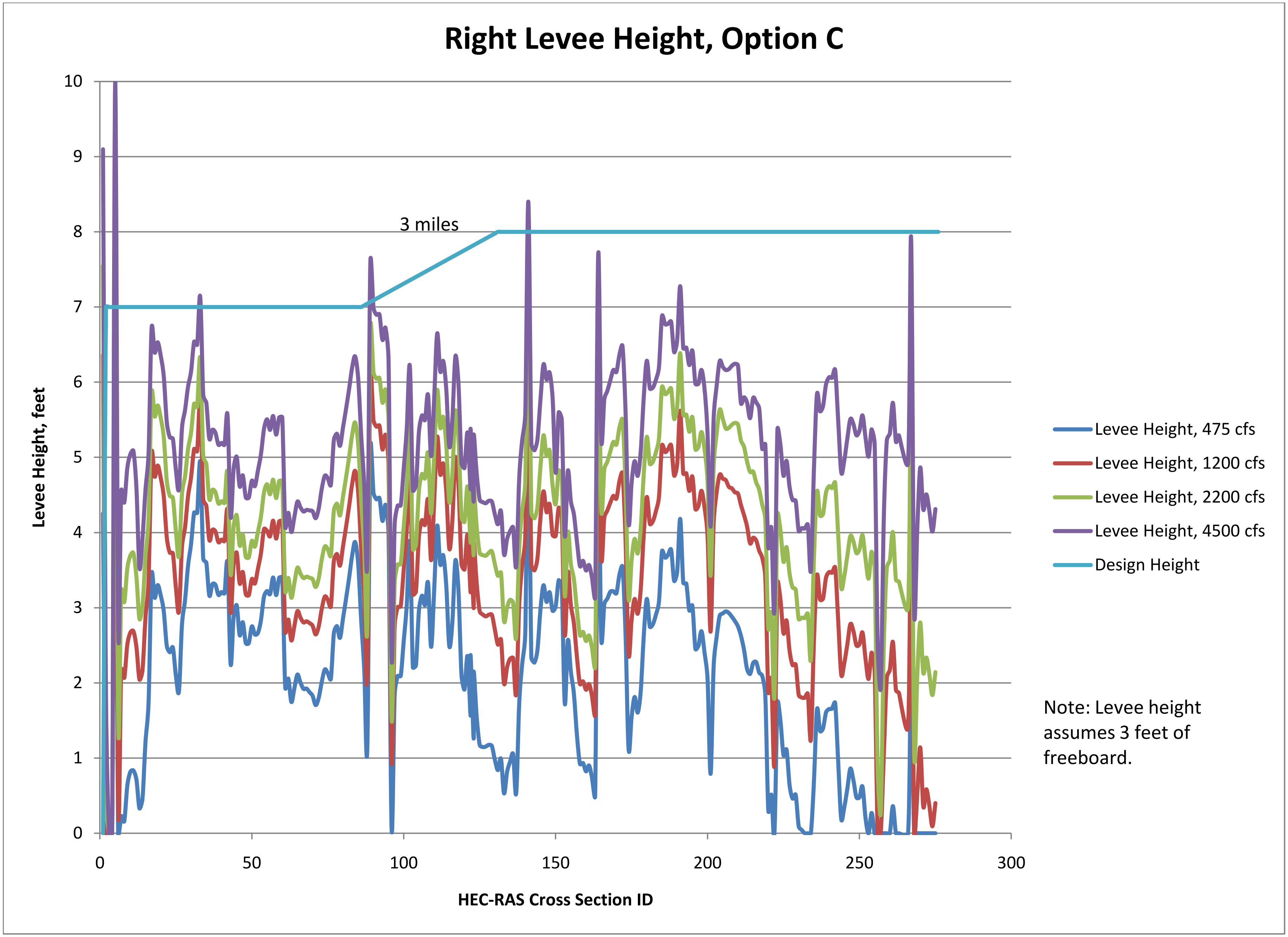
Left Levee Setback Option C
Elevation, feet
110
105
100
95
90
85
80
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation



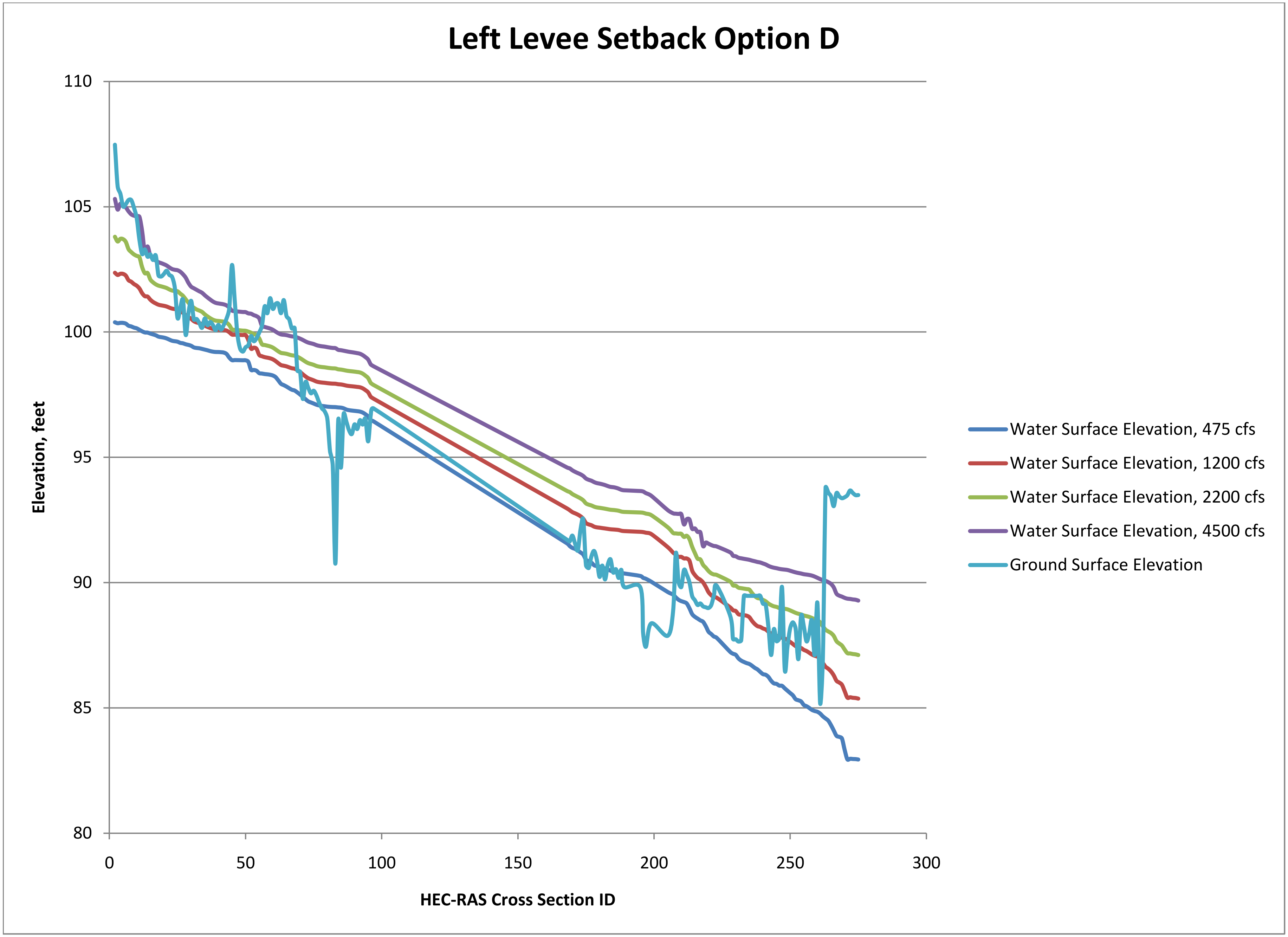
Left Levee Height, Option C
10
9
8
7
6
5
4
3
2
1
0
Levee Height, feet
2.25 miles
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

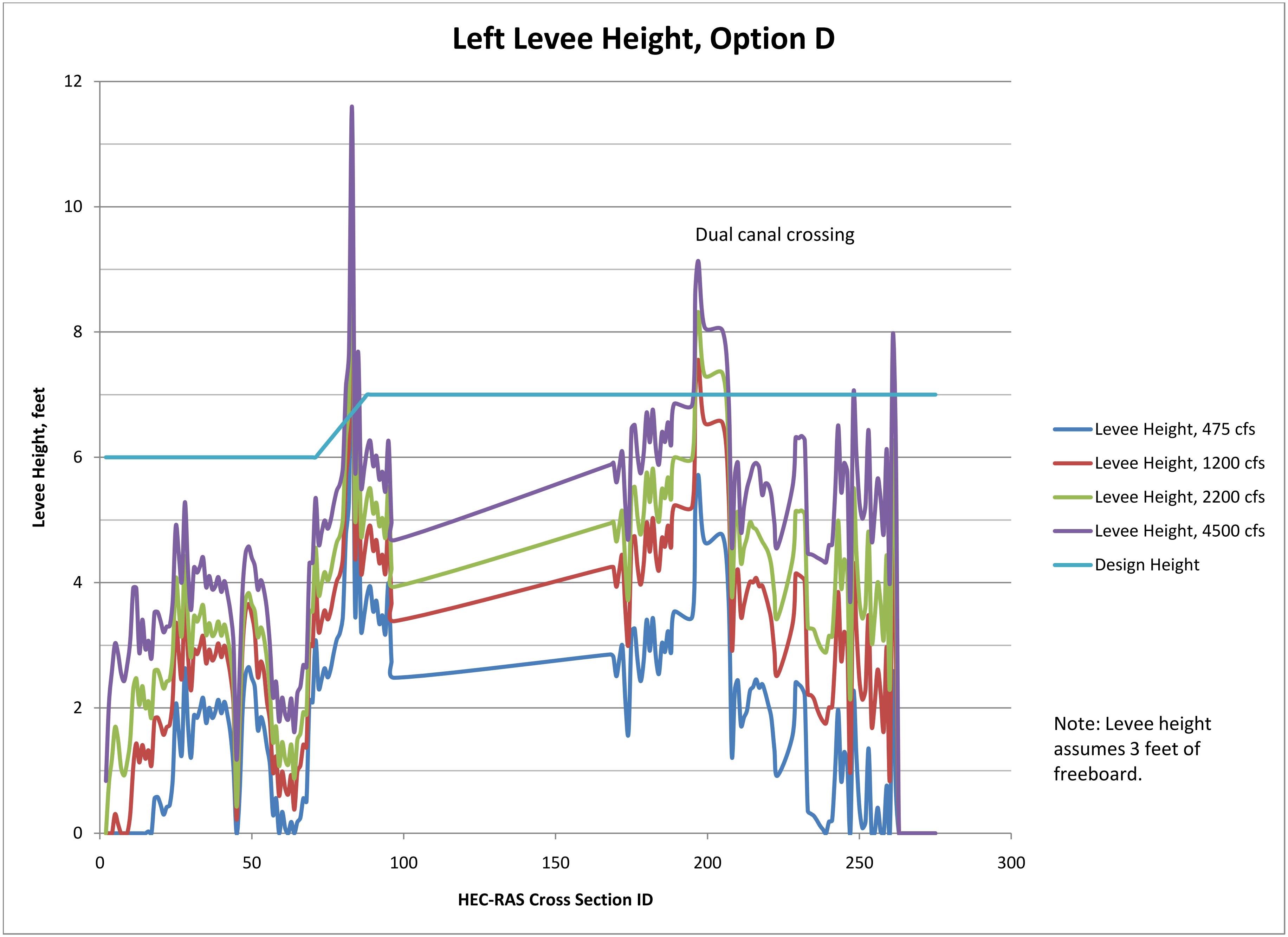


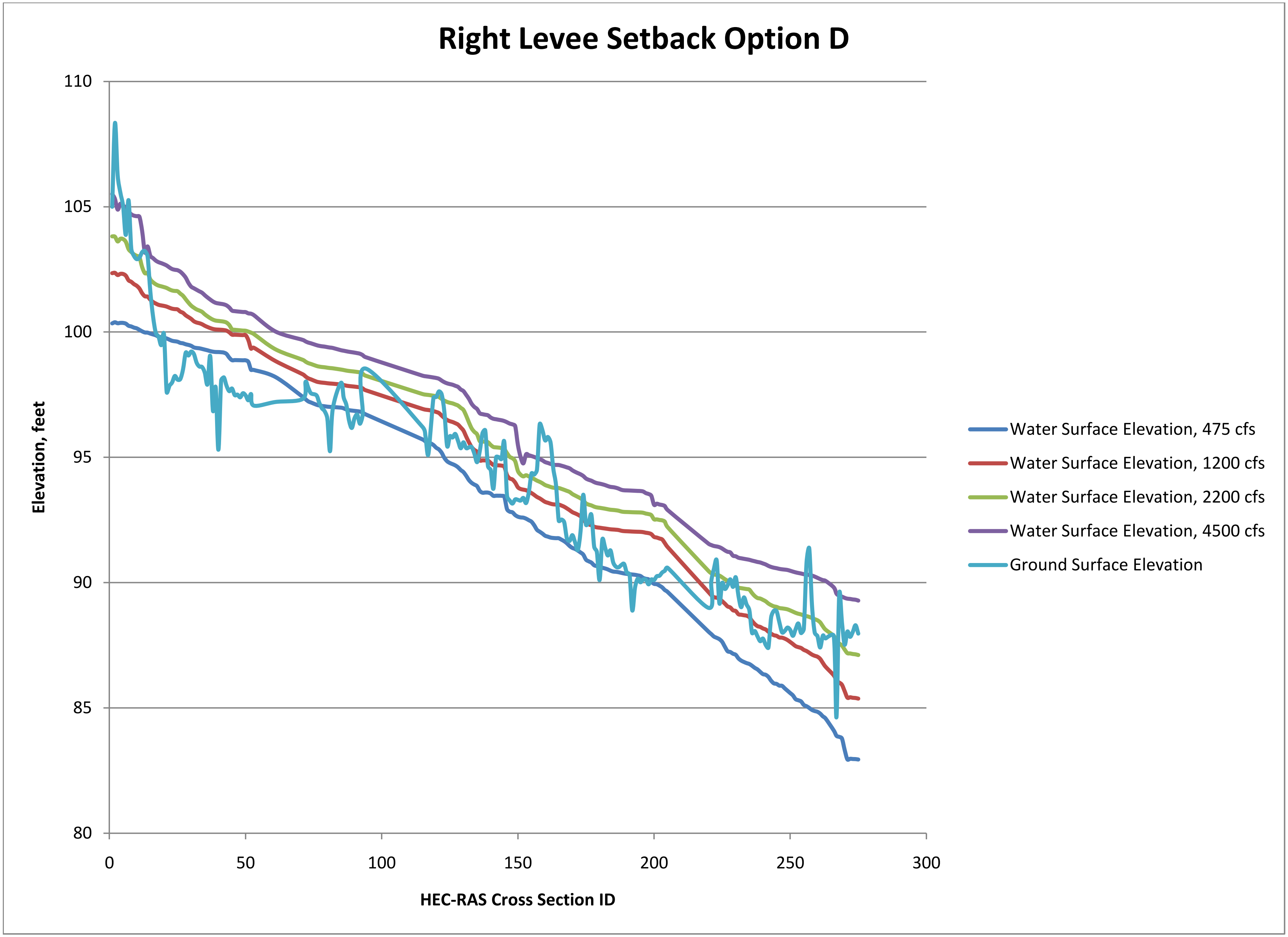
Right Levee Setback Option C
110
105
100
95
90
85
80
Elevation, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation

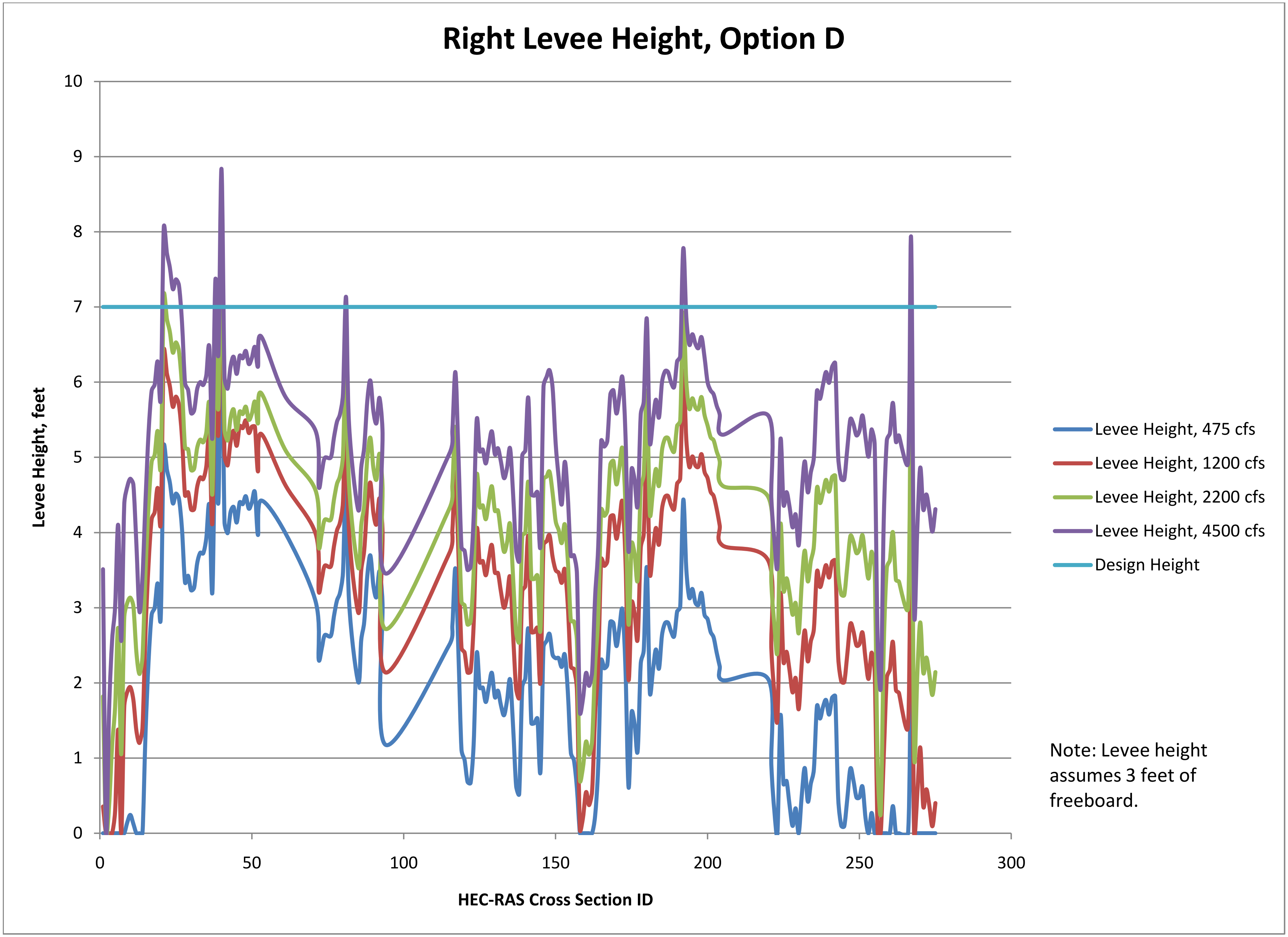


Right Levee Height, Option C
Levee Height, feet
HEC-RAS Cross Section ID
3 miles
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.
0
1
2
3
4
5
6
7
8
9
10
0
50
100
150
200
250
300


Left Levee Setback Option D
110
105
100
95
90
85
80
Elevation, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation


Left Levee Height, Option D
12
10
8
6
4
2
0
Levee Height, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Dual canal crossing
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

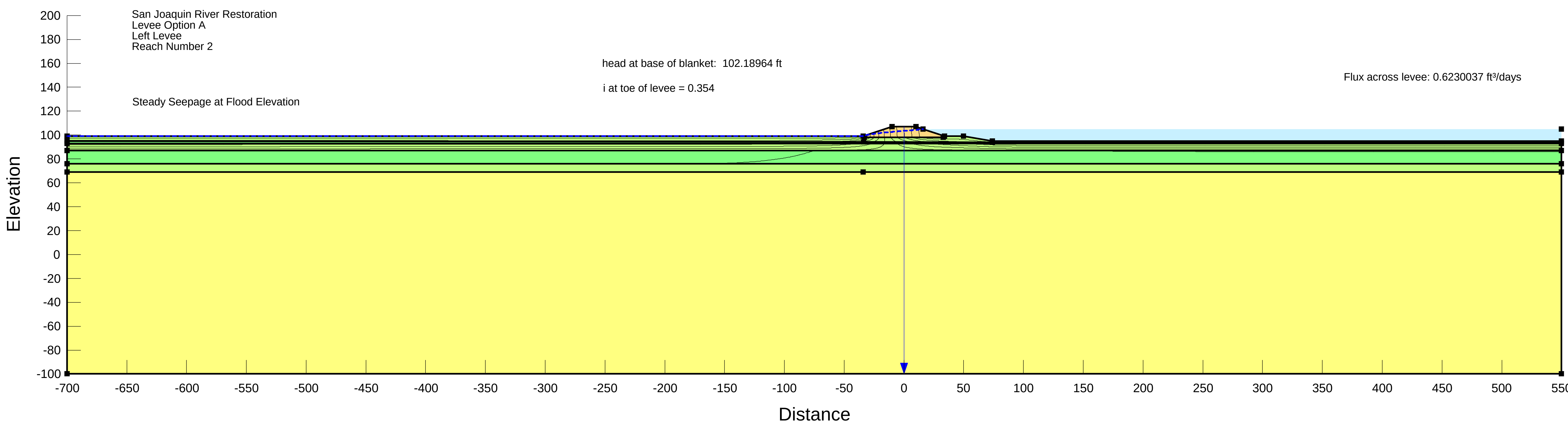

Right Levee Setback Option D
110
105
100
95
90
85
80
Elevation, feet
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Water Surface Elevation, 475 cfs
Water Surface Elevation, 1200 cfs
Water Surface Elevation, 2200 cfs
Water Surface Elevation, 4500 cfs
Ground Surface Elevation



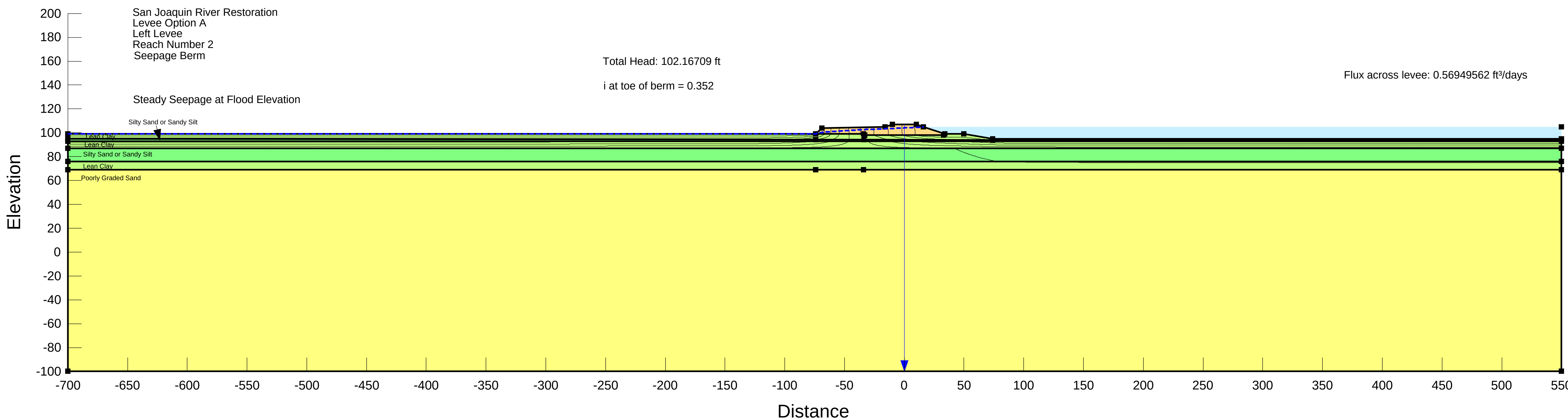
Right Levee Height, Option D
Levee Height, feet
10
9
8
7
6
5
4
3
2
1
0
0
50
100
150
200
250
300
HEC-RAS Cross Section ID
Levee Height, 475 cfs
Levee Height, 1200 cfs
Levee Height, 2200 cfs
Levee Height, 4500 cfs
Design Height
Note: Levee height assumes 3 feet of freeboard.

Attachment B

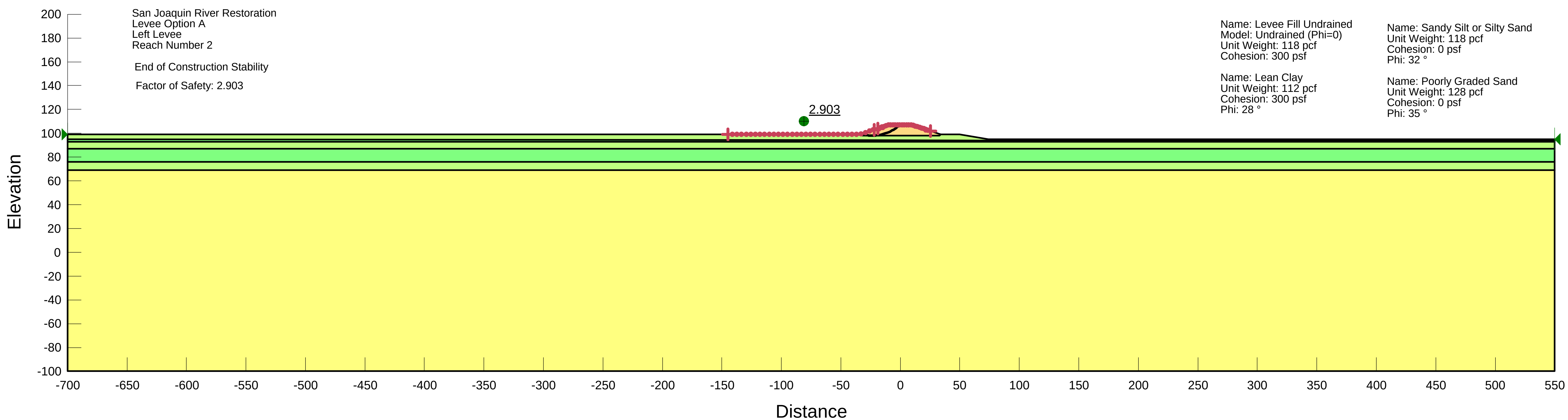
Levee Slope Stability Sections

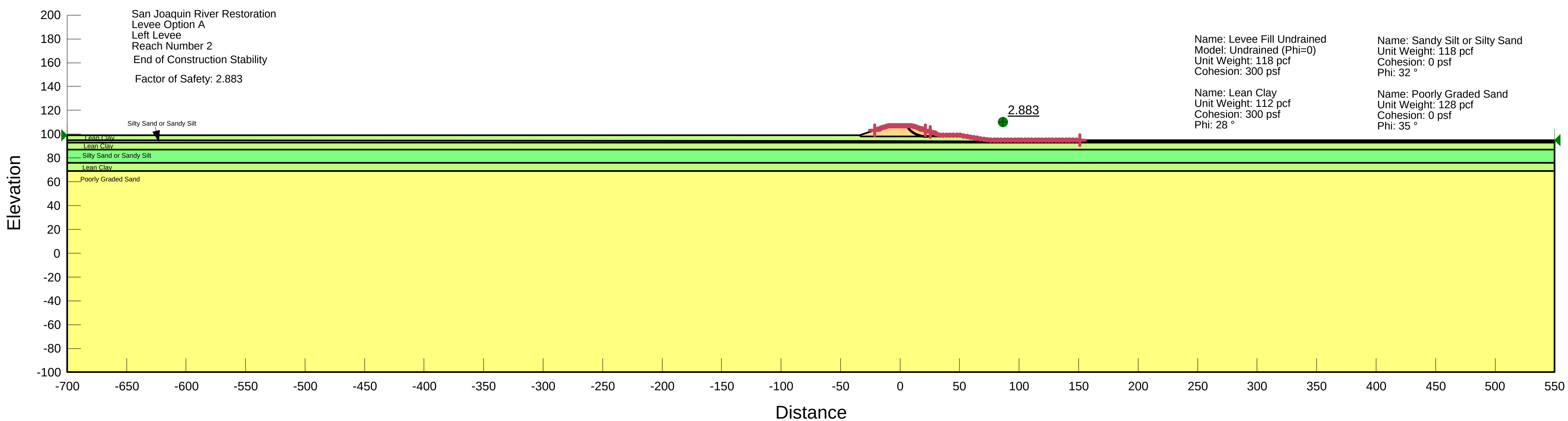


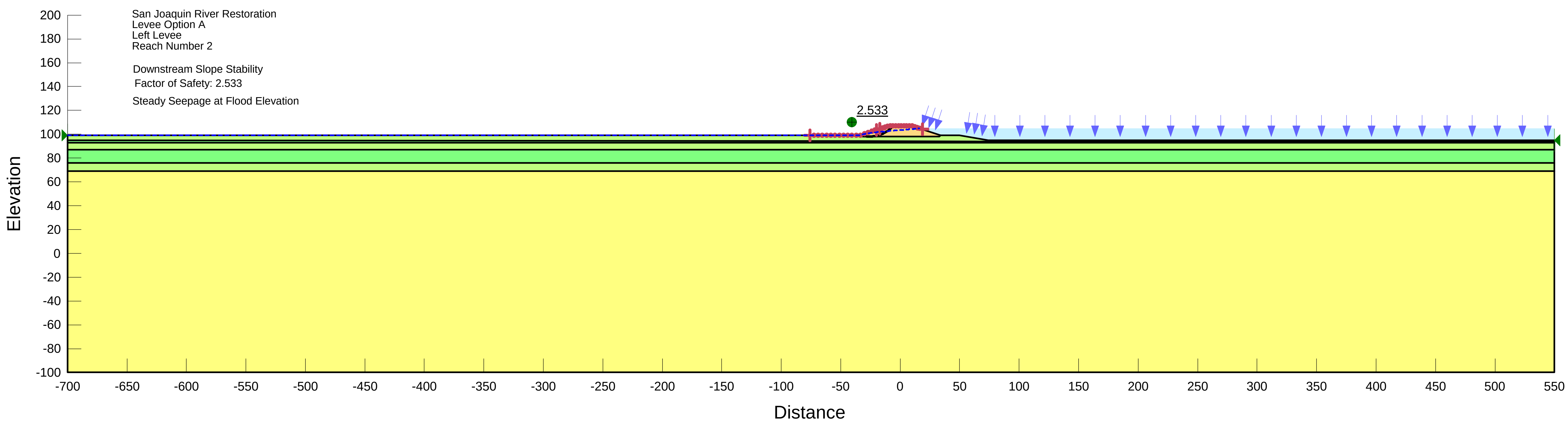
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
head at base of blanket: 102.18964 ft
i at toe of levee = 0.354
Flux across levee: 0.6230037 ft³/days
Steady Seepage at Flood Elevation
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550
Distance



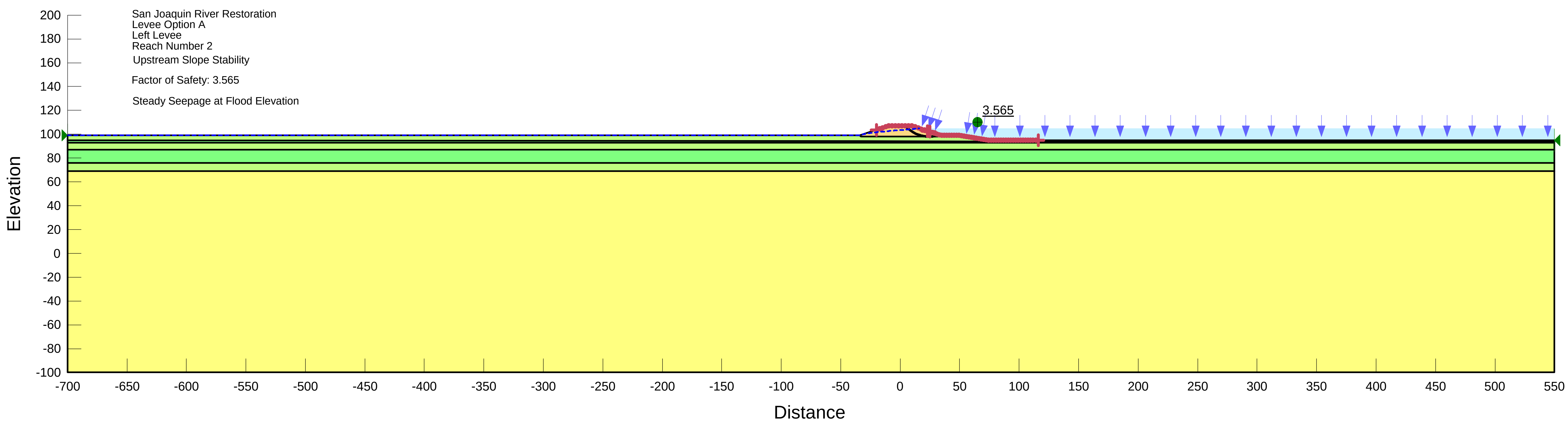
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Seepage Berm
Steady Seepage at Flood Elevation
Total Head: 102.16709 ft
i at toe of berm = 0.352
Flux across levee: 0.56949562 ft³/days
Silty Sand or Sandy Silt
Lean Clay
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
Distance
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

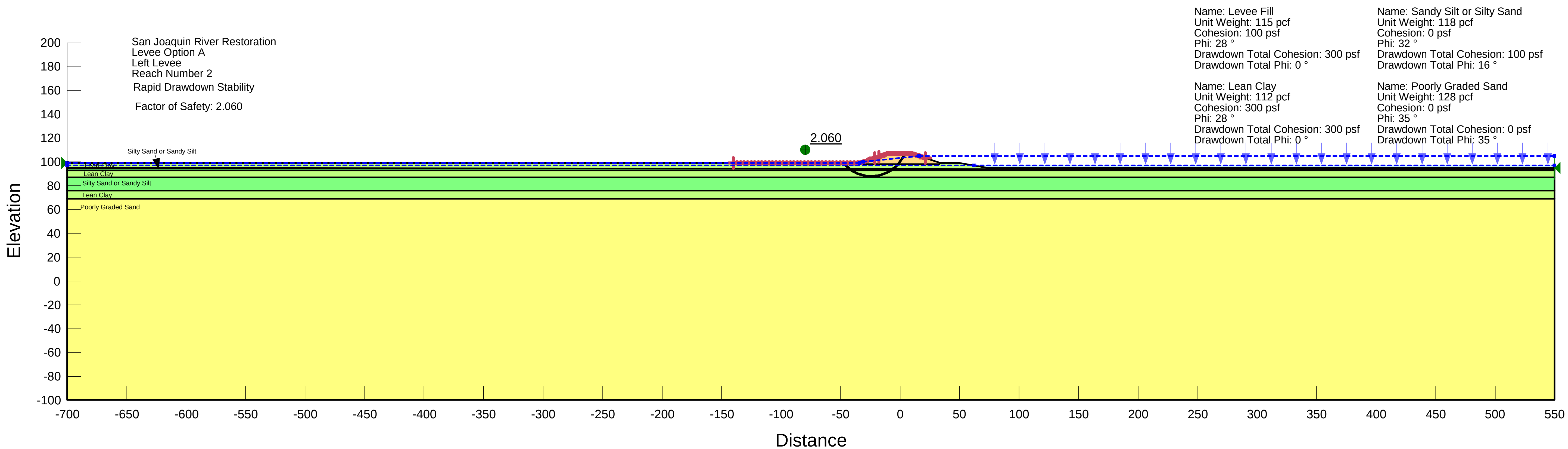

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
End of Construction Stability
Factor of Safety: 2.903
2.903
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Elevation
Distance


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
End of Construction Stability
Factor of Safety: 2.883
2.883
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance

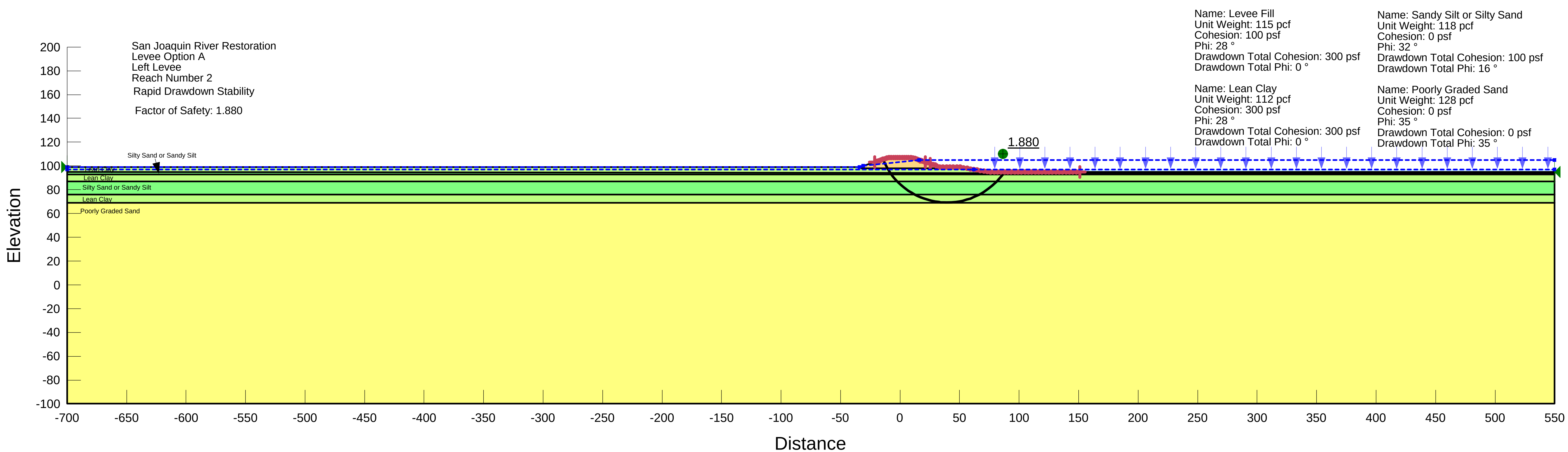


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Downstream Slope Stability
Factor of Safety: 2.533
Steady Seepage at Flood Elevation
2.533
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

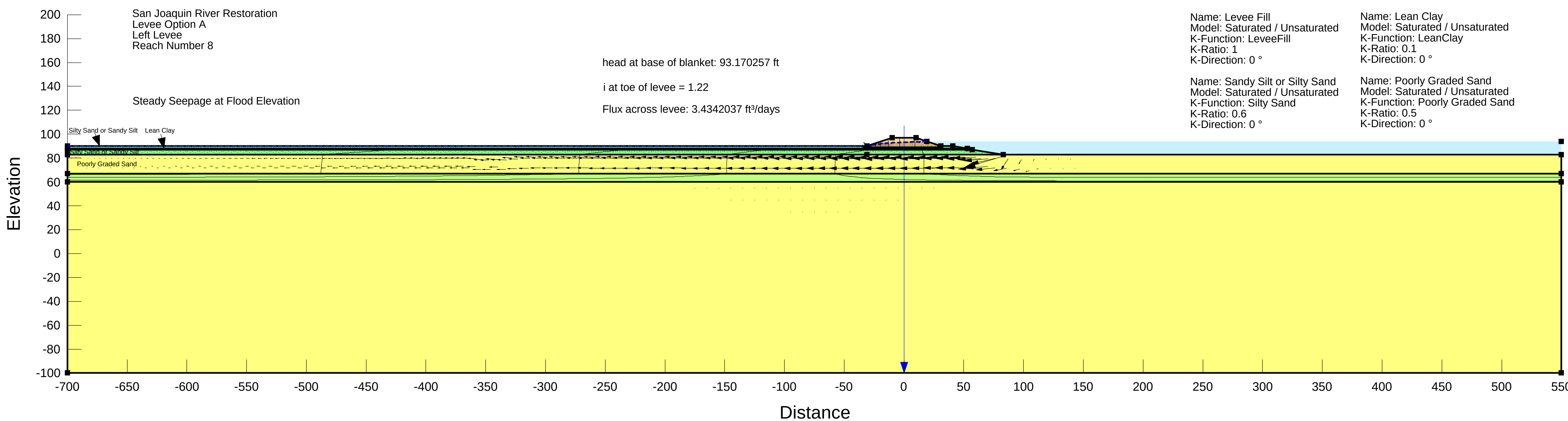

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Upstream Slope Stability
Factor of Safety: 3.565
Steady Seepage at Flood Elevation
3.565
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550
Distance



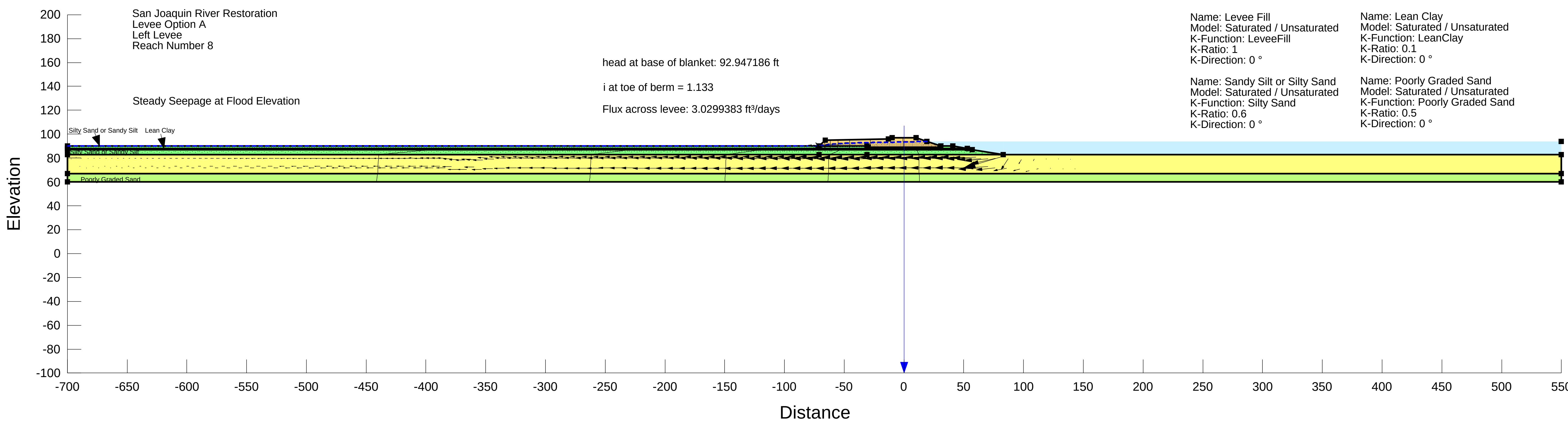
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Rapid Drawdown Stability
Factor of Safety: 2.060
2.060
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance



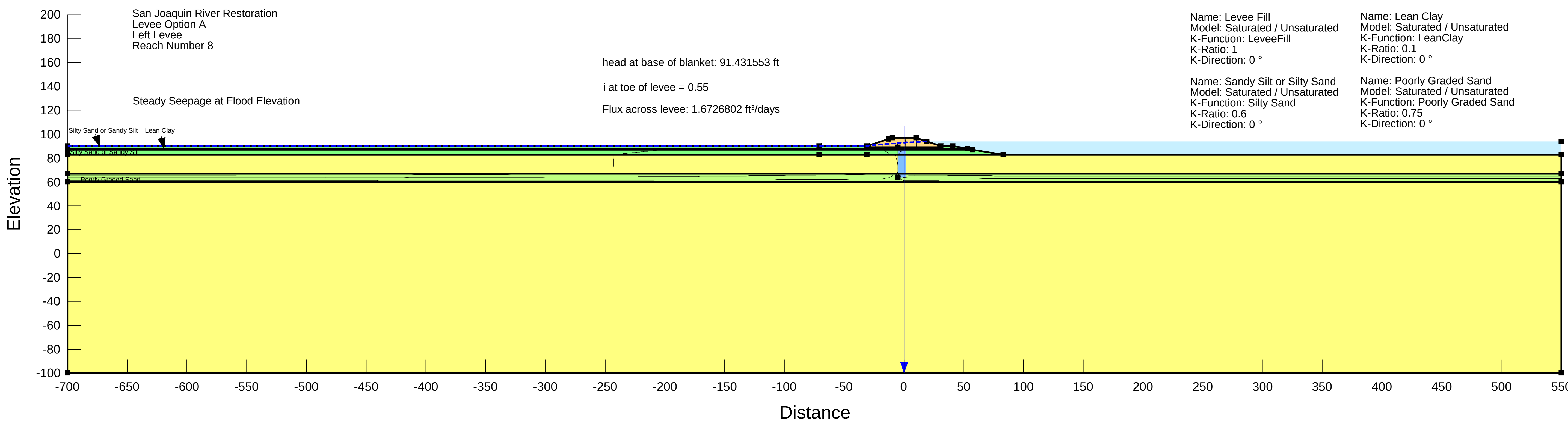
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 2
Rapid Drawdown Stability
Factor of Safety: 1.880
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
1.880
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance



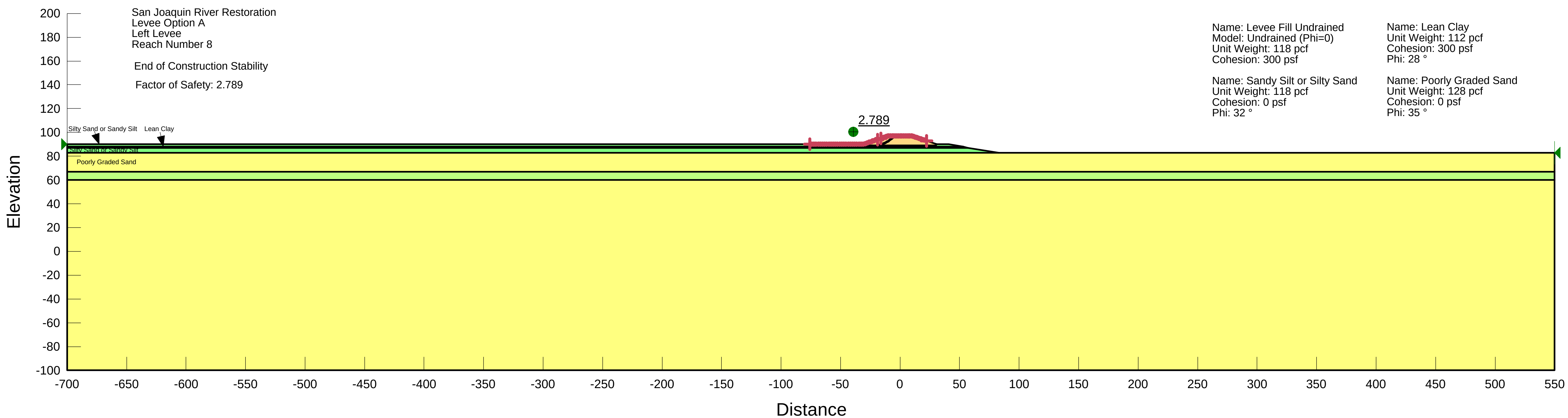
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Steady Seepage at Flood Elevation
head at base of blanket: 93.170257 ft
i at toe of levee = 1.22
Flux across levee: 3.4342037 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
K-Direction: 0 °
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
K-Direction: 0 °
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
K-Direction: 0 °
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
K-Direction: 0 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance



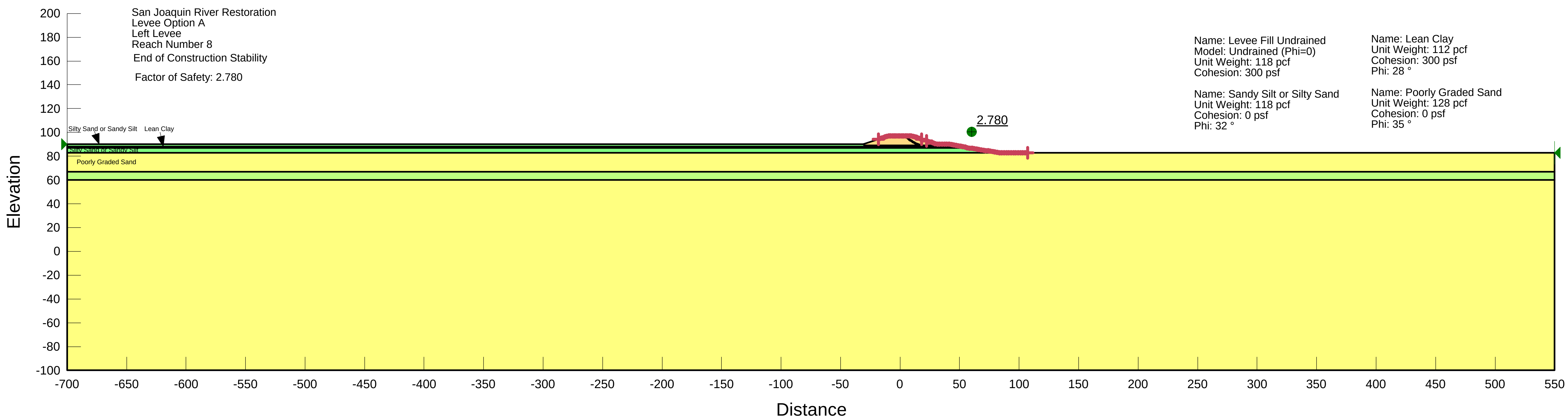
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Steady Seepage at Flood Elevation
head at base of blanket: 92.947186 ft
i at toe of berm = 1.133
Flux across levee: 3.0299383 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
K-Direction: 0 °
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
K-Direction: 0 °
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
K-Direction: 0 °
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
K-Direction: 0 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance

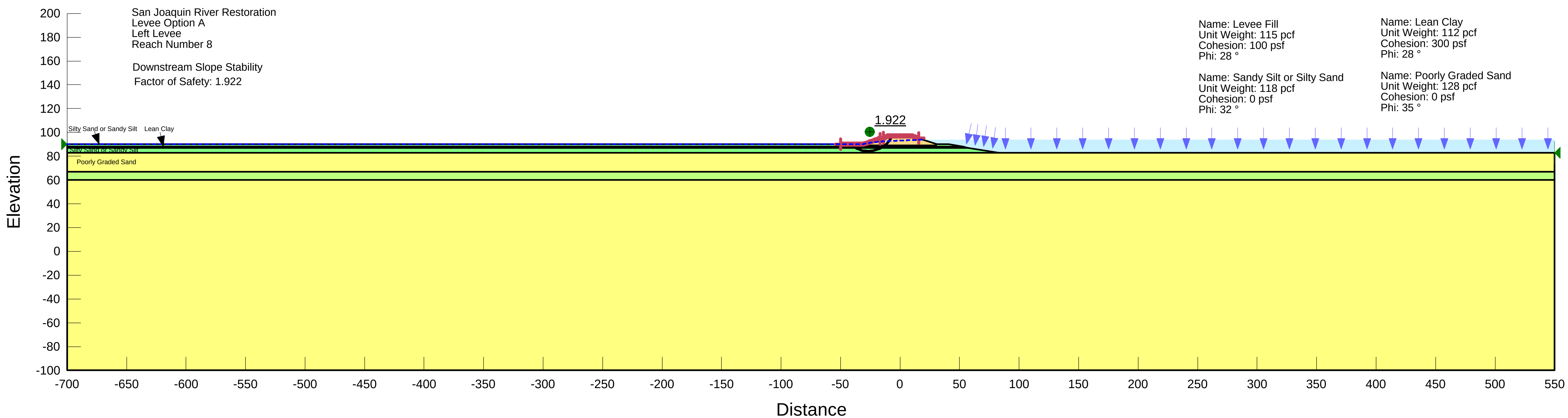


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Steady Seepage at Flood Elevation
head at base of blanket: 91.431553 ft
i at toe of levee = 0.55
Flux across levee: 1.6726802 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
K-Direction: 0 °
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
K-Direction: 0 °
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
K-Direction: 0 °
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.75
K-Direction: 0 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance

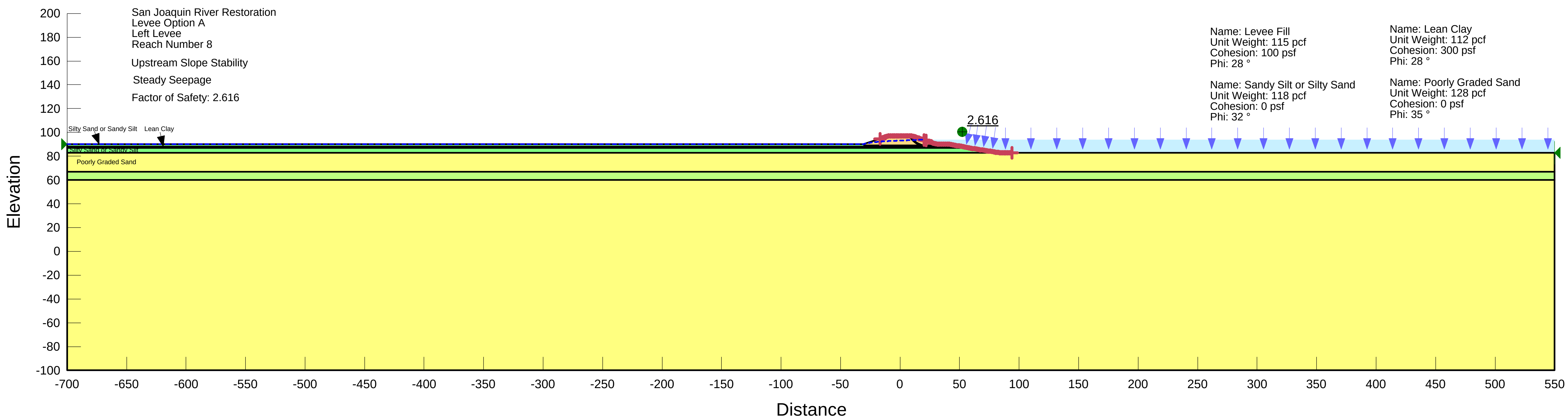


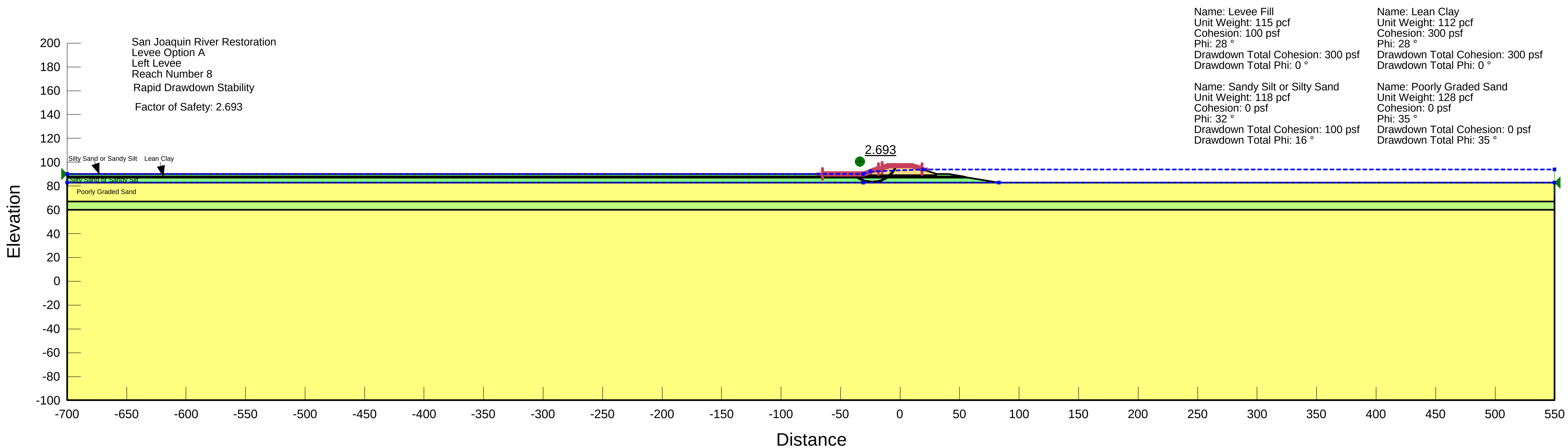
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
End of Construction Stability
Factor of Safety: 2.789
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
2.789
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550

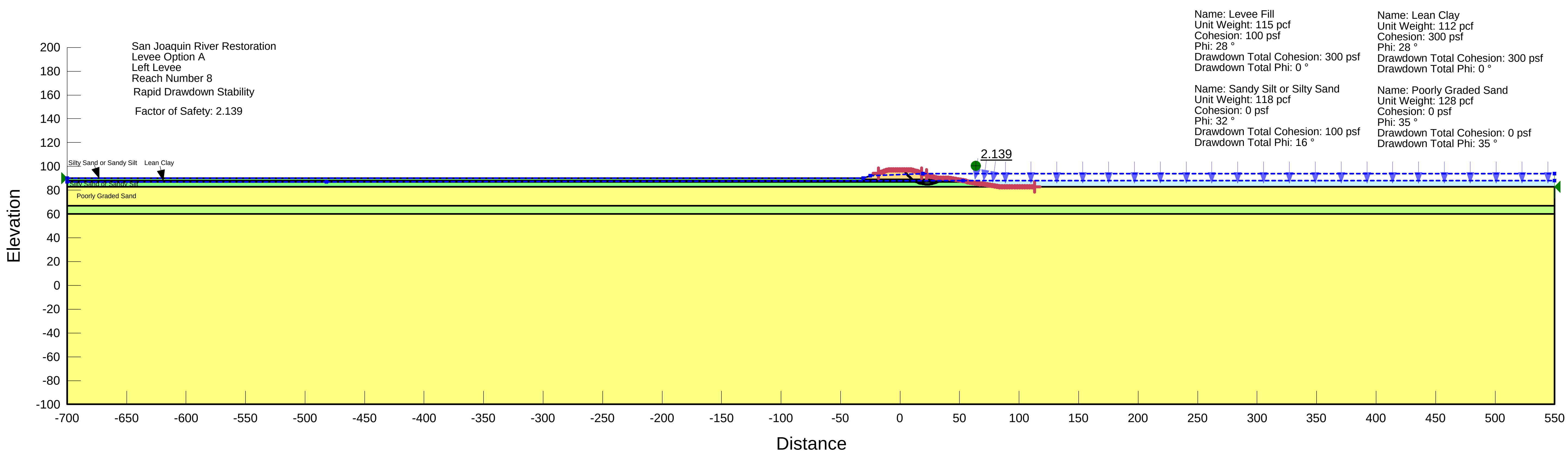

San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
End of Construction Stability
Factor of Safety: 2.780
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
2.780
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700 -650 -600 -550 -500 -450 -400 -350 -300 -250 -200 -150 -100 -50 0 50 100 150 200 250 300 350 400 450 500 550

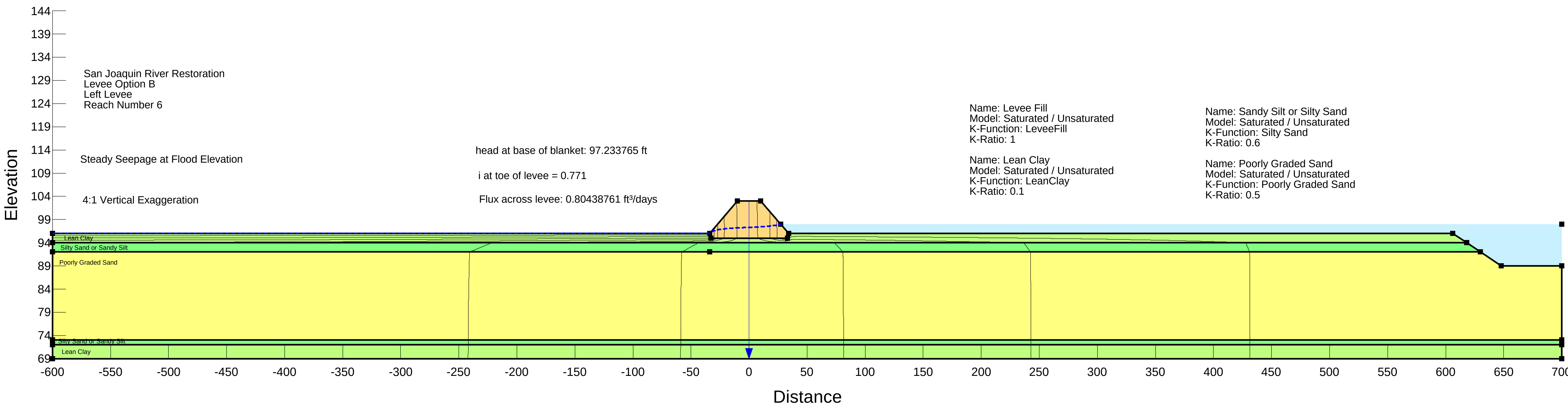


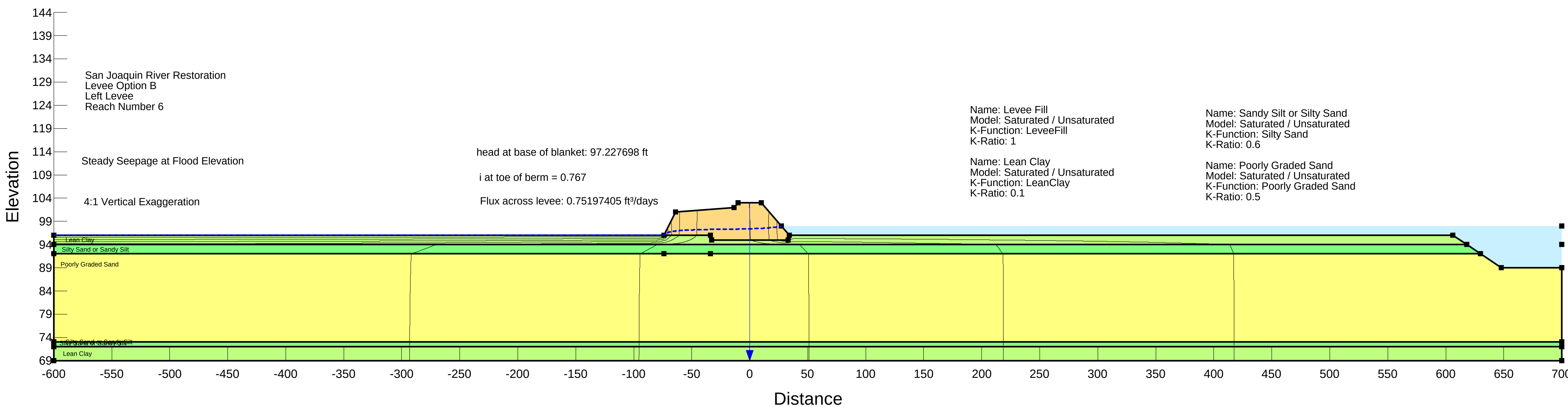
San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Downstream Slope Stability
Factor of Safety: 1.922
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
1.922
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
Distance
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Upstream Slope Stability
Steady Seepage
Factor of Safety: 2.616
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
2.616
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
Distance
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Rapid Drawdown Stability
Factor of Safety: 2.693
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
2.693
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
Distance


San Joaquin River Restoration
Levee Option A
Left Levee
Reach Number 8
Rapid Drawdown Stability
Factor of Safety: 2.139
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
2.139
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Elevation
200
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
Distance
-700
-650
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 97.233765 ft
i at toe of levee = 0.771
Flux across levee: 0.80438761 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 97.227698 ft
i at toe of berm = 0.767
Flux across levee: 0.75197405 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
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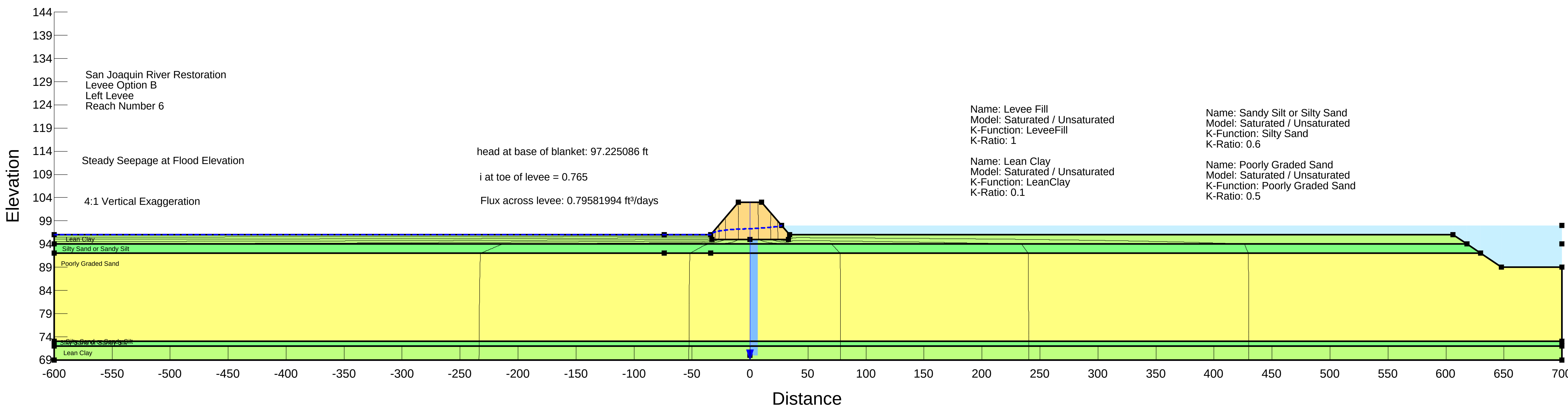
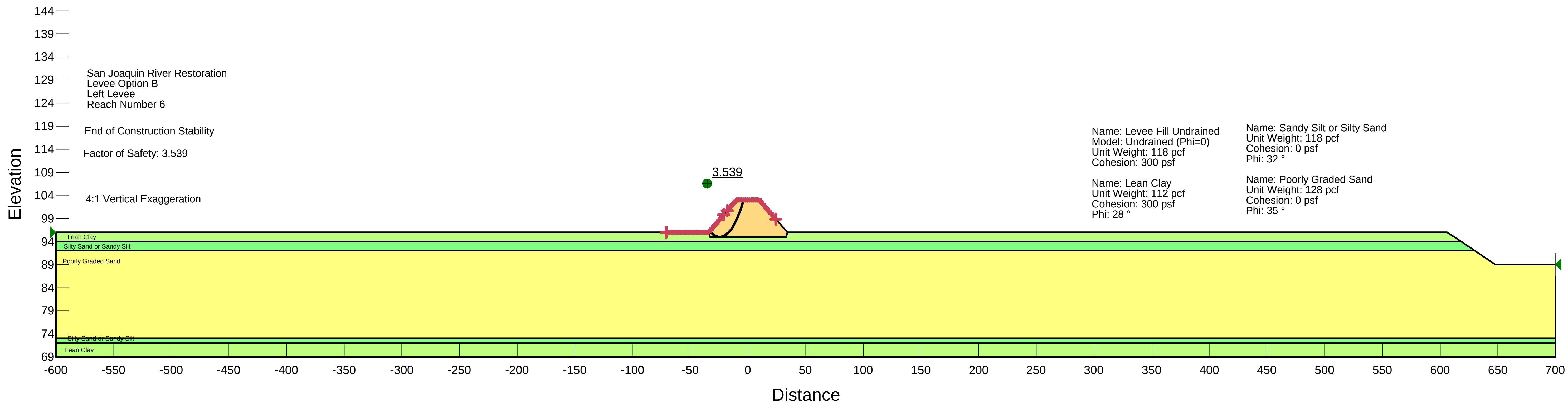
350
400
450
500
550
600
650
700


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 97.225086 ft
i at toe of levee = 0.765
Flux across levee: 0.79581994 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
End of Construction Stability
Factor of Safety: 3.539
4:1 Vertical Exaggeration
3.539
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
-600
-550
-500
-450
-400
-350
-300
-250
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0
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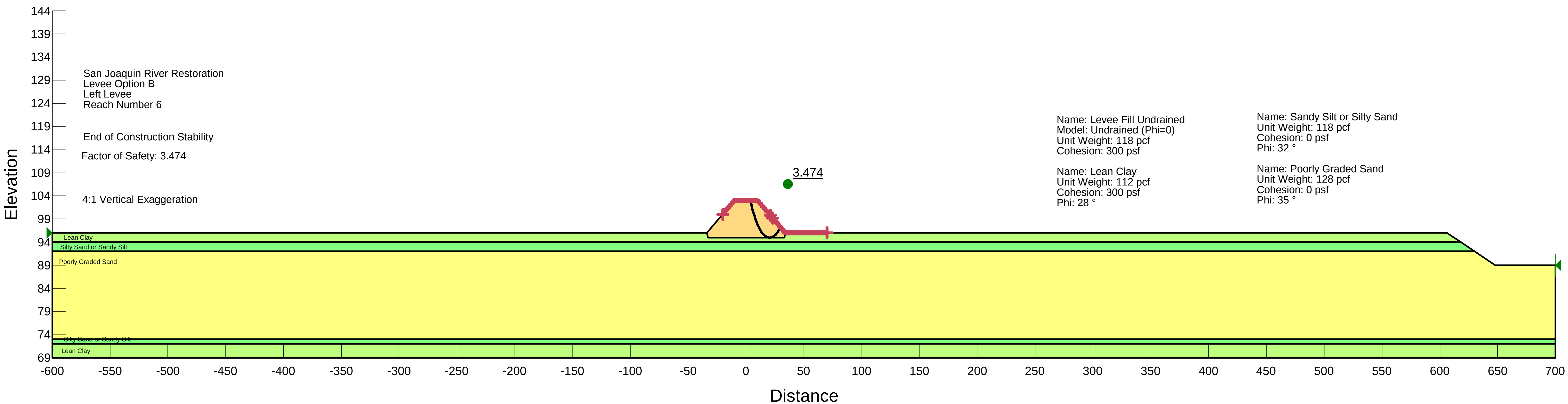
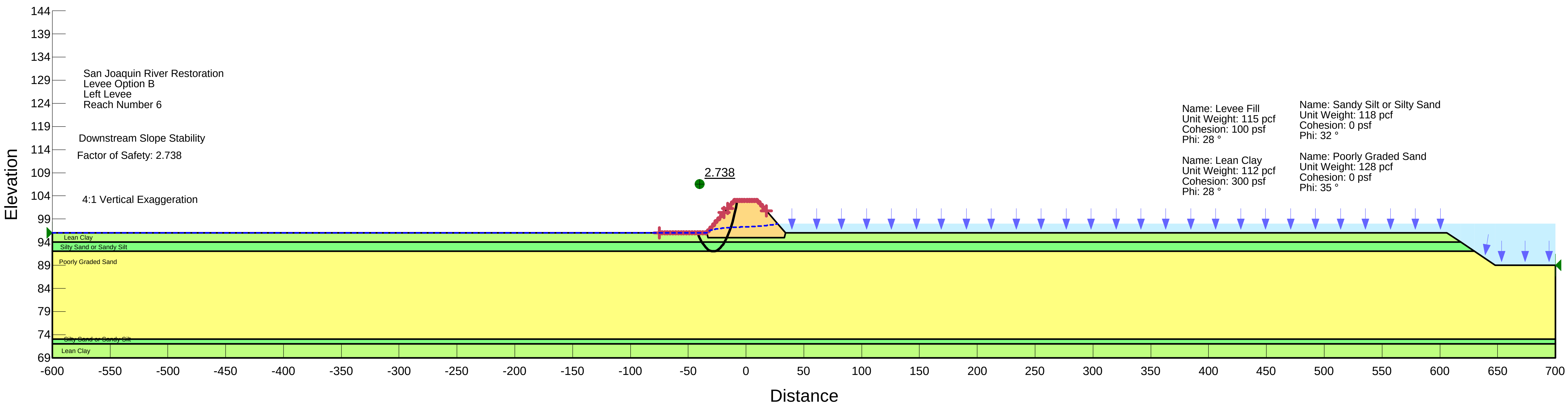
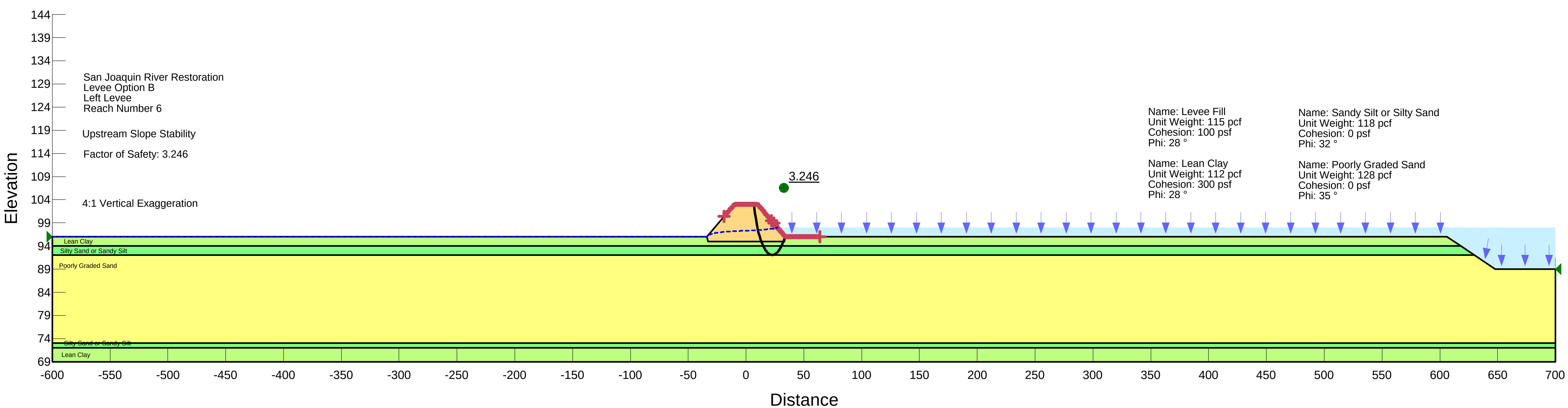
600
650
700



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
End of Construction Stability
Factor of Safety: 3.474
4:1 Vertical Exaggeration
3.474
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Downstream Slope Stability
Factor of Safety: 2.738
4:1 Vertical Exaggeration
2.738
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Upstream Slope Stability
Factor of Safety: 3.246
4:1 Vertical Exaggeration
3.246
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
Distance
-600
-550
-500
-450
-400
-350
-300
-250
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200
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350
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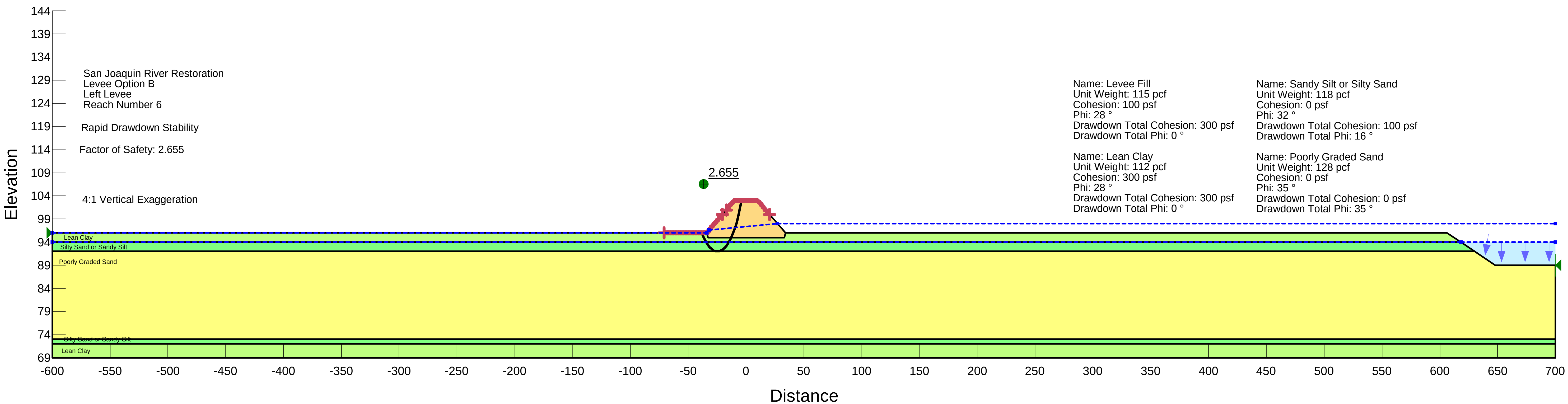
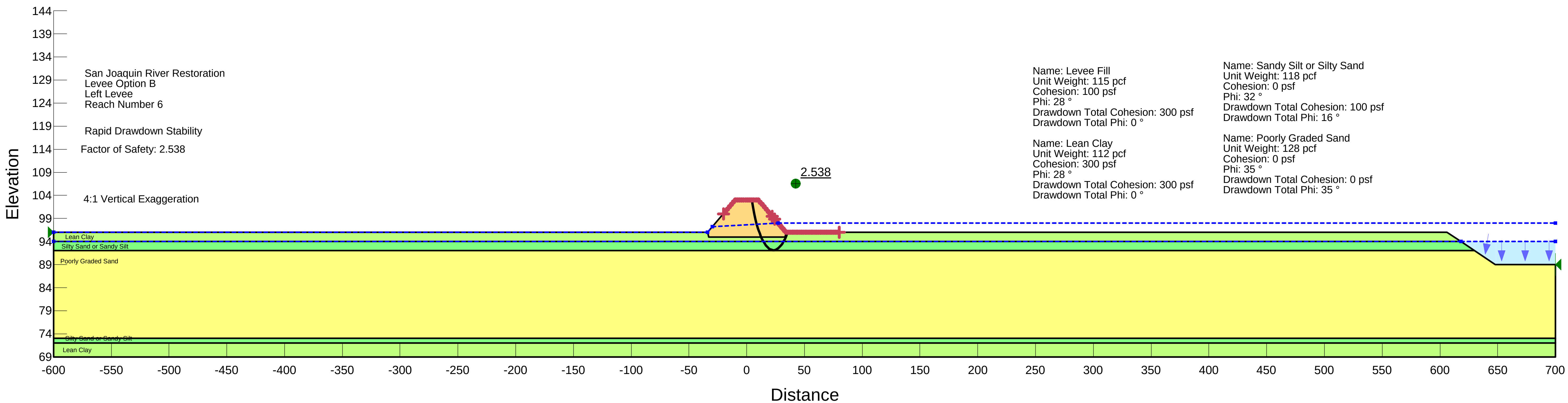
550
600
650
700



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Rapid Drawdown Stability
Factor of Safety: 2.655
4:1 Vertical Exaggeration
2.655
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
Distance


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 6
Rapid Drawdown Stability
Factor of Safety: 2.538
4:1 Vertical Exaggeration
2.538
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Lean Clay
Elevation
144
139
134
129
124
119
114
109
104
99
94
89
84
79
74
69
-600
-550
-500
-450
-400
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450
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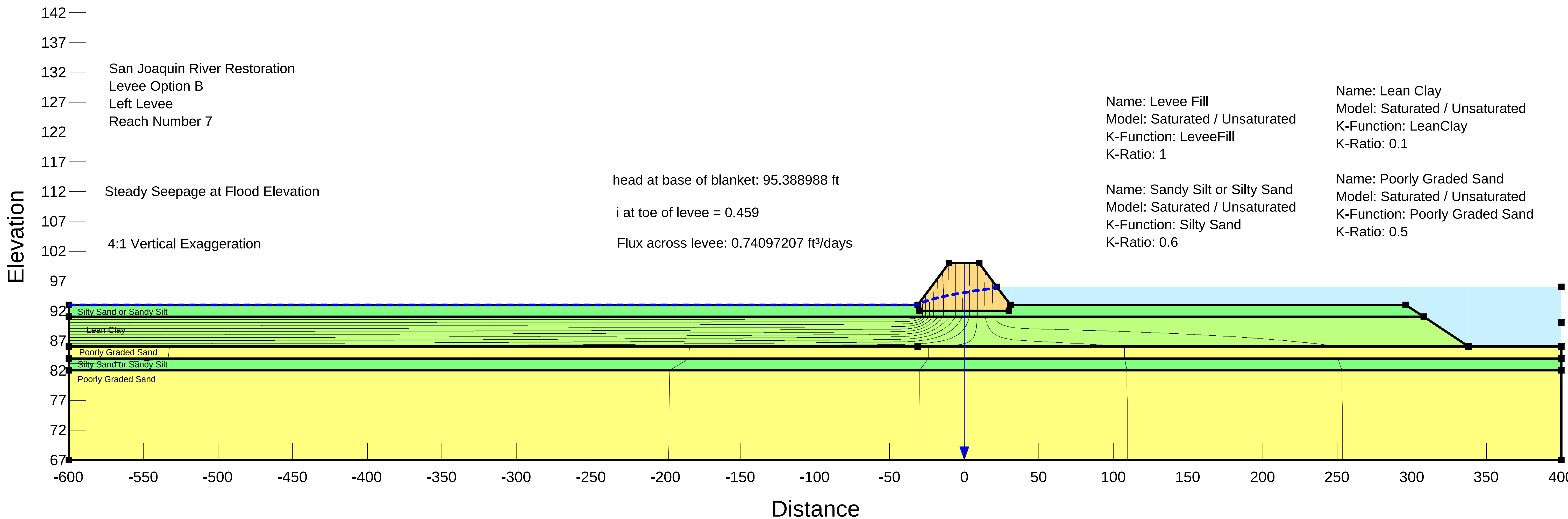
600
650
700
Distance



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 95.388988 ft
i at toe of levee = 0.459
Flux across levee: 0.74097207 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
Distance
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
-600
-550
-500
-450
-400
-350
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-200
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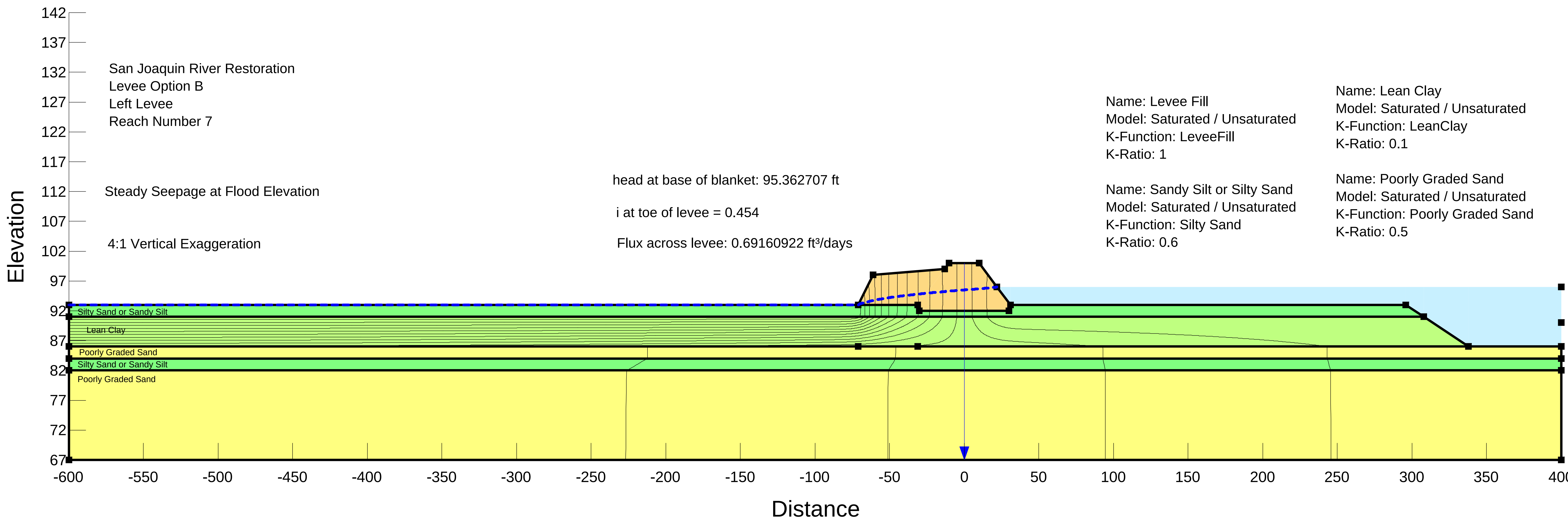
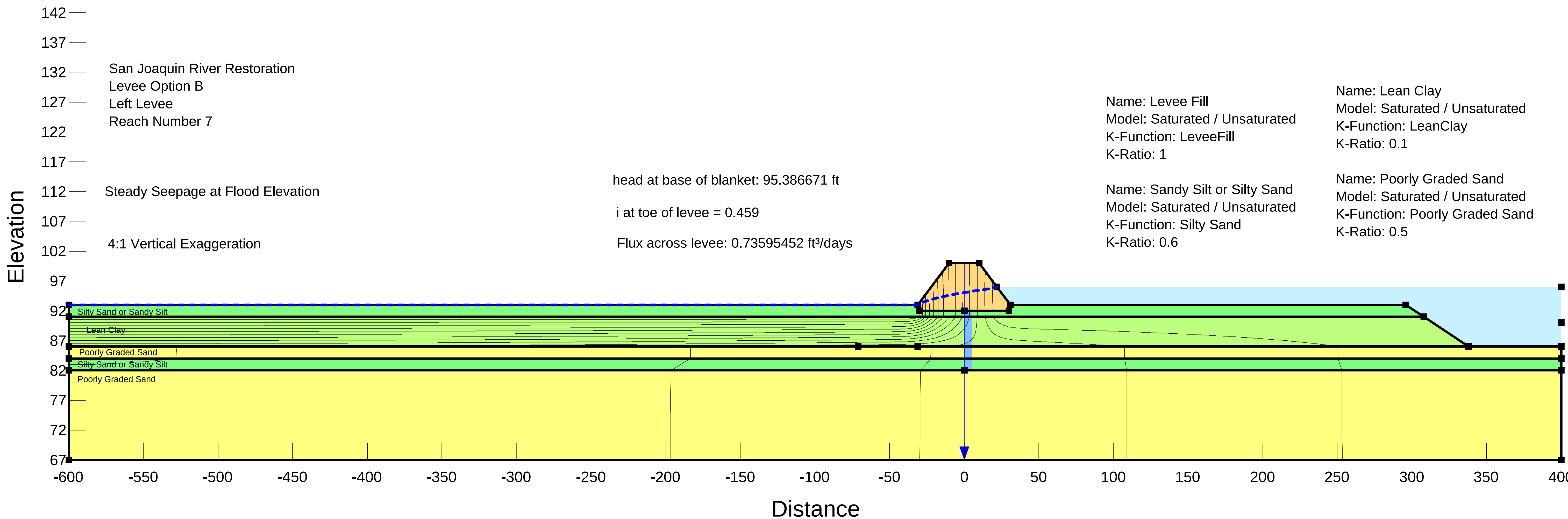
-100
-50
0
50
100
150
200
250
300
350
400


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 95.362707 ft
i at toe of levee = 0.454
Flux across levee: 0.69160922 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400



San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Steady Seepage at Flood Elevation
4:1 Vertical Exaggeration
head at base of blanket: 95.386671 ft
i at toe of levee = 0.459
Flux across levee: 0.73595452 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
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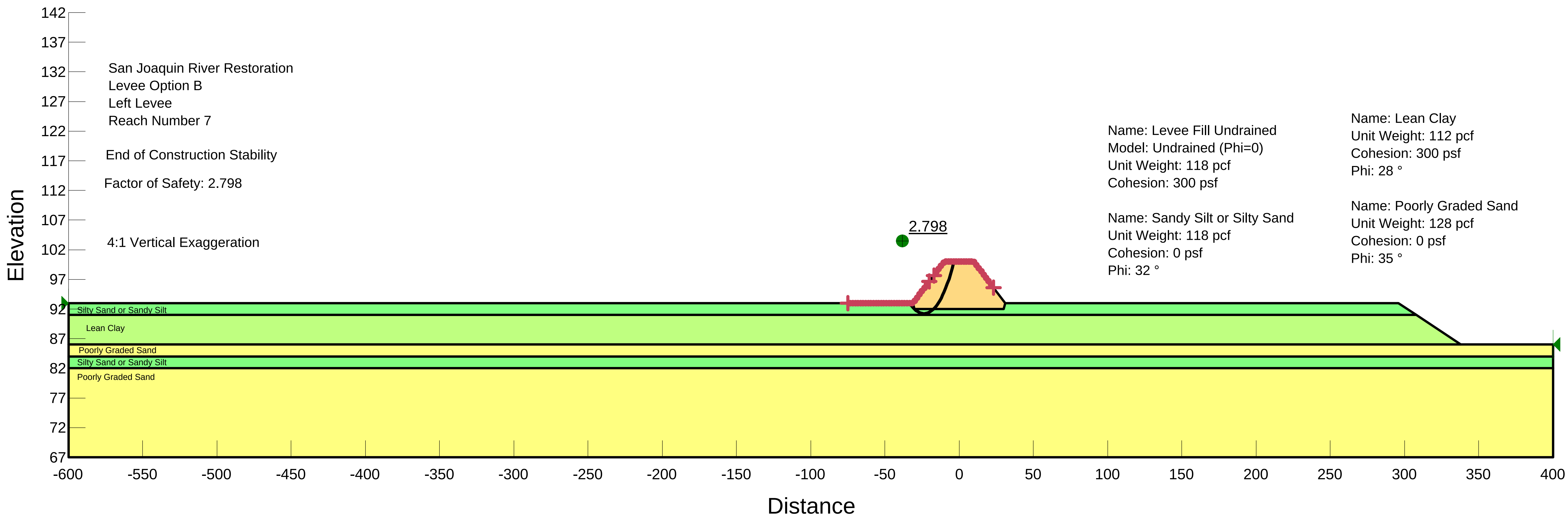
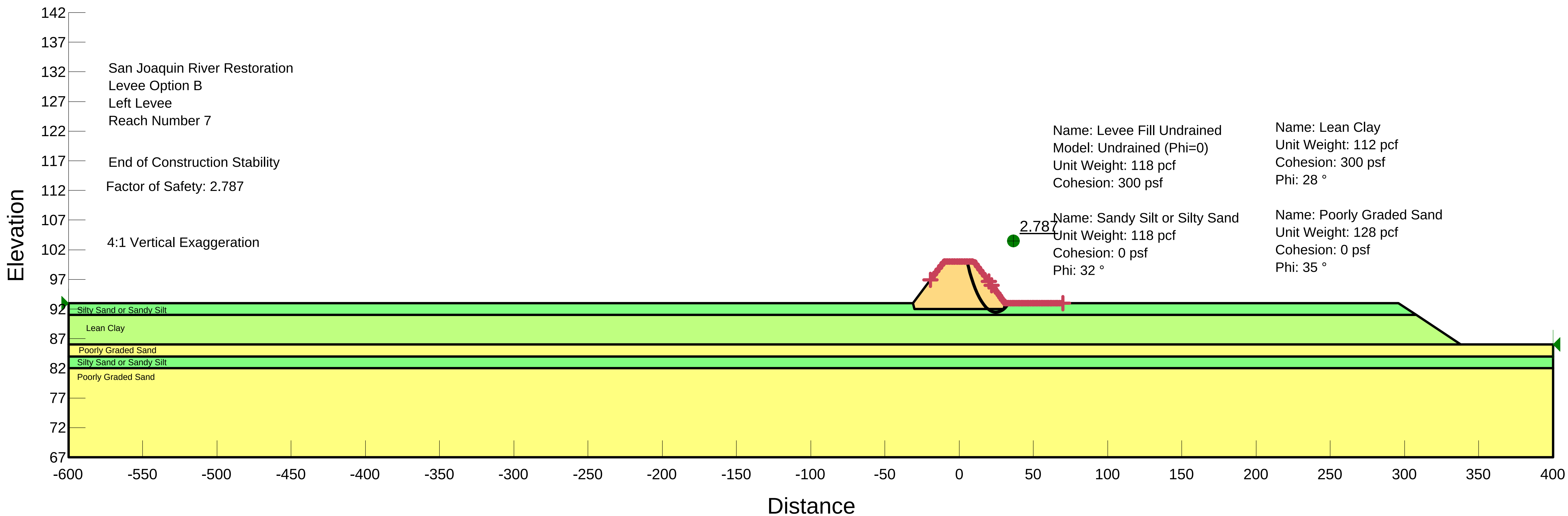
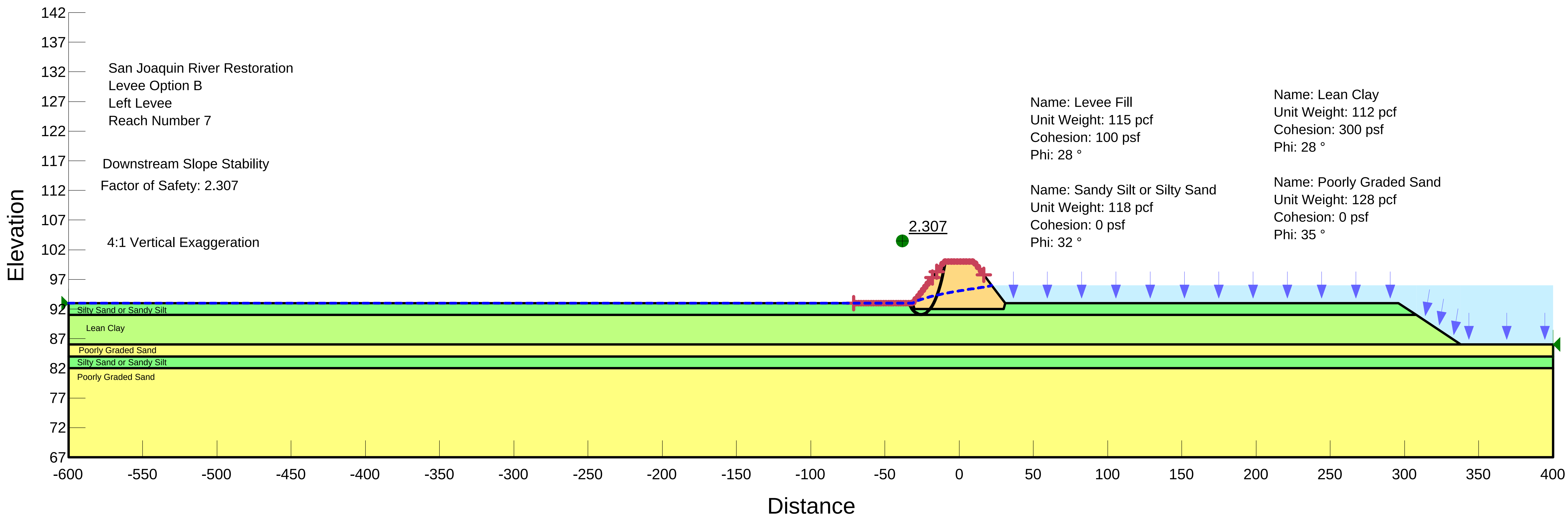
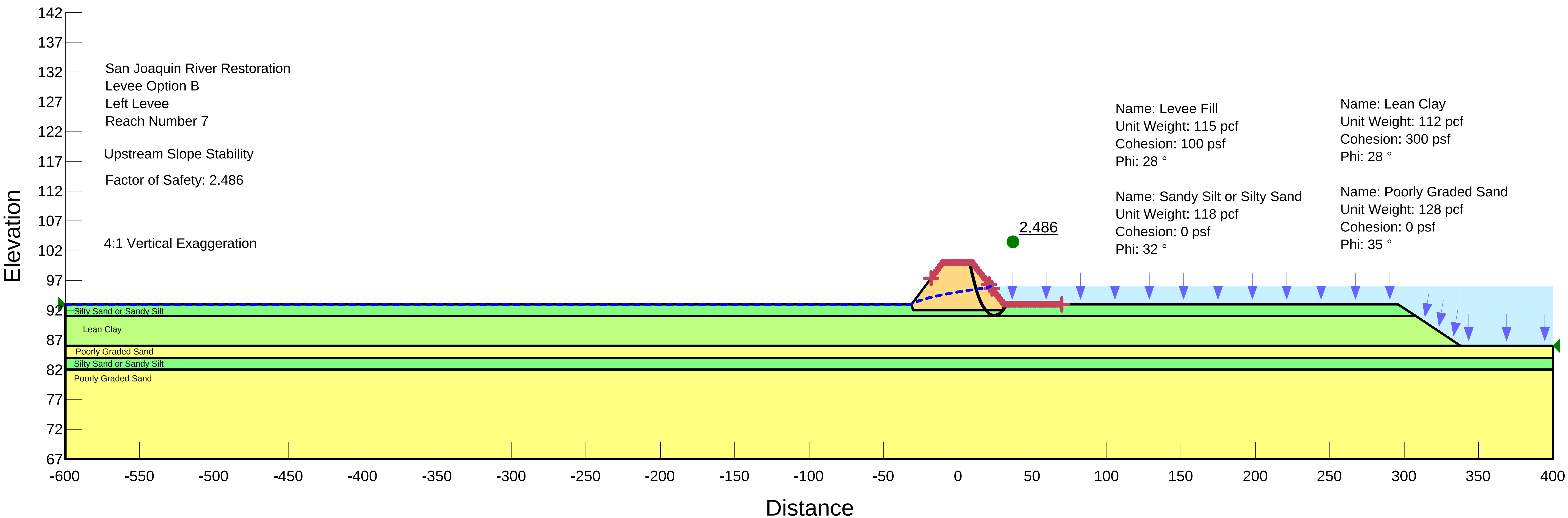
-150
-100
-50
0
50
100
150
200
250
300
350
400


San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
End of Construction Stability
Factor of Safety: 2.798
4:1 Vertical Exaggeration
2.798
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
Distance

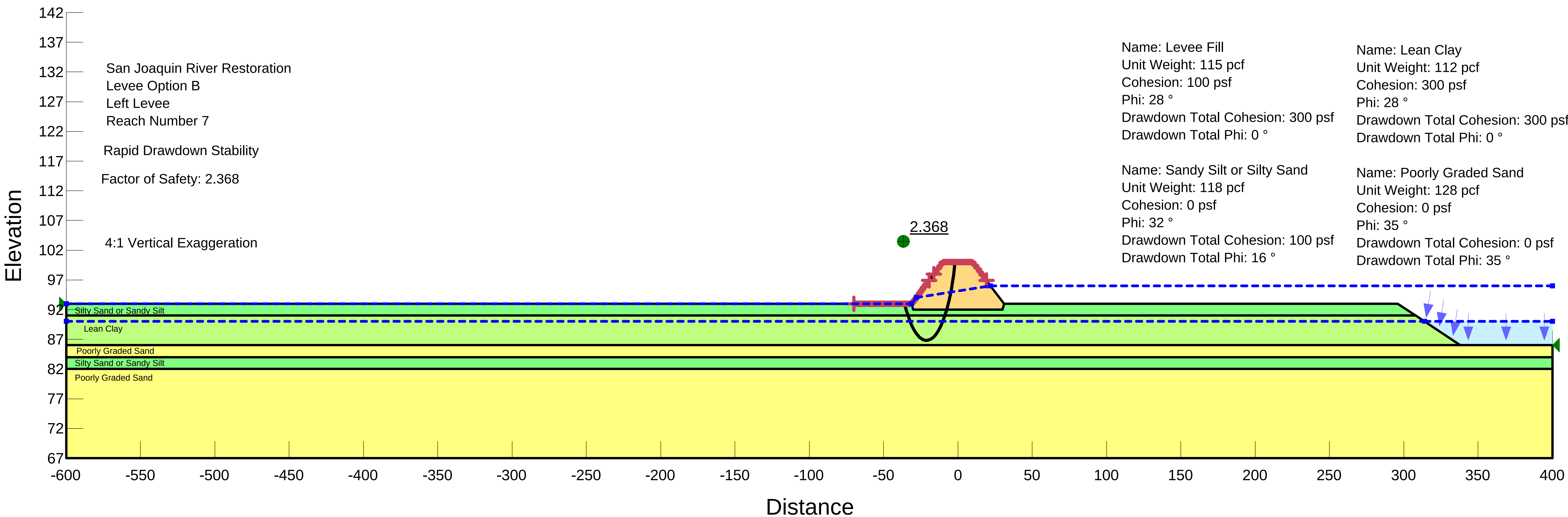

San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
End of Construction Stability
Factor of Safety: 2.787
4:1 Vertical Exaggeration
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
2.787
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
Distance



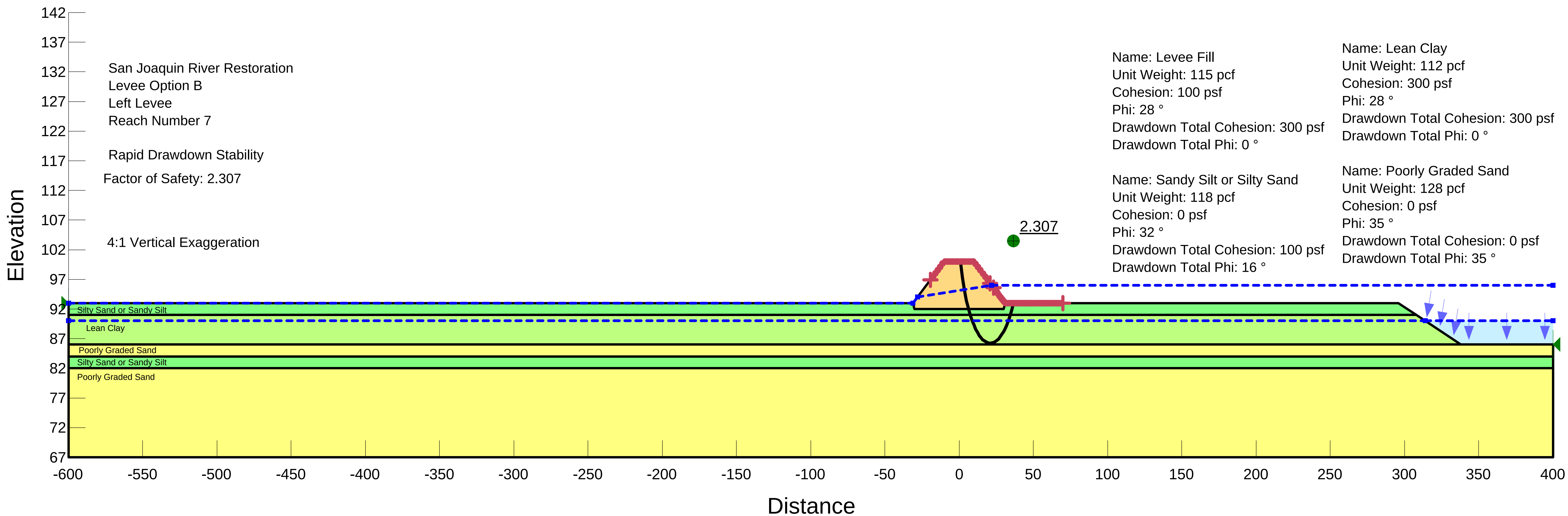
San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Downstream Slope Stability
Factor of Safety: 2.307
4:1 Vertical Exaggeration
2.307
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400
Distance



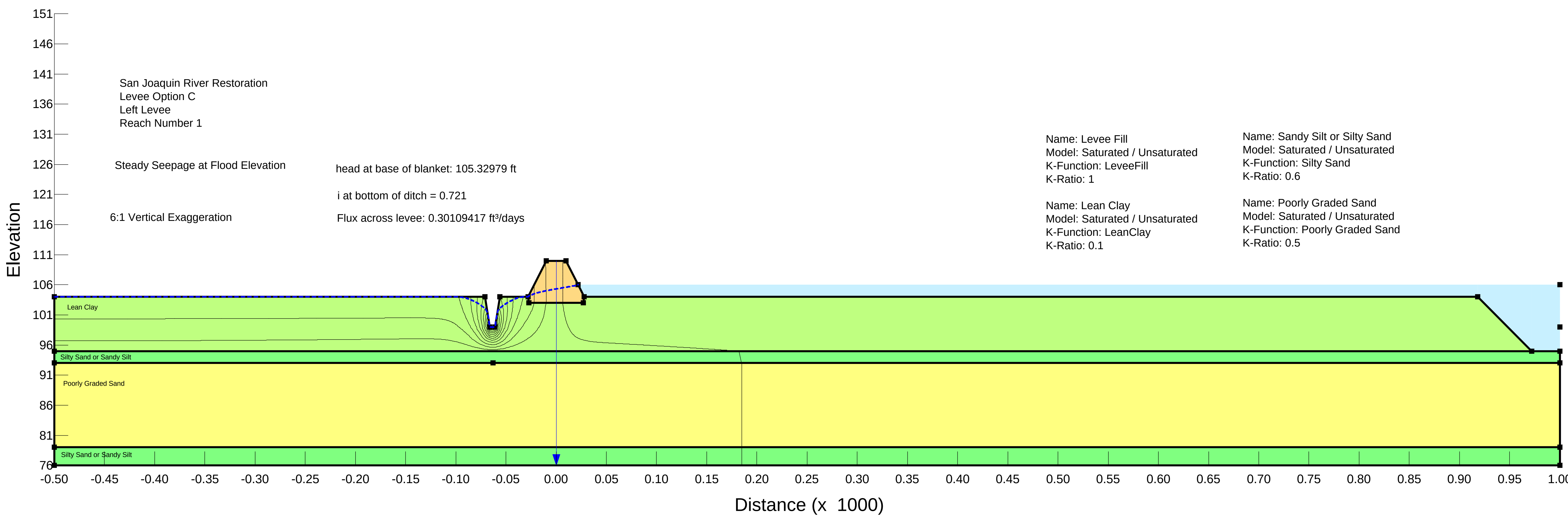
San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Upstream Slope Stability
Factor of Safety: 2.486
4:1 Vertical Exaggeration
2.486
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400



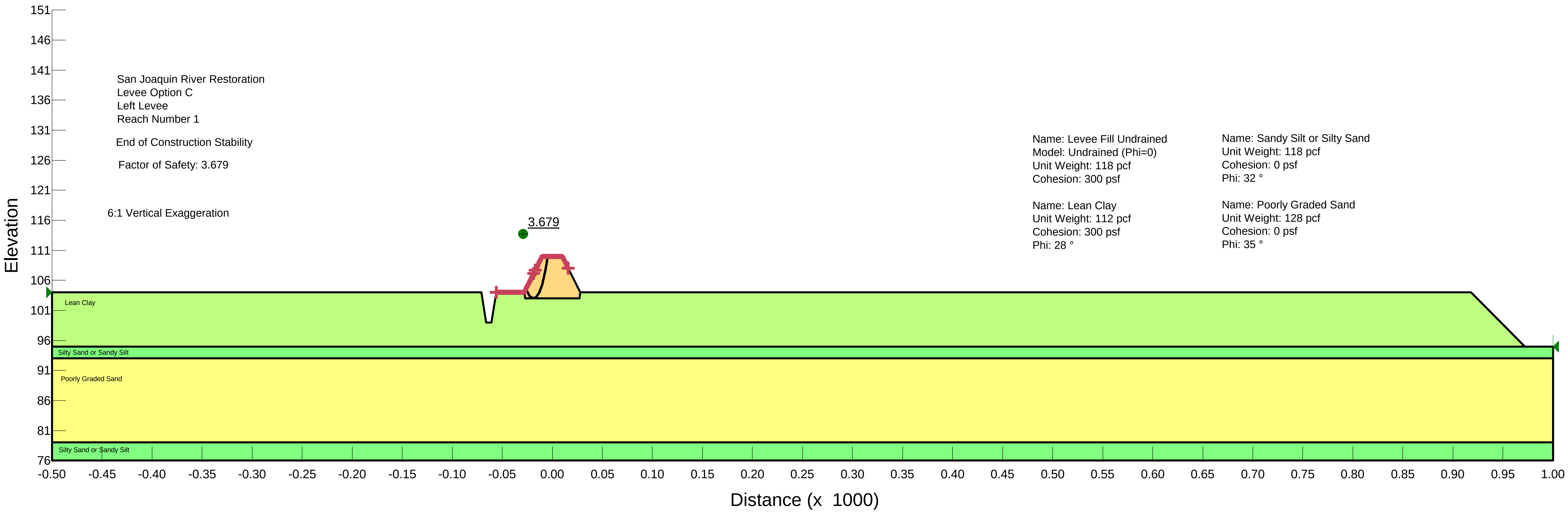
San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Rapid Drawdown Stability
Factor of Safety: 2.368
4:1 Vertical Exaggeration
2.368
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
142
137
132
127
122
117
112
107
102
97
92
87
82
77
72
67
Distance
-600
-550
-500
-450
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
350
400

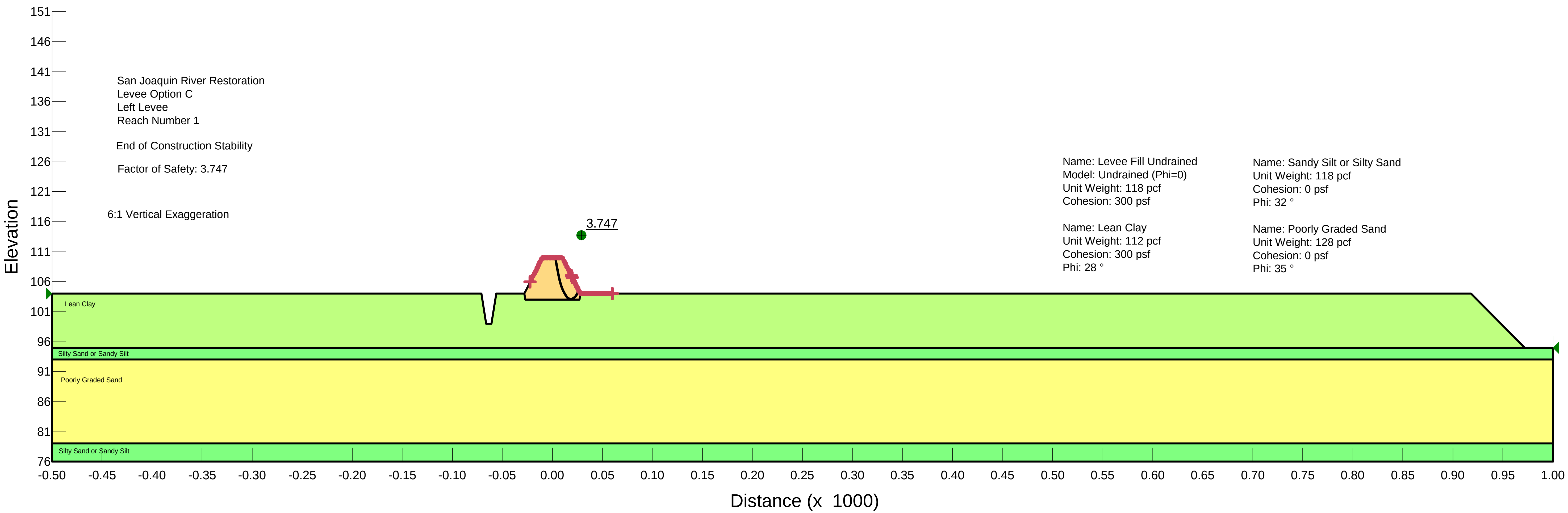


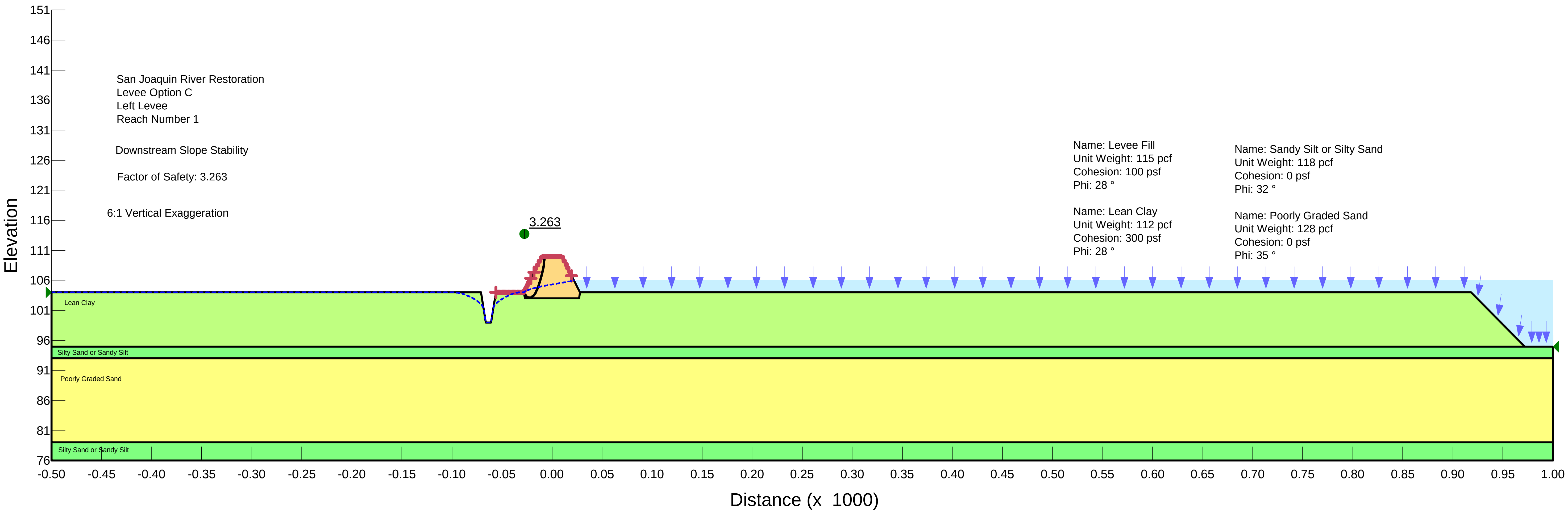
San Joaquin River Restoration
Levee Option B
Left Levee
Reach Number 7
Rapid Drawdown Stability
Factor of Safety: 2.307
4:1 Vertical Exaggeration
2.307
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Poorly Graded Sand
Silty Sand or Sandy Silt
Poorly Graded Sand
Elevation
Distance

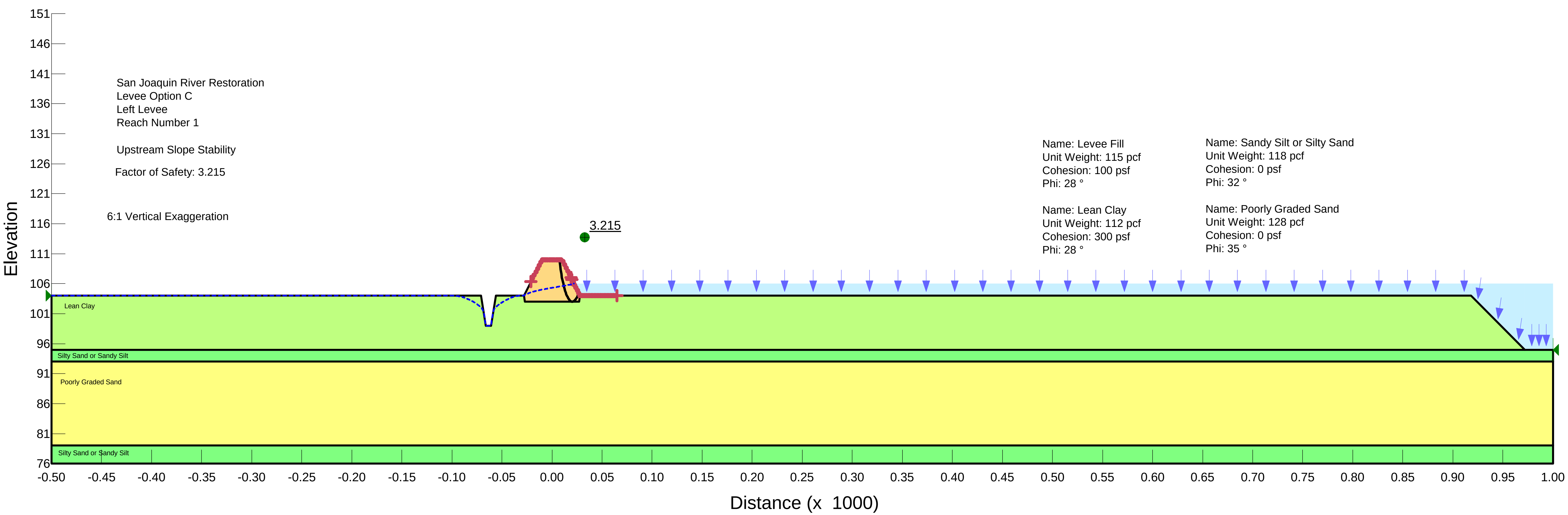


San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Steady Seepage at Flood Elevation
6:1 Vertical Exaggeration
head at base of blanket: 105.32979 ft
i at bottom of ditch = 0.721
Flux across levee: 0.30109417 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
Distance (x 1000)
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00

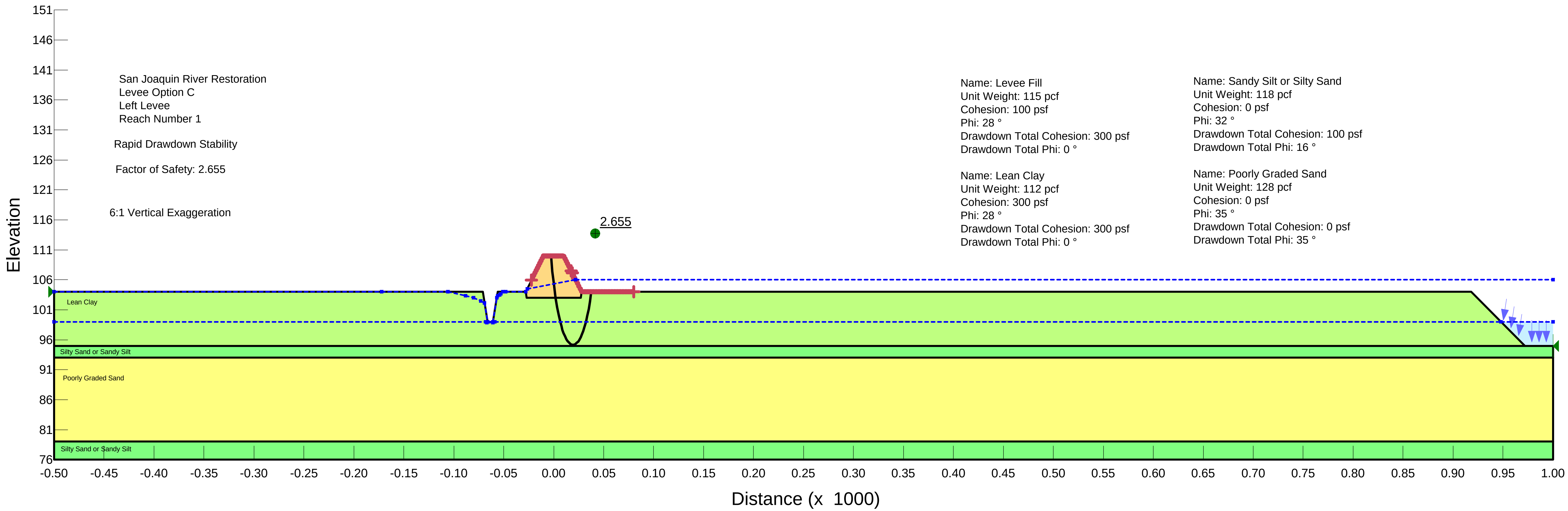

San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
End of Construction Stability
Factor of Safety: 3.679
6:1 Vertical Exaggeration
3.679
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00
Distance (x 1000)


San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
End of Construction Stability
Factor of Safety: 3.747
6:1 Vertical Exaggeration
3.747
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
Distance (x 1000)

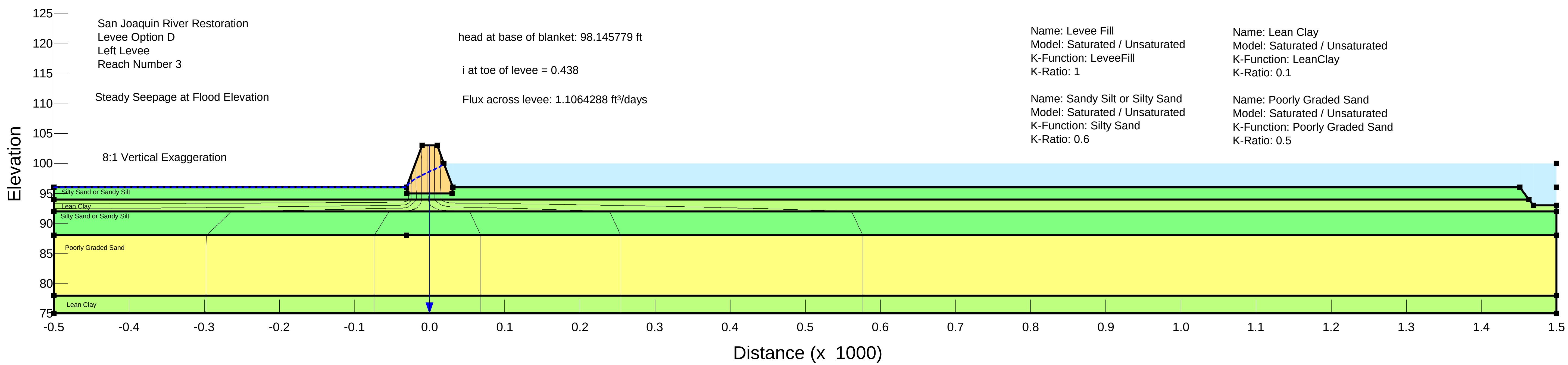

San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Downstream Slope Stability
Factor of Safety: 3.263
6:1 Vertical Exaggeration
3.263
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
Distance (x 1000)
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50 -0.45 -0.40 -0.35 -0.30 -0.25 -0.20 -0.15 -0.10 -0.05 0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65 0.70 0.75 0.80 0.85 0.90 0.95 1.00



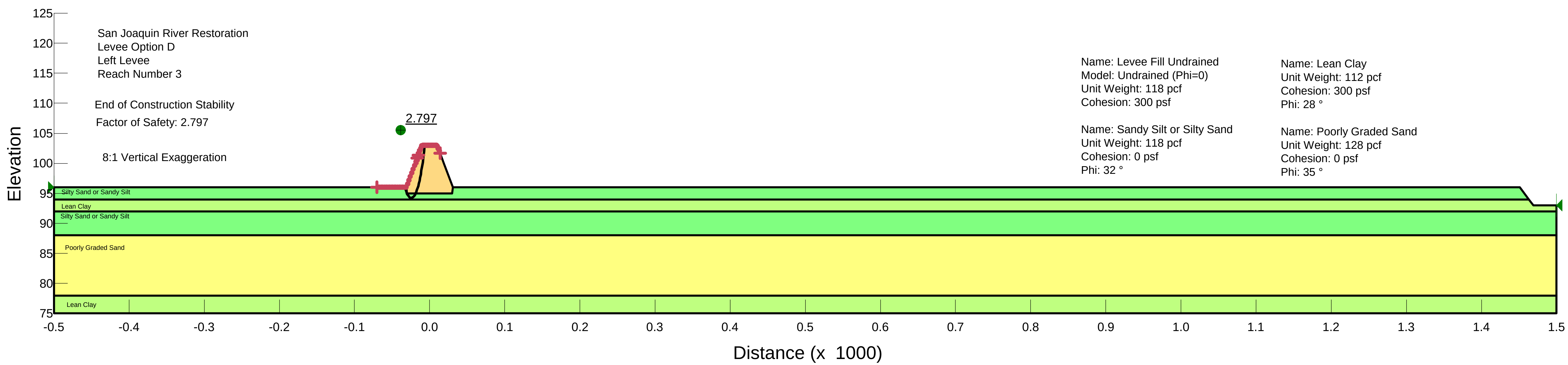
San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Upstream Slope Stability
Factor of Safety: 3.215
6:1 Vertical Exaggeration
3.215
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
151
146
141
136
131
126
121
116
111
106
101
96
91
86
81
76
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90
0.95
1.00
Distance (x 1000)

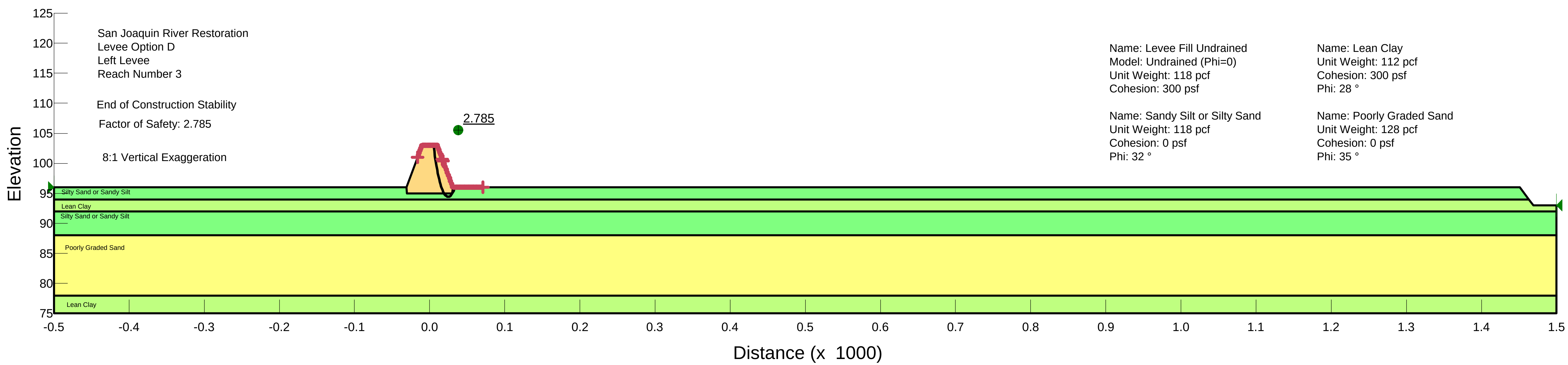


San Joaquin River Restoration
Levee Option C
Left Levee
Reach Number 1
Rapid Drawdown Stability
Factor of Safety: 2.655
6:1 Vertical Exaggeration
2.655
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Silty Sand or Sandy Silt
Elevation
Distance (x 1000)

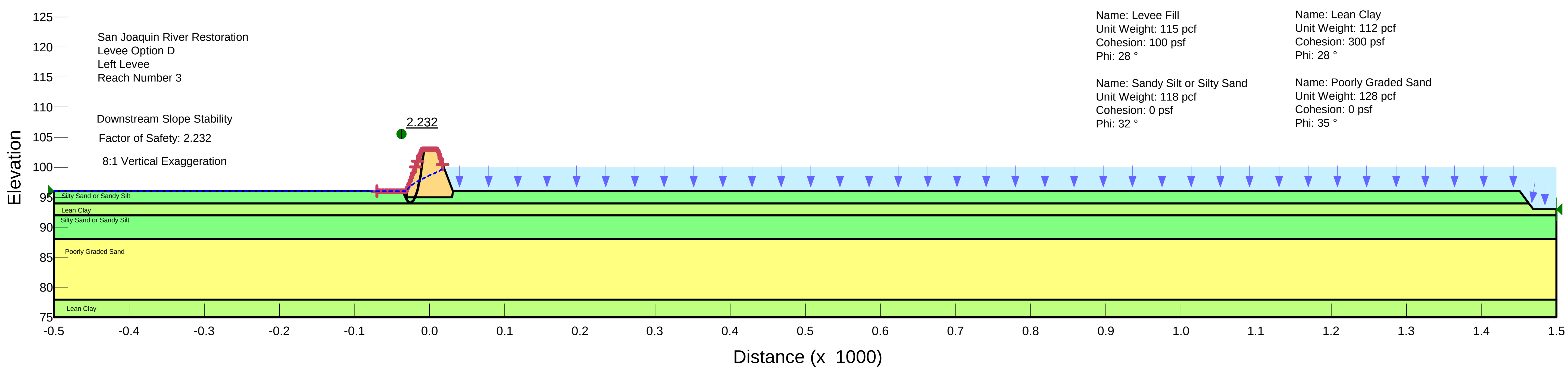


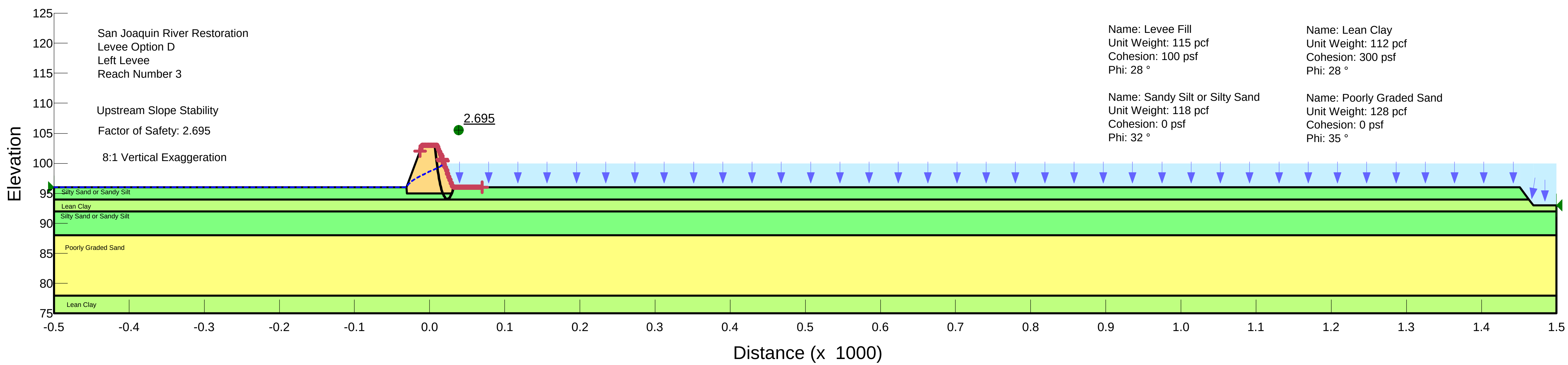
San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Steady Seepage at Flood Elevation
8:1 Vertical Exaggeration
head at base of blanket: 98.145779 ft
i at toe of levee = 0.438
Flux across levee: 1.1064288 ft³/days
Name: Levee Fill
Model: Saturated / Unsaturated
K-Function: LeveeFill
K-Ratio: 1
Name: Lean Clay
Model: Saturated / Unsaturated
K-Function: LeanClay
K-Ratio: 0.1
Name: Sandy Silt or Silty Sand
Model: Saturated / Unsaturated
K-Function: Silty Sand
K-Ratio: 0.6
Name: Poorly Graded Sand
Model: Saturated / Unsaturated
K-Function: Poorly Graded Sand
K-Ratio: 0.5
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)


San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
End of Construction Stability
Factor of Safety: 2.797
8:1 Vertical Exaggeration
2.797
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)

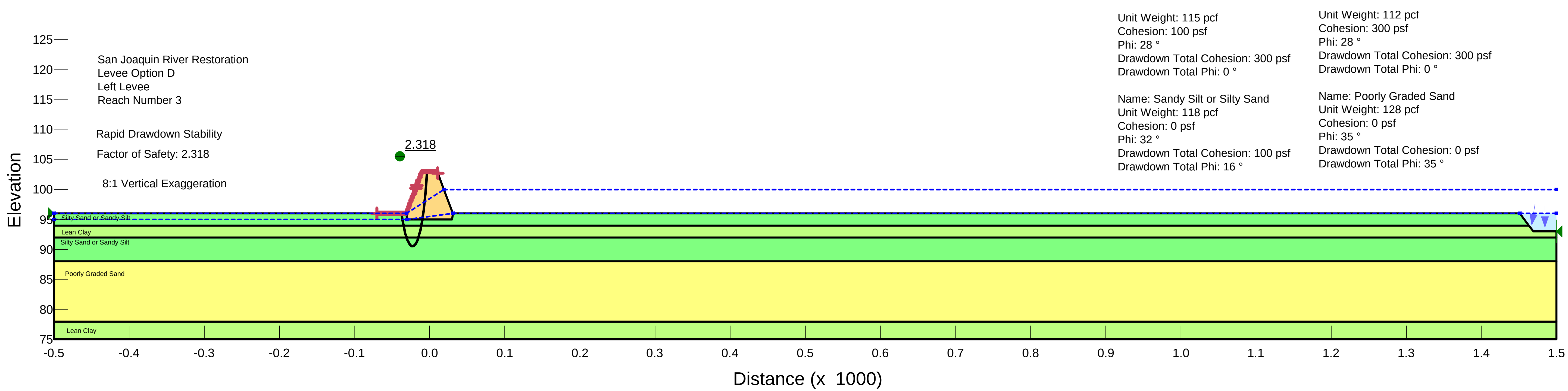


San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
End of Construction Stability
Factor of Safety: 2.785
8:1 Vertical Exaggeration
2.785
Name: Levee Fill Undrained
Model: Undrained (Phi=0)
Unit Weight: 118 pcf
Cohesion: 300 psf
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)

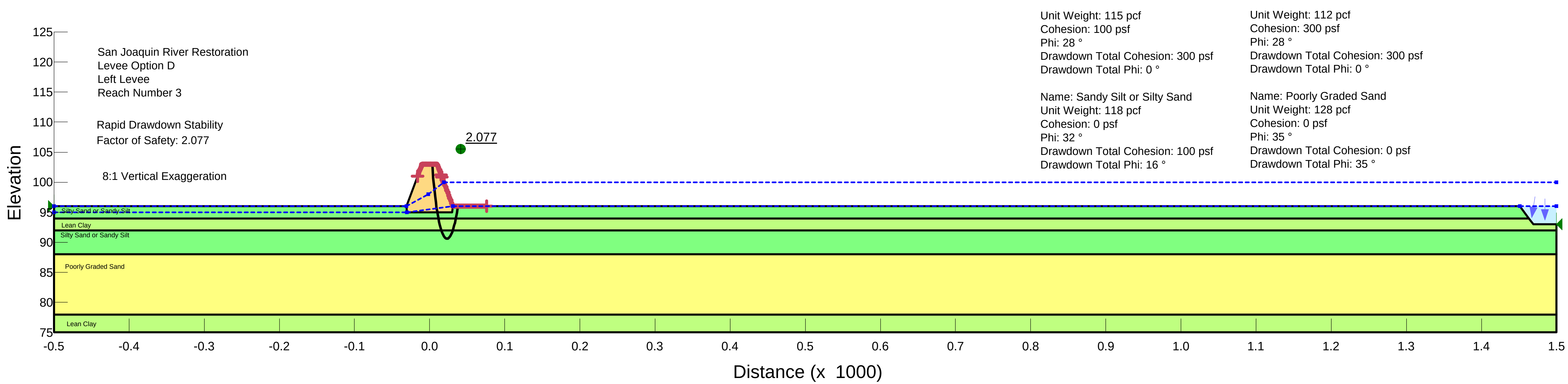

San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Downstream Slope Stability
Factor of Safety: 2.232
8:1 Vertical Exaggeration
2.232
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)



San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Upstream Slope Stability
Factor of Safety: 2.695
8:1 Vertical Exaggeration
2.695
Name: Levee Fill
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Name: Lean Clay
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)



San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Rapid Drawdown Stability
Factor of Safety: 2.318
8:1 Vertical Exaggeration
2.318
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)



San Joaquin River Restoration
Levee Option D
Left Levee
Reach Number 3
Rapid Drawdown Stability
Factor of Safety: 2.077
8:1 Vertical Exaggeration
2.077
Unit Weight: 115 pcf
Cohesion: 100 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Sandy Silt or Silty Sand
Unit Weight: 118 pcf
Cohesion: 0 psf
Phi: 32 °
Drawdown Total Cohesion: 100 psf
Drawdown Total Phi: 16 °
Unit Weight: 112 pcf
Cohesion: 300 psf
Phi: 28 °
Drawdown Total Cohesion: 300 psf
Drawdown Total Phi: 0 °
Name: Poorly Graded Sand
Unit Weight: 128 pcf
Cohesion: 0 psf
Phi: 35 °
Drawdown Total Cohesion: 0 psf
Drawdown Total Phi: 35 °
Silty Sand or Sandy Silt
Lean Clay
Silty Sand or Sandy Silt
Poorly Graded Sand
Lean Clay
Elevation
125
120
115
110
105
100
95
90
85
80
75
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
Distance (x 1000)

Attachment C

Levee Seepage Calculations

And

Seepage Berm and Slurry Wall Design

Project:	Left Levee Option A																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	9.997884	10	56	65.99788	105	2	102	102	3	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	2.572239	0.285804
MW 10-93																										
2	5242+49	5430+83	95	1.8	CL	15.99572	16	56	71.99572	103.9	2	99	99	4.9	5.8	CL/ML	0.02835	14.17	110	499.8236	0.001770848	564.7012		8	4.345923	0.54324
MW 10-98																										
3	5430+83	5550+65	93	0	CL	28.60243	30	68	96.60243	100.1	7	96	96	4.1	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.831256	0.373726
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	49.97314	50	56	105.9731	99	2	96	96	3	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99		19.6	2.764672	0.141055
MW 10-108																										
5	5641+96	5768+50	88	0	ML/CL	59.84051	60	56	115.8405	100	2	97	97	3	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	2.558232	0.224406
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	56.18928	100	62	118.1893	99.1	7	96	96	3.1	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.049089	0.617111
MW 10-106																										
7	5901+47	5983+69	86	0	CH/CL	138.2671	140	62	200.2671	96	2	93	93	3	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	2.347931	0.451525
MW 11-140																										
8	5983+69	6238+39	83	0	SM/CL	9.976258	10	62	71.97626	93.8	7	90	90	3.8	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	2.362728	0.908742
MW 10-110																										

Project: Left Levee Option A

Project Segment	Levee Station From	To	Semi Pervious Berm Design Values: i_o with berm	i_l with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		Semi Pervious Berm Design Values or Minimum Berm Design Values: H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	Z_t + $t_{rec\ toe}$	i_o with rec berm		Final Recommended Berm Dimensions: Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-93																										
2	5242+49	5430+83	0.5	0.5	1	6.764961	4	4.141525	0.09435	0.010625	19.63842		0.6125	0.127493	31.6	0.055959	5	2	6.25	13	0.318579		35	6.25	5.375	1:40
MW 10-98			Low excessive gradient values indicate using a minimum berm																							
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	17.72967	0.85	0.90244	0.03496	0.099245	3.621371		1.823529	1.954944	24.4	0.403595	5	2	6.25	6.7	0.134693		25	6.25	5.625	1:40
MW 10-106																							Minimum berm			
7	5901+47	5983+69	0.5	0.5	1	7.666323	2.6	2.537152	-0.0419	0.008321	-17.6468		0.576923	0.277721	24	0.033282	5	2	6.25	10.2	0.24874		25	6.25	5.625	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																				Minimum berm			
8	5983+69	6238+39	0.5	0.5	1	9.649862	1.3	1.65079	0.23386	0.050709	28.49627		1.461538	0.60831	27.2	0.229882	5	2	6.25	7.6	0.217209		300	6.25	5.375	1:40
MW 10-110			Design indicates using minimum berm																				Based on geostudios model			

				Project:	Left Levee Option A				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	28	110	25%	127.9957	3.99458382	0.499322977
	MW 10-98								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	21	21.5	98%	160.1893	0.84939473	0.499643959
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	230.2671	2.27389337	0.437287186
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6238+39	78	100	78%	227.9763	1.29836803	0.49937232
	MW 10-110								

Project:	Right Levee Option A																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	59.547	60	62	121.547	106.4	2	103	103	3.4	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	2.602832	0.289204
MW10-93																										
2	5242+49	5430+83	96	1	SC	61.00864	122	62	123.0086	103.3	7	99	99	4.3	4	SC	0.567	28.35	20.3	50	0.015694121	63.71813	20	4	0.601362	0.150341
MW 10-97																										
Ditch																										
3	5430+83	5550+65	92	0	CL	9.945534	10	74	83.94553	102.1	7	97	97	5.1	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435	620	4.9	2.455963	0.501217
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	39.97631	40	74	113.9763	99	2	96	96	3	9	CL/CH	0.002835	2.835	100	1000	0.001054093	948.6833		10.5	2.678233	0.25507
MW 10-108																										
5	5641+96	5768+50	88	0	ML/CL	39.95266	40	56	95.95266	101	2	97	97	4	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	3.499447	0.306969
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	19.30099	20	56	75.30099	98.2	7	95	95	3.2	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.425048	0.838264
MW 10-106																										
7	5901+47	5983+69	88	0	CH/CL	548.7265	720	56	604.7265	95	2	92	92	3	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.631672	0.313783
MW 11-140																										
8	5983+69	6119+04	82	0	SM/CL	16.88398	17	56	72.88398	94.1	7	91	91	3.1	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	1.918338	0.737822
MW 10-110																										

Project: Right Levee Option A

Project Segment	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
	From	To	i_o with berm	i_l with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-97																										
Ditch																										
3	5430+83	5550+65	0.5	0.5	1	12.45947	2.45	2.452535	0.00169	0.076948	0.080633		1.040816	1.076579	32.4	0.415521	5	2	6.25	9.9	0.247731		35	6.25	5.375	1:40
MW 10-113			Design indicates using minimum berm																							
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	13.47323	0.85	1.010458	0.106972	0.099245	10.5007		1.882353	1.245538	24.8	0.410212	5	2	6.25	6.7	0.150815		25	6.25	5.625	1:40
MW 10-106			Design indicates using minimum berm																							
7	5901+47	5983+69	0.4	0.4	1	11.03163	2.08	1.969337	-0.07904	0.008321	-39.4442		0.576923	0.838605	24	0.033282	5	2	6.25	10.2	0.193072		25	6.25	5.625	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6119+04	0.5	0.5	1	9.695892	1.3	1.463218	0.108812	0.050709	14.02442		1.192308	0.615982	24.4	0.206218	5	2	6.25	7.6	0.192529		25	6.25	5.625	1:40
MW 10-110			Design indicates using minimum berm																							

				Project:	Right Levee Option A				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-97								
	Ditch								
	3	5430+83	5550+65	15.2	15.2	100%	114.3455	2.067749	0.42199
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	24.5	21.5	114%	124.301	1.047108	0.615946
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	634.7265	1.595569	0.30684
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6119+04	46	100	46%	164.884	1.295161	0.498139
	MW 10-110								

Project:	Left Levee Option B																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1 MW 10-91	5217+38	5242+49	95	6.7	SC/CL	243.6071	250	62	305.6071	106.4	2	103	103	3.4	15.8	CL/SC	0.02835	14.17	100	499.8236	0.001125286	888.6627	350	19.8	1.815111	0.091672
2 MW 10-98	5242+49	5430+83	97	10	CL	233.4643	250	62	295.4643	107.9	2	102	102	5.9	5.8	CL/ML	0.0567	28.35	100	500	0.001856953	538.5165	245	8	2.674552	0.334319
3 MW 10-113	5430+83	5550+65	93	0	CL	77.97433	610	62	139.9743	100.2	7	96	96	4.2	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435	1000	4.9	1.502612	0.306655
4 MW 10-108	5550+65	5641+96	92	0	CL/CH	299.0414	305	62	361.0414	99.9	2	96	96	3.9	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99		19.6	3.023267	0.154248
5 MW 10-105	5641+96	5768+50	88	0	ML/CL	321.3558	350	62	383.3558	100.6	2	97	97	3.6	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	2.290844	0.200951
6 MW 10-106	5768+50	5901+47	89	0	CL/SM	60.4566	575	62	122.4566	100	7	96	96	4	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.322083	0.777696
7 MW 11-140	5901+47	5983+69	86	0	CH/CL	253.6818	265	62	315.6818	97	2	93	93	4	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	2.782083	0.535016
8 MW 10-110	5983+69	5995+37	83	0	SM/CL	117.2671	320	62	179.2671	93.8	7	90	90	3.8	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	1.510884	0.581109

Project: Left Levee Option B

Project Segment	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-91																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-98																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	1.016558	0.111039	0.099245	10.86941		2.352941	2.025529	28	0.463142	5	2	6.25	6.7	0.151725		30	6.25	5.5	1:40
MW 10-106			Design Values indicate using minimum berm																							
7	5901+47	5983+69	0.5	0.5	1	8.626631	2.6	2.660906	0.040604	0.008321	16.69906		0.769231	0.437772	28	0.038829	5	2	6.25	10.2	0.260873		30	6.25	5.5	1:40
MW 11-140			Design Values indicate using minimum berm																							
8	5983+69	5995+37	0.5	0.5	1	15.0905	1.3	1.367793	0.045195	0.050709	6.017261		1.461538	1.515083	27.2	0.229882	5	2	6.25	7.6	0.179973		30	6.25	5.5	1:40
MW 10-110			Design Values indicate using minimum berm																							

				Project:	Left Levee Option B				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-91								
	2	5242+49	5430+83	No cutoff required					
	MW 10-98								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	24.5	21.5	114%	171.4566	1.042745	0.61338
	MW 10-106								
	7	5901+47	5983+69	37	100	37%	389.6818	2.596743	0.499374
	MW 11-140								
	8	5983+69	5995+37	25	100	25%	229.2671	1.293546	0.497518
	MW 10-110								

Project:	Right Levee Option B																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	59.547	60	68	127.547	107.5	2	103	103	4.5	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	3.405509	0.37839
MW 10-93																										
2	5242+49	5430+83	96	1	SC	62.71221	154	68	130.7122	104.8	7	99	99	5.8	4	SC	0.567	28.35	20.3	50	0.015694121	63.71813		4	1.900759	0.47519
MW 10-97																										
3	5430+83	5550+65	92	0	CL	77.2636	210	74	151.2636	102.7	7	97	97	5.7	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.938832	0.39568
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	870.584	1078	68	938.584	100.1	2	96	96	4.1	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99		19.6	2.337662	0.119268
MW 10-108																										
5	5641+96	5768+50	88	0	ML/CL	264.7978	280	62	326.7978	101.2	2	97	97	4.2	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	2.824172	0.247734
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	60.43837	266	62	122.4384	98	7	95	95	3	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	0.991661	0.58333
MW 10-106																										
7	5901+47	5983+69	88	0	CH/CL	548.7265	720	62	610.7265	95.6	2	92	92	3.6	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.949185	0.374843
MW 11-140																										
8	5983+69	6119+04	82	0	SM/CL	16.88398	17	62	78.88398	94	7	91	91	3	1.4	SM/CL	0.2835	28.35	100	100	0.008451543	118.3216		2.6	1.799973	0.692297
MW 10-111																										

			Project:		Right Levee Option B																			
	Levee Station		Semi Pervious Berm Design Values									Semi Pervious Berm Design Values or Minimum Berm Design Values									Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b	H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm	Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																					
MW 10-93																								
2	5242+49	5430+83	No Berm Needed																					
MW 10-97																								
3	5430+83	5550+65	No Berm Needed																					
MW 10-113																								
4	5550+65	5641+96	No Berm Needed																					
MW 10-108																								
5	5641+96	5768+50	No Berm Needed																					
MW 10-105																								
6	5768+50	5901+47	0.5	0.5	1	18.15137	0.85	0.885902	0.023935	0.099245	2.501812	1.764706	2.025228	24	0.396979	5	2	6.25	6.7	0.132224	30	6.25	5.5	1:40
MW 10-106			Design indicates using minimum berm																					
7	5901+47	5983+69	0.5	0.5	1	11.08155	2.6	2.408261	-0.12783	0.008321	-55.2991	0.692308	0.846925	26.4	0.03661	5	2	6.25	10.2	0.236104	30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																					
8	5983+69	6119+04	0.5	0.5	1	10.00015	1.3	1.427268	0.084845	0.050709	11.06599	1.153846	0.666691	24	0.202837	5	2	6.25	7.6	0.187798	30	6.25	5.5	1:40
MW 10-111			Design indicates using minimum berm																					

				Project:	Right Levee Option B				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-97								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	16	21.5	74%	154.4384	0.843993	0.496466
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	640.7265	1.906247	0.366586
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6119+04	38	100	38%	154.884	1.299259	0.499715
	MW 10-111								

Project:	Left Levee Option C																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1 MW 10-92	5217+38	5242+49	95		CL	298.4144	890	56	354.4144	109.8	7	104	104	5.8	9	CL/SM	0.2835	28.35	100	100	0.003333333	300	28	9	0.42467	0.047186
2 MW 10-100	5242+49	5430+83	95	10	CL	308.4958	950	56	364.4958	106.9	7	101	101	5.9	9.6	CL/SM	0.2835	28.35	100	100	0.003227486	309.8387		9.6	2.710892	0.282385
3 MW 10-113	5430+83	5550+65	93	0	CL	77.97435	750	56	133.9744	101.8	7	96	96	5.8	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	2.133777	0.435465
4 MW 10-109	5550+65	5641+96	92	0	CL/SM	289.0293	305	56	345.0293	99	2	96	96	3	11.1	CL/ML	0.0567	28.35	100	500	0.001342312	744.9832		11.1	2.050389	0.18472
5 MW 10-105	5641+96	5768+50	88	0	ML/CL	561.3538	812	56	617.3538	99.2	2	96	96	3.2	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	1.666409	0.146176
6 MW 10-106	5768+50	5901+47	89	0	CL/SM	60.4566	658	62	122.4566	100.1	7	96	96	4.1	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566	310	1.7	1.355135	0.797138
7 MW 11-140	5901+47	5983+69	86	0	CH/CL	640.6653	1020	68	708.6653	95.6	2	91	91	4.6	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103	265	5.2	1.25197	0.240764
8 MW 10-111	5983+69	6238+39	83	0	SM/CL	314.4501	705	68	382.4501	95	7	89	89	6	10.4	SM/CL	0.2835	28.35	100	100	0.003100868	322.4903		18.8	2.74483	0.146002

Project: Left Levee Option C

Project Segment	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-92																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-100																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-109																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	1.033591	0.122394	0.099245	11.88899		2.411765	2.025529	28.4	0.469759	5	2	6.25	6.7	0.154267		35	6.25	5.375	1:40
MW 10-106			Design indicates minimum berm																							
7	5901+47	5983+69	0.5	0.5	1	11.89645	2.6	2.493796	-0.0708	0.008321	-30.0833		0.884615	0.982742	30.4	0.042157	5	2	6.25	10.2	0.24449		35	6.25	5.375	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6238+39	No Berm Needed																							
MW 10-111																										

				Project:	Left Levee Option C				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-92								
	2	5242+49	5430+83	No cutoff required					
	MW 10-100								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-109								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	24.5	21.5	114%	171.4566	1.068814	0.628714
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	738.6653	2.272341	0.436989
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6238+39	No cutoff required					
	MW 10-111								

Project:	Right Levee Option C																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	394.9908	1200	62	456.9908	110	2	103	103	7	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627	250	9	2.47528	0.275031
MW 10-93																										
2	5242+49	5430+83	95	3	sCL	123.3627	706	62	185.3627	103.1	7	99	99	4.1	8.9	CL/SM	0.2835	28.35	17.1	100	0.008106006	123.3653	1000	8.9	1.638328	0.184082
MW 10-96																										
3	5430+83	5550+65	92	0	CL	77.97435	895	62	139.9744	101.6	7	97	97	4.6	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435	10	4.9	0.306719	0.062596
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	1105.465	1758	62	1167.465	99.9	2	96	96	3.9	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99	624	19.6	1.358441	0.069308
MW 10-108																										
5	5641+96	5768+50	88	0	SM/CL	173.205	1350	68	241.205	98.3	7	95	95	3.3	3	SM/CL	0.2835	28.35	100	100	0.005773503	173.2051		11.1	1.379254	0.124257
MW 10-103																										
6	5768+50	5901+47	89	0	CL/SM	60.4566	1084	68	128.4566	100.4	7	95	95	5.4	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.728125	1.016544
MW 10-106																										
7	5901+47	5983+69	88	0	CH/CL	701.2468	1540	68	769.2468	95.9	2	92	92	3.9	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.887018	0.362888
MW 11-140																										
8	5983+69	6119+04	82	0	CL/ML	731.4194	880	68	799.4194	95.9	2	91	91	4.9	12.2	CL/ML	0.02835	28.35	100	1000	0.000905357	1104.536		14.3	2.842623	0.198785
MW 11-137																										

Project: Right Levee Option C

	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-96																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-103																										
6	5768+50	5901+47	0.5	0.5	1	18.74864	0.85	1.299755	0.299836	0.099245	26.278		3.176471	2.124774	33.6	0.555771	5	2	6.25	6.7	0.193993		35	6.25	5.375	1:40
MW 10-106			Design indicates minimum berm																							
7	5901+47	5983+69	0.5	0.5	1	12.40052	2.6	2.373853	-0.15076	0.008321	-65.7162		0.75	1.066753	27.6	0.038274	5	2	6.25	10.2	0.232731		30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6119+04	No Berm Needed																							
MW 11-137																										

				Project:	Right Levee Option C				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-96								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-103								
	6	5768+50	5901+47	24.5	21.5	114%	177.4566	1.372205	0.807179
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	799.2468	1.849783	0.355727
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6119+04	No cutoff required					
	MW 11-137								

Project:	Left Levee Option D																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	0	CL/CH	393.3555	1075	56	449.3555	107	2	104	104	3	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627		9	1.406952	0.156328
MW 10-93																										
2	5242+49	5430+83	95	10	CL	309.2798	1086	56	365.2798	104	7	101	101	3	9.6	CL/SM	0.2835	28.35	100	100	0.003227486	309.8387		9.6	1.376819	0.143419
MW 10-100																										
3	5430+83	5550+65	93	0	CL	77.97435	1420	62	139.9744	100.7	7	96	96	4.7	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.681494	0.343162
MW 10-113																										
4	5550+65	5641+96	92	0	CL/SM	938.0831	8100	62	1000.083	101.3	2	98	98	3.3	8.8	CL/SM	0.02835	28.35	100	1000	0.001066004	938.0832		10.6	1.597218	0.150681
MW 10-114																										
5	5641+96	5768+50	88	0	ML/CL	670.8201	5200	62	732.8201	99	2	96	96	3	9	CL/SC	0.0567	28.35	100	500	0.001490712	670.8204		11.4	1.433744	0.125767
MW 10-105																										
6	5768+50	5901+47	89	0	CL/SM	60.4566	3055	62	122.4566	99.1	7	96	96	3.1	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.024614	0.602714
MW 10-106																										
7	5901+47	5983+69	86	0	CH/CL	720.2338	2670	62	782.2338	94.9	2	91	91	3.9	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.870716	0.359753
MW 11-140																										
8	5983+69	6238+39	83	0	SM/CL	314.4501	705	62	376.4501	95.1	7	89	89	6.1	10.4	SM/CL	0.2835	28.35	100	100	0.003100868	322.4903		18.8	2.814533	0.149709
MW 10-111																										

Project: Left Levee Option D

Project Segment	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-100																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-114																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-105																										
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	0.895896	0.030597	0.099245	3.180717		1.823529	2.025529	24.4	0.403595	5	2	6.25	6.7	0.133716		30	6.25	5.5	1:40
MW 10-106			Design indicates using minimum berm																							
7	5901+47	5983+69	0.4	0.4	1	12.50858	2.08	2.012571	-0.04816	0.008321	-23.7686		0.75	1.084763	27.6	0.038274	5	2	6.25	10.2	0.197311		30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6238+39	No Berm Needed																							
MW 10-111																										

				Project:	Left Levee Option D				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-100								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-114								
	5	5641+96	5768+50	No cutoff required					
	MW 10-105								
	6	5768+50	5901+47	19	21.5	88%	160.4566	0.848367	0.499039
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	812.2338	1.834115	0.352714
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6238+39	No cutoff required					
	MW 10-111								

Project:	Right Levee Option D																									
	Levee Station		Riverside Conditions								Landside Conditions															
Project Segment	From	To	El Riverside Borrow Pit	Z_{br} ft	Soil Type	X_1 ft	L_1 ft	L_2 ft	S ft	El Flow Line	Seepage Exit Case	El LS Ground	El Tailwater	H ft	Z_{BL} ft	Soil Type	K_{BL} (ft/day)	K_f (ft/day)	D ft	K_f/K_{BL}	$C=(K_{BL}/K_fZD)^{0.5}$	X_3 ft	L_3 ft	Z_t ft	h_0 ft	i_0 (h_0/Z_t)
1	5217+38	5242+49	95	2	SC	210.9072	235	62	272.9072	106	2	103	103	3	9	CL/CH	0.002835	2.835	17.5	1000	0.002519763	396.8627	1000	9	1.777608	0.197512
MW 10-93																										
2	5242+49	5430+83	95	4.3	CL	123.198	450	62	185.198	104	7	99	99	5	8.9	CL/SM	0.2835	28.35	17.1	100	0.008106006	123.3653		8.9	1.999028	0.22461
MW 10-96																										
3	5430+83	5550+65	92	0	CL	77.97435	1490	62	139.9744	101.1	7	97	97	4.1	4	ML/CL/SM	0.2835	28.35	15.2	100	0.012824729	77.97435		4.9	1.466835	0.299354
MW 10-113																										
4	5550+65	5641+96	92	0	CL/CH	1227.014	3065	62	1289.014	99	2	96	96	3	15.5	CL/CH	0.002835	2.835	100	1000	0.000803219	1244.99	890	19.6	1.225325	0.062517
MW 10-108																										
5	5641+96	5768+50	88	0	SM/CL	173.2051	2020	62	235.2051	98.1	7	95	95	3.1	3	SM/CL	0.2835	28.35	100	100	0.005773503	173.2051		11.1	1.314697	0.118441
MW 10-103																										
6	5768+50	5901+47	89	0	CL/SM	60.4566	2383	62	122.4566	98.2	7	95	95	3.2	1.7	CL/SM	0.2835	28.35	21.5	100	0.016540792	60.4566		1.7	1.057666	0.622157
MW 10-106																										
7	5901+47	5983+69	88	0	CH/CL	719.9855	2580	62	781.9855	95.8	2	92	92	3.8	5.2	CH/CL	0.02835	28.35	100	1000	0.00138675	721.1103		5.2	1.82305	0.350587
MW 11-140																										
8	5983+69	6119+04	82	0	CL/ML	824.1463	1065	62	886.1463	95.9	2	91	91	4.9	12.2	CL/ML	0.02835	28.35	100	1000	0.000905357	1104.536		14.3	2.71878	0.190124
MW 11-137																										

Project: Right Levee Option D

	Levee Station		Semi Pervious Berm Design Values										Semi Pervious Berm Design Values or Minimum Berm Design Values										Final Recommended Berm Dimensions			
Project Segment	From	To	i_o with berm	i_i with berm	r	A	h_a at berm toe	h_o' with berm	t_{berm}	2c(2+r)	X_b		H/Z_t	S/X_3	X_b Rec	X_b/X_3	t_{rec} at toe	t_{rec} at crown of berm	1.25*t	$Z_t + t_{rec\ toe}$	i_o with rec berm		Rec Final Berm Width	Rec Final Thickness at Toe	Rec Final Thickness at Crown	Rec Berm Slope
1	5217+38	5242+49	No Berm Needed																							
MW 10-93																										
2	5242+49	5430+83	No Berm Needed																							
MW 10-96																										
3	5430+83	5550+65	No Berm Needed																							
MW 10-113																										
4	5550+65	5641+96	No Berm Needed																							
MW 10-108																										
5	5641+96	5768+50	No Berm Needed																							
MW 10-103																										
6	5768+50	5901+47	0.5	0.5	1	18.15317	0.85	0.90656	0.037707	0.099245	3.897241		1.882353	2.025529	24.8	0.410212	5	2	6.25	6.7	0.135307		30	6.25	5.5	1:40
MW 10-106			Design indicates using minimum berm																							
7	5901+47	5983+69	0.5	0.5	1	12.50651	2.6	2.360314	-0.15979	0.008321	-69.8611		0.730769	1.084419	27.2	0.03772	5	2	6.25	10.2	0.231403		30	6.25	5.5	1:40
MW 11-140			Marginal Reach, Minimum Berm Recommended																							
8	5983+69	6119+04	No Berm Needed																							
MW 11-137																										

				Project:	Right Levee Option D				
		Levee Station		Estimated Slurry Cutoff Depth					
	Project Segment	From	To	d_{trench}	D	d/D % cutoff penetration	S_{mod}	h_o modified	i_o modified
	1	5217+38	5242+49	No cutoff required					
	MW 10-93								
	2	5242+49	5430+83	No cutoff required					
	MW 10-96								
	3	5430+83	5550+65	No cutoff required					
	MW 10-113								
	4	5550+65	5641+96	No cutoff required					
	MW 10-108								
	5	5641+96	5768+50	No cutoff required					
	MW 10-103								
	6	5768+50	5901+47	24.5	21.5	114%	171.4566	0.834196	0.490704
	MW 10-106								
	7	5901+47	5983+69	15	100	15%	811.9855	1.787376	0.343726
	MW 11-140			Marginal Reach, use minimum cutoff wall					
	8	5983+69	6119+04	No cutoff required					
	MW 11-137								

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Checked by Jeanne Major, P.E.	Date