Reach 10

Introduction

The design section includes: clay embankment (EL +5.5 ft), underlain by a shallow Marsh deposit (EL -1.5 ft to EL -13.0 ft). The shallow Marsh is underlain by a Lacustrine Clay stratum (EL -13.0 to -29.0 ft) which mantles a lower Beach Sand deposit located at EL. -29.0 feet to -48.0 ft. Beneath the Beach Sand stratum lies a Bay Sound Clay layer that extends to an EL -70.0 ft. The clay embankment material was assigned a unit weight of 109 pcf with a cohesion of 500 psf. The shear strength values used for the clay embankment are higher than those in the underlying marsh deposit. The elevation of the flood side ground line at the wall face is approximately EL 2.5 ft resulting in 3.0 ft difference in soil elevation across the wall. The existing I-wall has a top elevation of 12.4 ft consisting of a concrete cap and Frodingham 1B sheet pile to tip elevation of -6.0 ft. Figures D-1 and D-2 show the Geo-Studio and FLAC model cross sections. The FLAC model created by the template is constrained to use horizontal soil layers so the top of the upper marsh strata was set at EL -1.5 ft, as it is shown on the flood side of the I-Wall in Figure D-2, without sloping to the levee toe to best capture the wall displacement behavior.

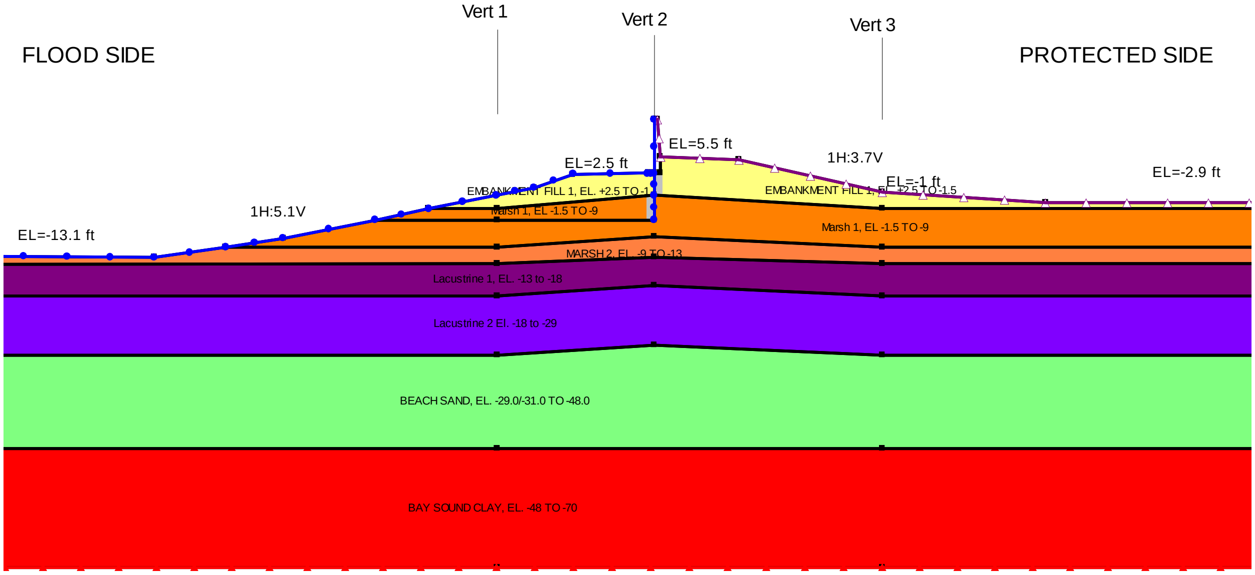


Figure D-1. Geo-Studio model for 17th Street Outfall Canal Reach 10

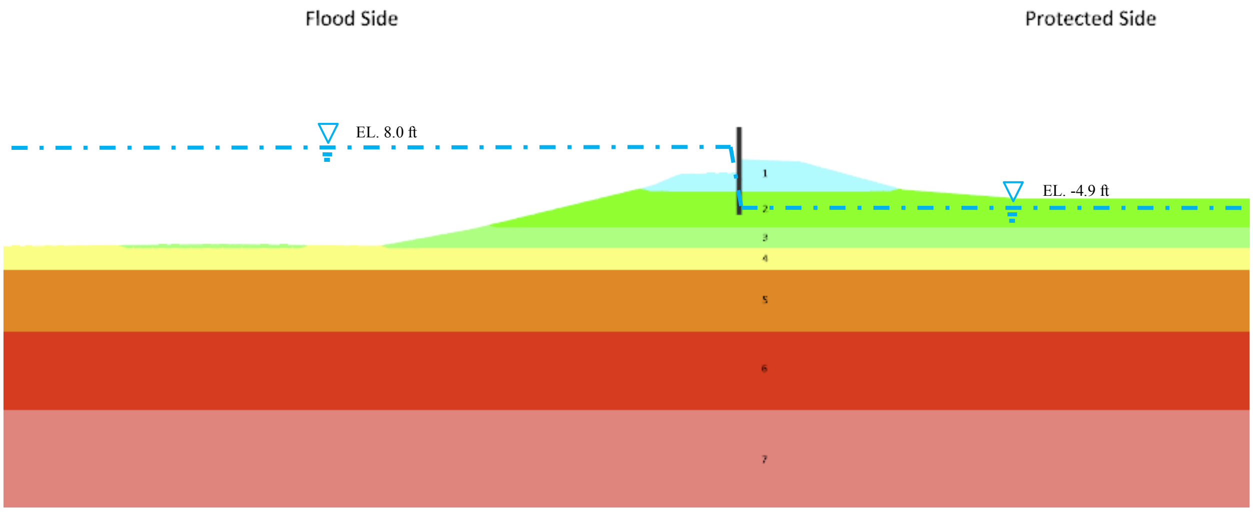


Figure D-2. FLAC Model for 17th Street Outfall Canal Reach 10

Foundation Parameters

The FLAC analyses are based on simple Mohr-Coulomb constitutive models (elastic-perfectly plastic soil behavior). Unit weight and shear strength parameters for the various soil layers were based on the information in the MOWL Report. The cross section used is the Seep/W file from the MOWL report. As-built drawings were examined for the properties of the I-Wall.

Soil modulus values were determined or selected assuming the soils are linearly elastic and isotropic with Poisson's ratio based on expected drainage conditions during loading. The parameters used for analysis are presented in Tables D-1 thru D-4. The soil modulus values were selected using the same G/Su ratios selected for the FLAC model calibrated to the London Load Test (LLT) results. The soil modulus values used in the LLT FLAC model were primarily based on pressuremeter testing and relationships for G/Su. At London Avenue Canal, the shear modulus values were determined by multiplying the G/Su ratio for a given soil by its undrained shear strength. Young's Modulus for the levee and sand were assigned the same value used in the LLT calibration. The at-rest earth pressure coefficients are computed only to initialize stresses during model development so equilibrium can be reached in fewer computational steps.

At 17th Street Outfall Canal, seepage conditions were modeled as steady state using the Seep/W model, and previously accepted material seepage properties and protected side boundary conditions, from the MOWL report. The flood side canal total head boundary was incrementally raised from a starting water level of EL +0.4 ft to EL +1.0 ft and then by 1 ft. The water table was assumed to be constant for the protected side two feet below the ground surface -4.9 ft and 8.0 ft for the flood side. The water table elevations are presented on figure D-2.

Table D-1. Summary of Centerline Soil Parameters

Material	Strata top elevation (NAVD88)	Strata bottom elevation (NAVD88)	unit wt. (pcf)	unit wt/g	Su (psf)	ϕ' (deg)
1 – Embankment	2.5	-1.5	109	3.385	700	0
2 – Marsh 1	-1.5	-9.0	109	3.385	375	0
3 – Marsh 2	-9.0	-13.0	82	2.547	350	0
4 – Lacustrine 1	-13.0	-18.0	106	3.292	300	0
5 – Lacustrine 2	-18.0	-29.0	102	3.168	300	0
6 – Beach Sand	-29.0	-48.0	122	3.789	0	30
7 – Bay Sound Clay	-48.0	-70.0	105	3.261	830	0

Table D-2. Centerline Most Likely Value Modulus

Material	E/Su	E (psf)	Poisson	G (psf)	K (psf)	ko
1 – Embankment	225	1.58E+05	0.40	56250	262500	0.86
2 – Marsh 1	200	7.50E+04	0.47	25510	416667	0.95
3 – Marsh 2	200	7.00E+04	0.47	23810	388889	0.97
4 – Lacustrine 1	300	9.00E+04	0.47	30612	500000	0.95
5 – Lacustrine 2	300	9.00E+04	0.47	30612	500000	0.96
6 – Beach Sand	–	7.32E+05	0.33	275188	732000	0.75
7 – Bay Sound Clay	600	4.98E+05	0.495	166555	16600000	0.99

Table D-3. Summary of Toe Soil Parameters

Material	Strata top elevation (NAVD88)	Strata bottom elevation (NAVD88)	unit wt. (pcf)	unit wt/g	Su (psf)	ϕ' (deg)
1 – Embankment	2.5	-1.5	109	3.385	500	0
2 – Marsh 1	-1.5	-9.0	109	3.385	180	0
3 – Marsh 2	-9.0	-13.0	82	2.547	180	0
4 – Lacustrine 1	-13.0	-18.0	106	3.292	180	0
5 – Lacustrine 2	-18.0	-29.0	102	3.168	258	0
6 – Beach Sand	-29.0	-48.0	122	3.789	0	30
7 – Bay Sound Clay	-48.0	-70.0	105	3.261	800	0

Table D-4. Toe Most Likely Value Modulus

Material	E/Su	E (psf)	Poisson	G (psf)	K (psf)	ko
1 – Embankment	315	1.58E+05	0.40	56250	262500	0.86
2 – Marsh 1	200	3.60E+04	0.47	12245	200000	0.95
3 – Marsh 2	200	3.60E+04	0.47	12245	200000	0.97
4 – Lacustrine 1	300	5.40E+04	0.47	18367	300000	0.95
3 – Lacustrine 2	300	7.74E+04	0.47	26327	430000	0.96
4 – Beach Sand	-	7.32E+05	0.33	275188	732000	0.75
5 – Bay Sound Clay	600	4.80E+05	0.495	160535	16000000	0.99

Structural Parameters

The current I-wall structure was modeled as two beam elements: (1) the upper concrete portion of the I-wall and (2) the supporting sheet pile beneath the concrete. Interface elements were applied to the wall below the ground surface. These elements allow slip and separation between the soil and wall. The shear strength of the interfaces was set at 90% of the shear strength of the strongest cohesive soil layer.

In FLAC the structural beam properties are formulated in plane stress (like a plate) and are adjusted for plane strain conditions by dividing Young's modulus by $1-\nu^2$ (ν =Poisson's ratio). The structural parameters are included in Table D-5.

Table D-5. Summary of Structural Parameters

Member	E (psi)	E* (psi)	E* (psf)	I (in4/ft)	E*I (lbft2/ft)	A (in2/ft)	E*A (lb/ft)	ν
Concrete	3.00E+06	3.13E+06	4.50E+08	1728	3.75E+07	144	4.50E+08	0.2
Frodingham 1 B	2.90E+07	3.19E+07	4.59E+09	36.02	7.97E+06	7.87	2.51E+08	0.3

E = Young's Modulus
E* = Adj. Young's Modulus for Plain Strain
I = Moment of Inertia per foot of wall
A = Cross Sectional Area per foot of wall
ν = Poisson's Ratio

Loading Conditions and Gap Formation

Canal water loadings are modeled as mechanical pressures acting normal to the ground surface and normal to the wall face. When a gap is included between the soil and I-wall a horizontal mechanical pressure is added to both the soil and the wall to the depth of the gap.

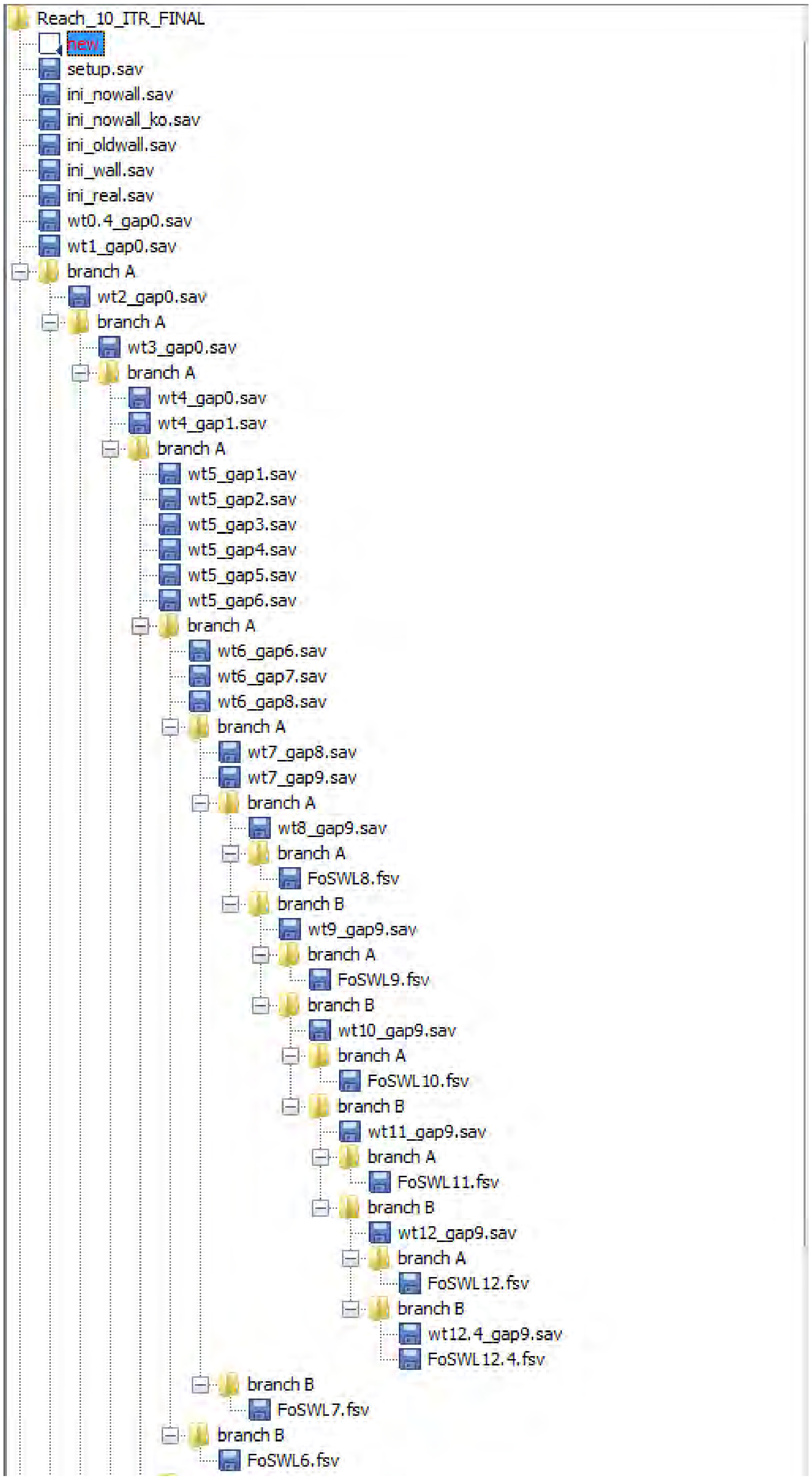
Gap development is modeled following the step-by-step procedure outlined in the London Avenue Outfall Canal Reevaluation report as well as the IPET report. The total horizontal stress in the element adjacent to the wall is compared to the hydrostatic pressure that would exist if a gap were present. If the hydrostatic water pressure exceeds the total horizontal stress it is assumed that a gap would form. Each zone is checked as canal water levels are raised from the normal pool elevation of 0.4 ft to the maximum operating level of 8 ft in 1 ft increments. Gaps were deepened in 1 ft increments as they developed.

At lower canal water levels, it is believed the higher soil level on the protected side of the wall serves to increase the horizontal stresses along the flood side of the sheet pile which slows the progression of the gap.

Results

The gap depth calculations prepared by Black and Veatch which follow IPET guidance was checked and compared with the FLAC results. The gap depth extends to the tip of the sheet pile for both methods. The FLAC and hand calculation analysis had the gap extending to approximate EL -6.0 ft. It should be noted that for even the shallower water depths, the hand calculation resulted in a gap to approximate EL -6.0 ft. The gap tip is 23.0 ft above the sand interface.

The maximum protected side ground displacement for the MLV at water level EL 8.0 ft was about 1.499 inches. The maximum developed crack depth was 8.5 ft. Graphs of the top of protected side ground and top of wall displacement and gap propagation versus canal water elevation can be found in Figures D-4 and D-5.



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  wt1_gap0.sav
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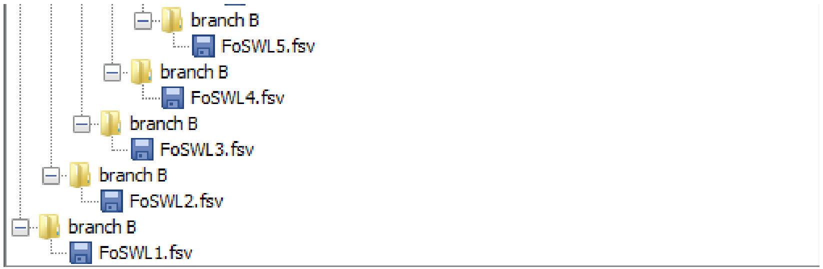

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branch B
FoSWL4.fsv
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branch B
FoSWL1.fsv

Figure D-3. FLAC model progression of water loading and gap development for Reach 10

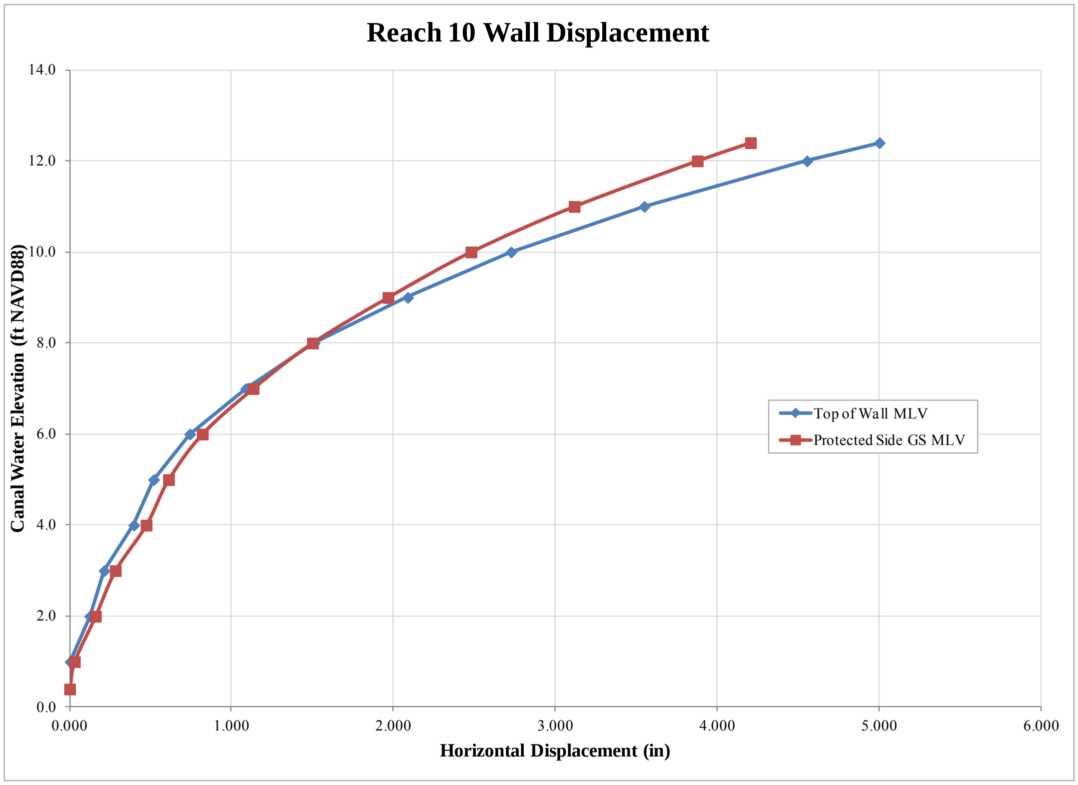

Figure D-4. FLAC computed I-wall displacement.

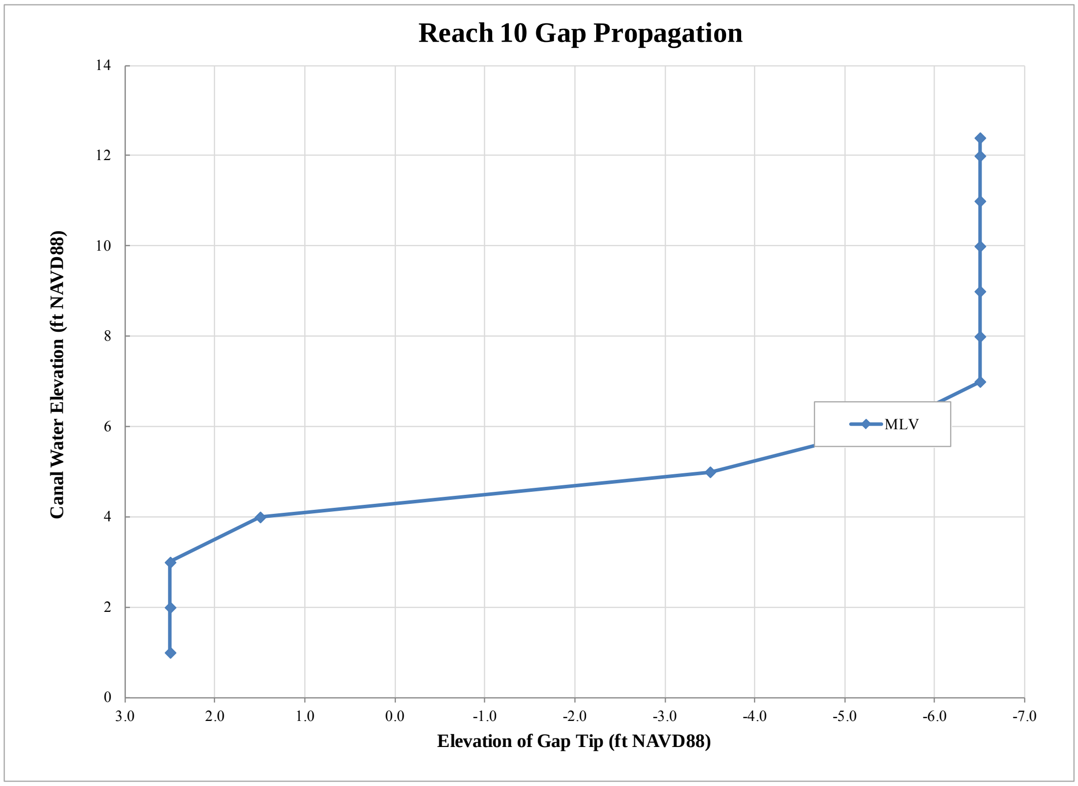

Figure D-5. FLAC computed gap propagation

The automated c-ϕ reduction technique in FLAC was used for all factor of safety (FoS) calculations. Figure D-6 presents the computed factors of safety for differing canal water levels and Figures D-7 through D-14 show the shear strain increment (ssi) and wall locations (original and displaced) for factor of safety at varying water levels. A summary of the FoS and controlling failure mode (global stability or wall rotation) are presented in Table D-6.

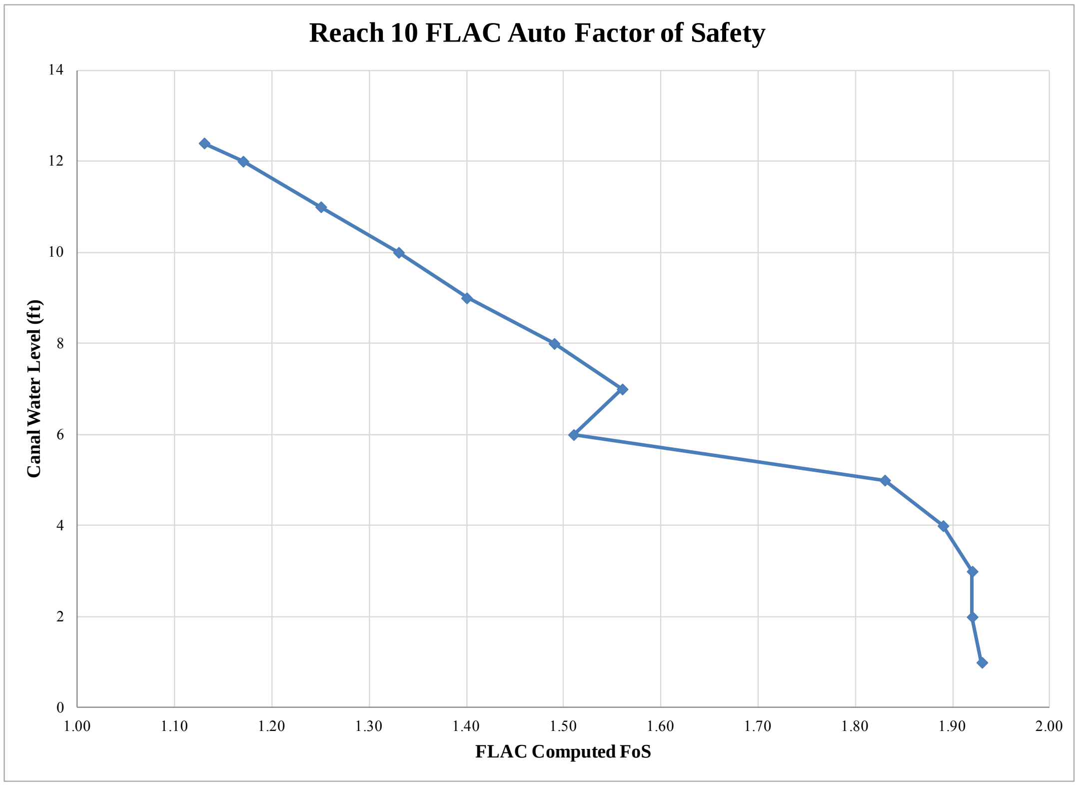

Figure D-6. FLAC computed factor of safety (automated c-ϕ reduction technique).

Table D-6. Summary of FLAC FoS and Controlling Failure Mode.

Canal WL (ft)	FLACAUTO FoS	Controlling Failure Mode
1	1.93	Global Stability
2	1.92	Global Stability
3	1.92	Global Stability
4	1.89	Global Stability
5	1.83	Global Stability
6	1.51	Global Stability
7	1.56	Global Stability
8	1.49	Global Stability
9	1.40	Global Stability
10	1.33	Global Stability
11	1.25	Global Stability
12	1.17	Global Stability
12.4	1.13	Global Stability

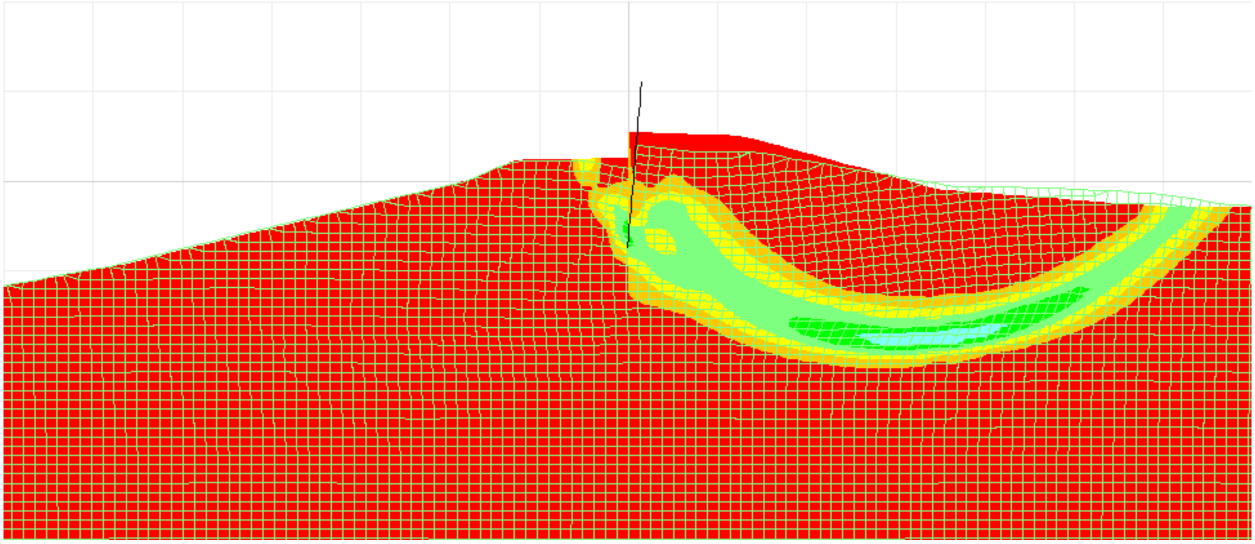

Figure D-7. WL+1 ft, FoS ssi and wall displacement magnified 5X.

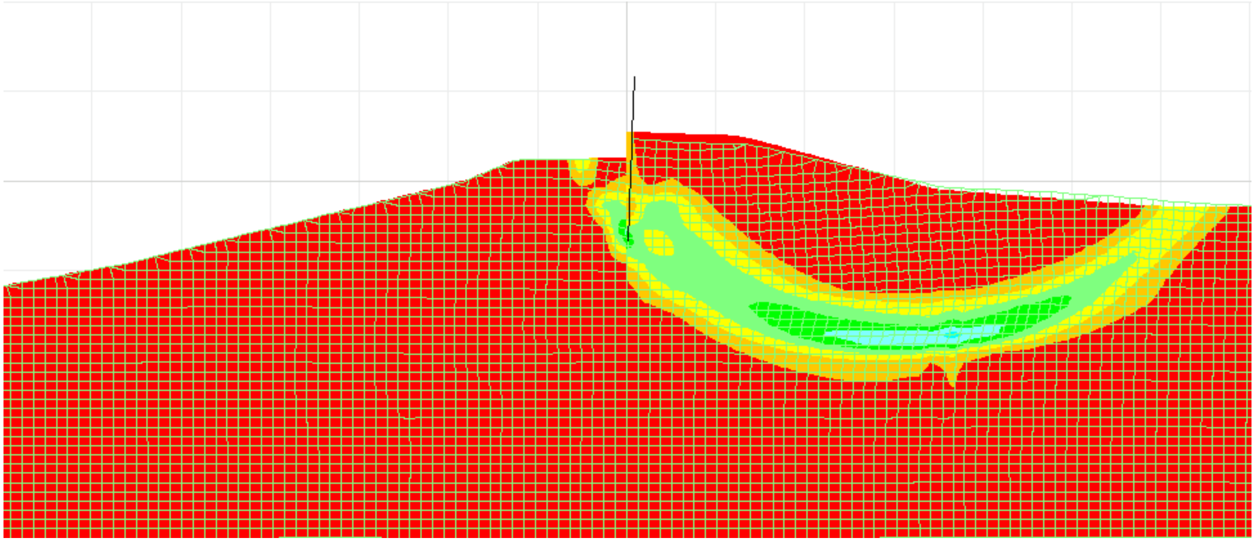

Figure D-8. WL+2 ft, FoS ssi and wall displacement magnified 5X.

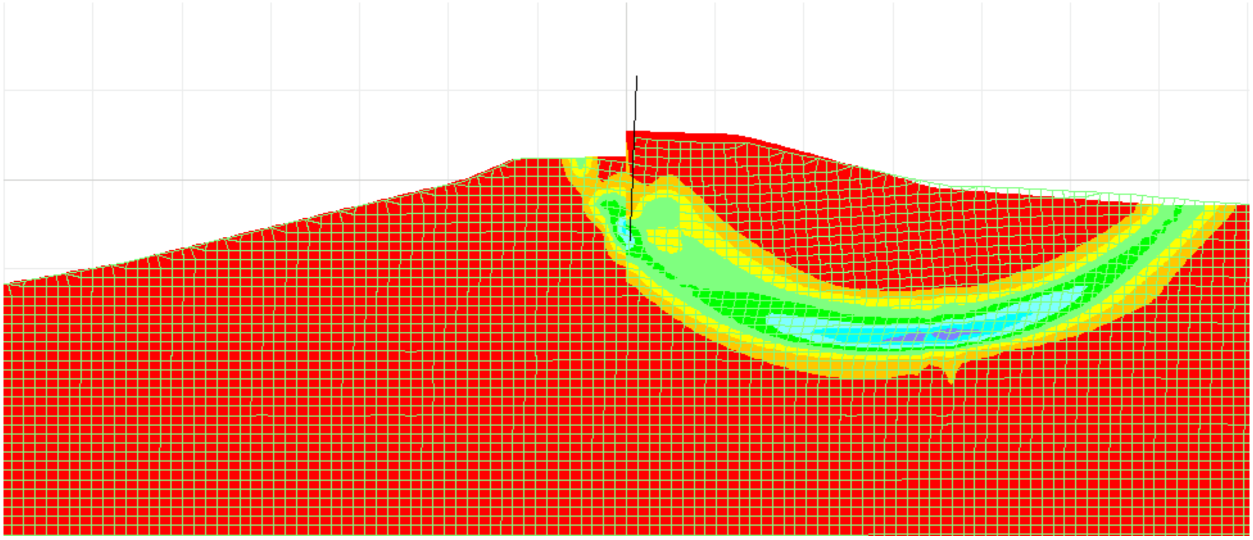

Figure D-9. WL+3 ft, FoS ssi and wall displacement magnified 5X.

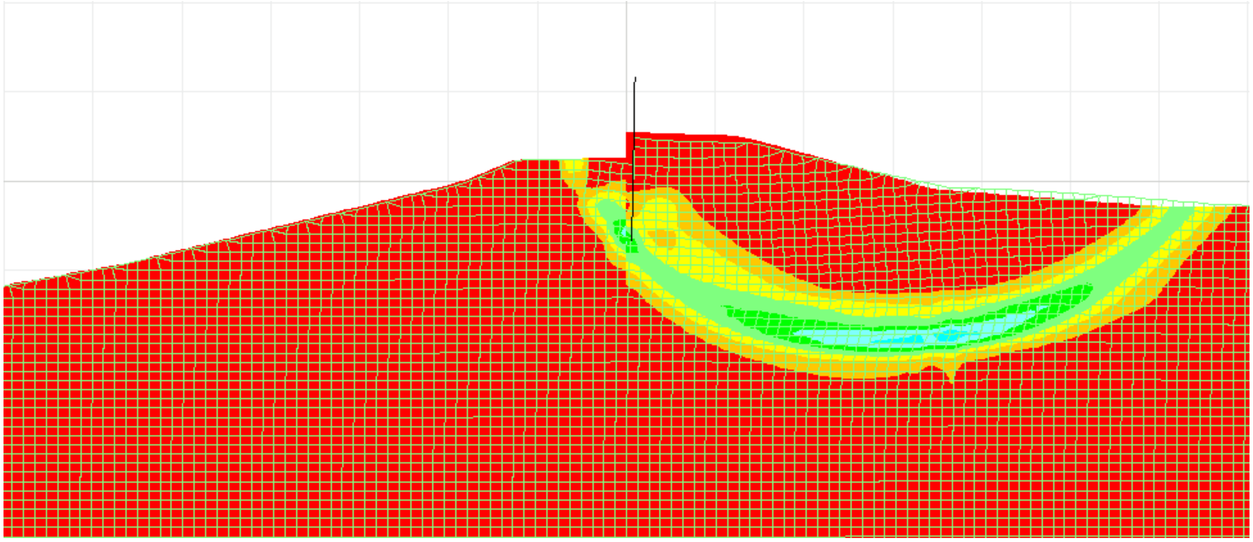

Figure D-10. WL+4 ft, FoS ssi and wall displacement magnified 5X.

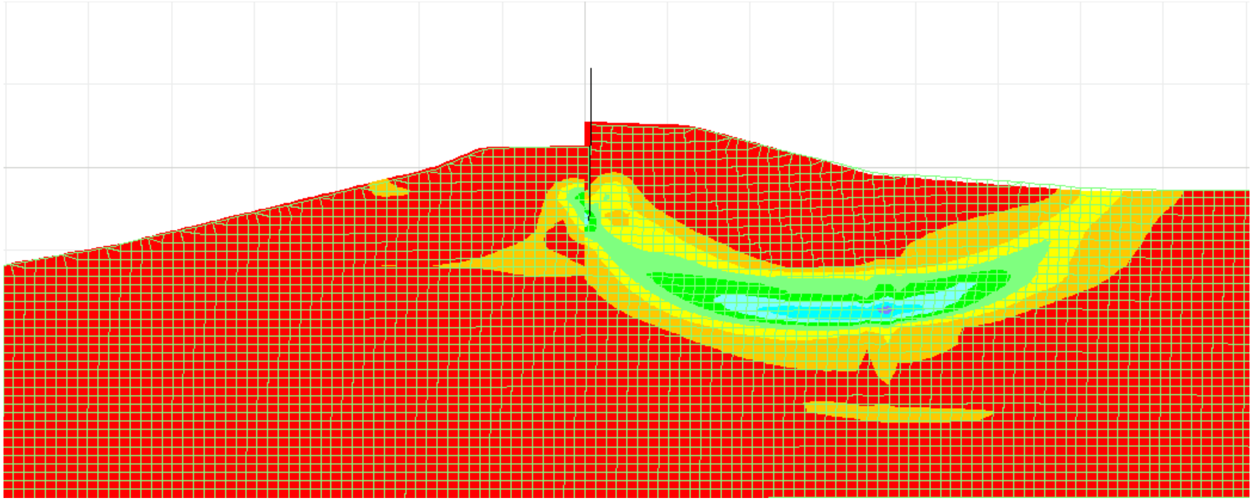

Figure D-11. WL+5 ft, FoS ssi and wall displacement magnified 5X.

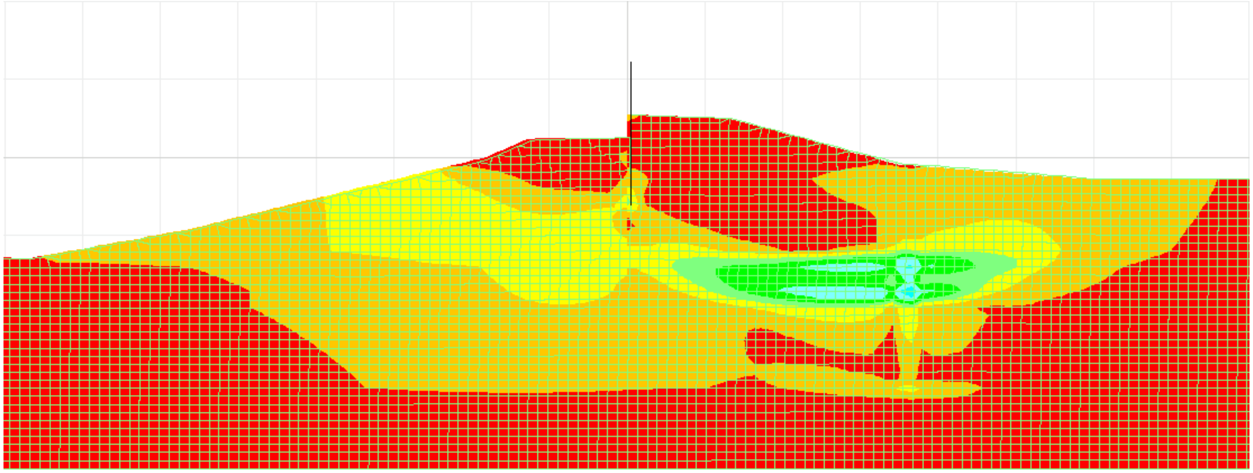

Figure D-12. WL+6 ft, FoS ssi and wall displacement magnified 5X.

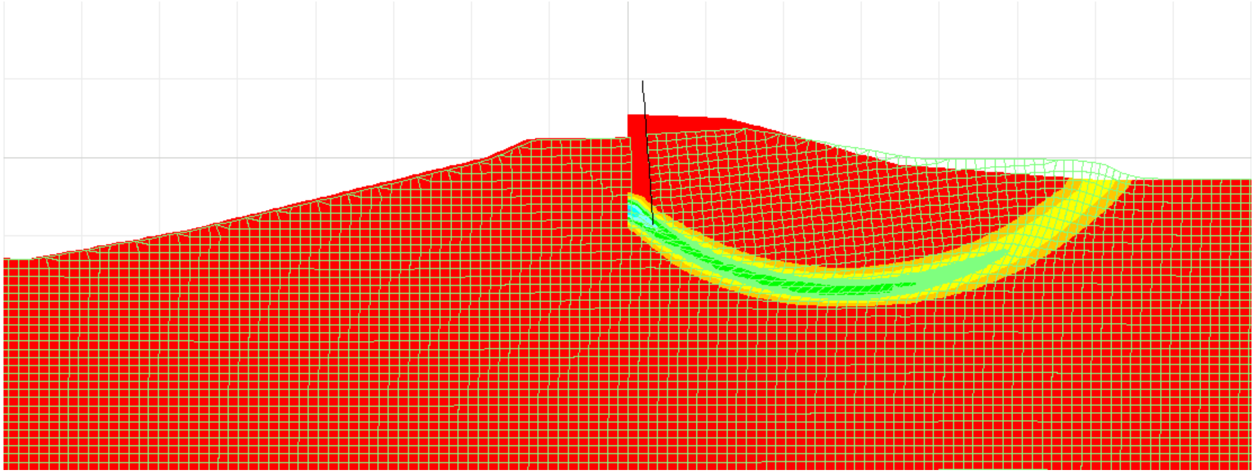

Figure D-13. WL+7 ft, FoS ssi and wall displacement magnified 5X.

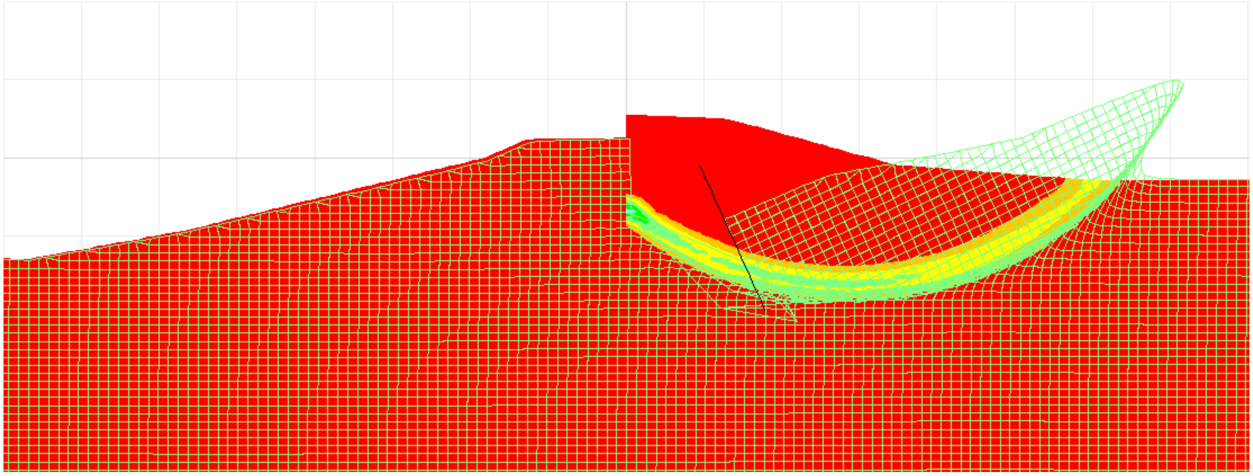

Figure D-14. WL+8 ft, FoS ssi and wall displacement magnified 5X.

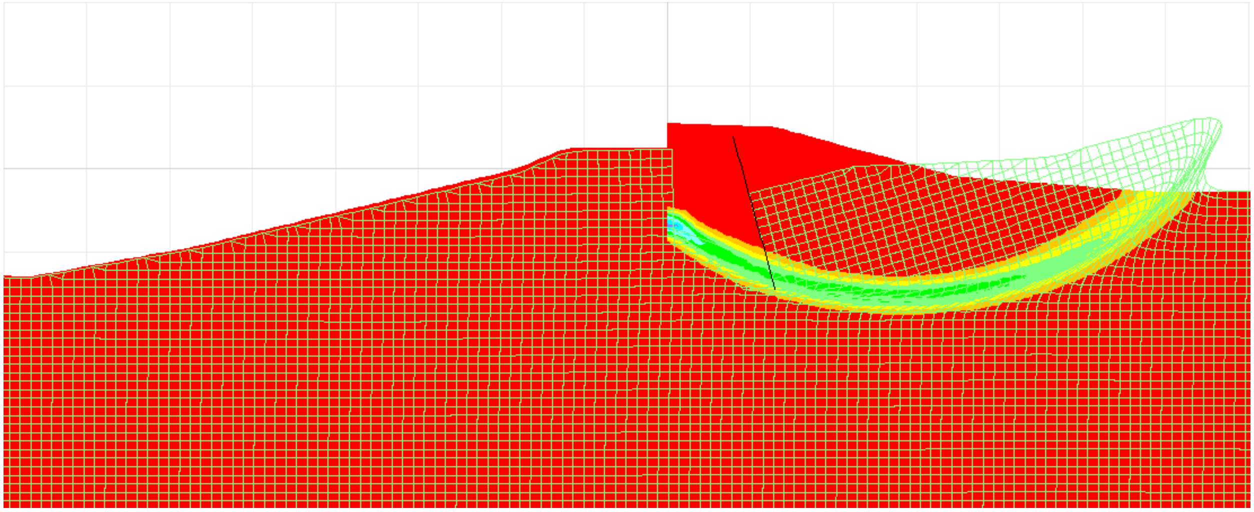

Figure D-15. WL+9 ft, FoS ssi and wall displacement magnified 5X.

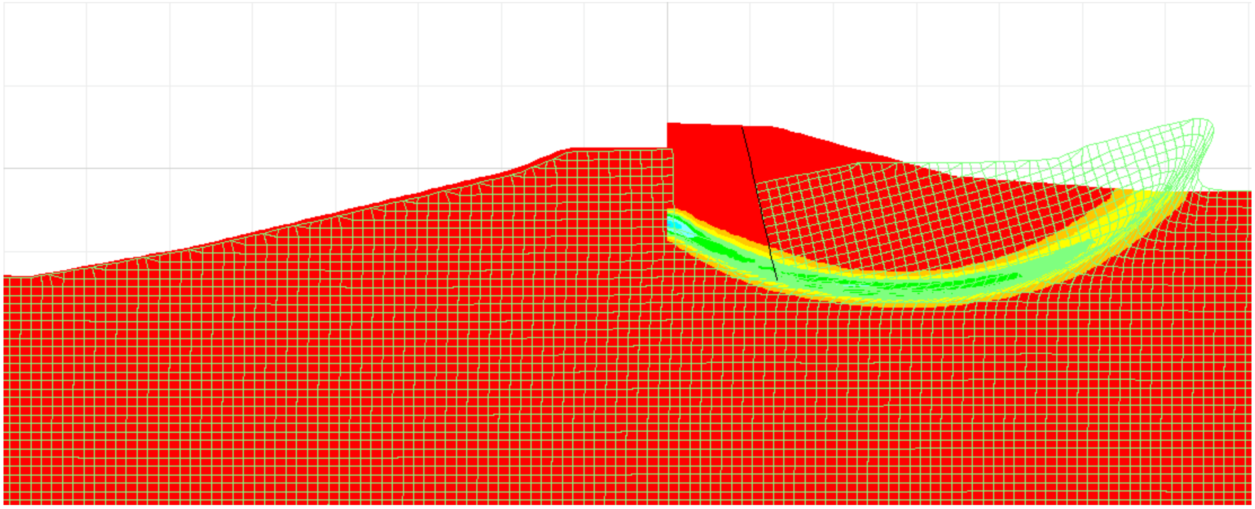

Figure D-16. WL+10ft, FoS ssi and wall displacement magnified 5X.

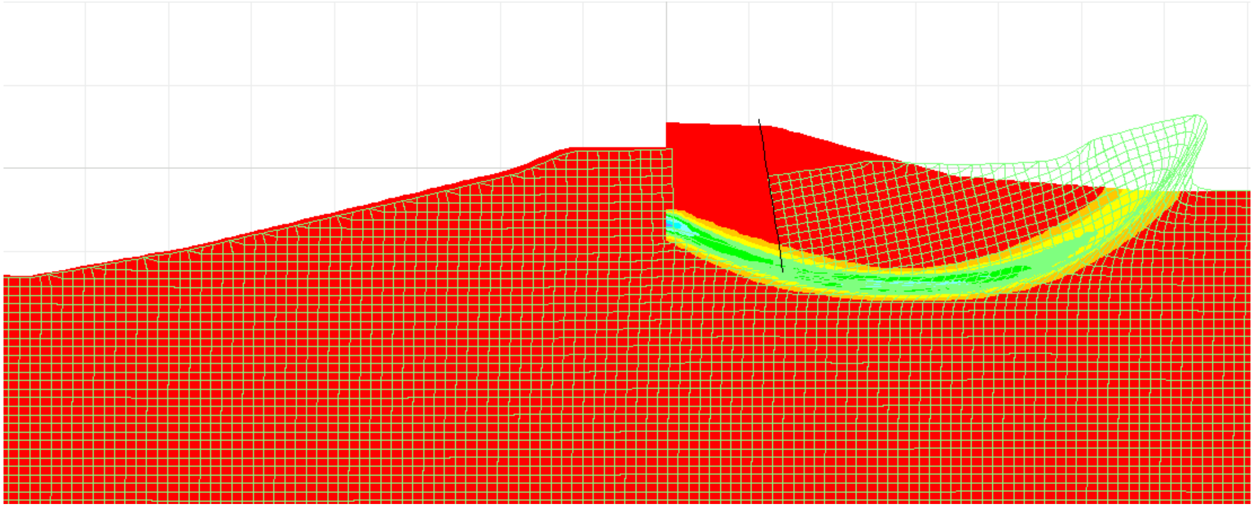

Figure D-17. WL+11 ft, FoS ssi and wall displacement magnified 5X.

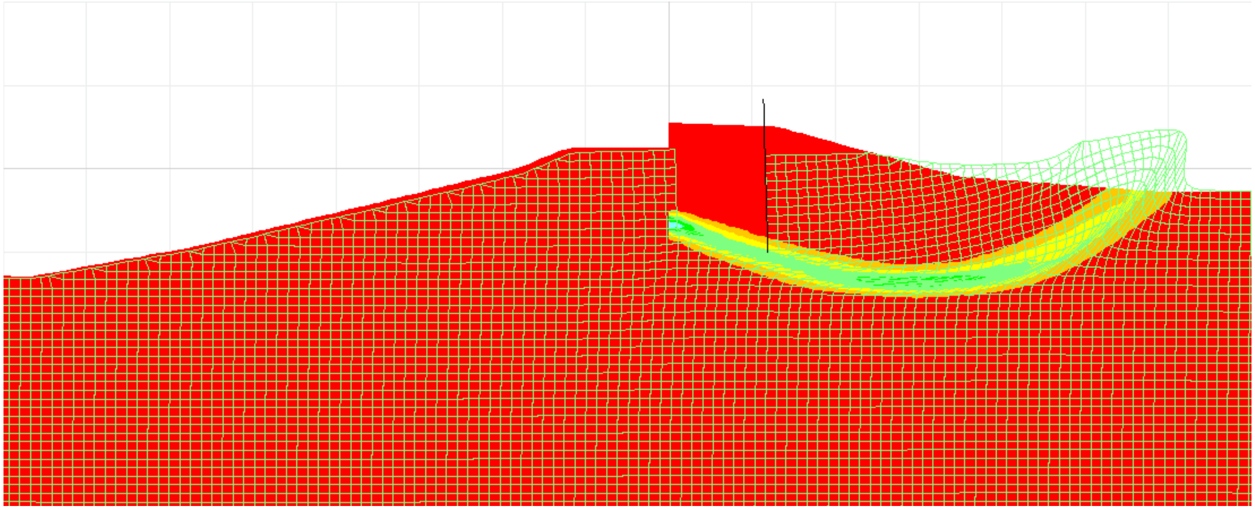

Figure D-18. WL+12 ft, FoS ssi and wall displacement magnified 5X.

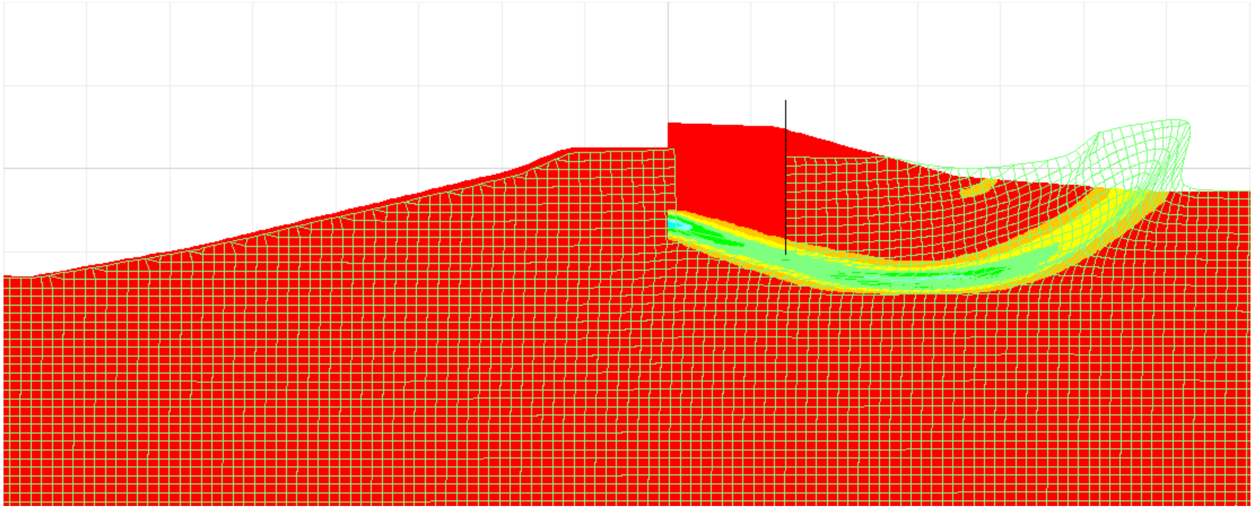

Figure D-19. WL+12.4 ft, FoS ssi and wall displacement magnified 5X.

Reach 11

Introduction

The design section includes: clay embankment (EL +5.5 ft), underlain by a shallow Marsh deposit (EL -6.0 ft to EL -16.0 ft). The shallow Marsh is underlain by a Lacustrine clay stratum (EL -16.0 to -27.0 ft) which mantles a lower Beach Sand deposit located at EL -27.0 ft to EL -42.0 ft. Beneath the Beach Sand stratum lies a Bay Sound Clay layer that extends to an EL of -70.0 ft. The upper clay embankment material was assigned a unit weight of 118 pcf with a cohesion of 800 psf. The shear strength values used for the clay embankment are higher than those in the underlying marsh deposit. The elevation of the flood side ground line at the wall face is approximately EL 2.5 ft resulting in 3.0 ft difference in soil elevation across the wall. The existing I-wall has a top elevation of 12.5 ft consisting of a concrete cap and Frodingham 1B sheet pile to tip elevation of -6.0 ft. Figures D-1 and D-2 show the Geo-Studio and FLAC model cross sections. The FLAC model created by the template is constrained to use horizontal soil layers so the top of the upper marsh strata was set at EL -6.0 ft, as it is shown on the flood side of the I-Wall in Figure D-2, without sloping to the levee toe to best capture the wall displacement behavior.

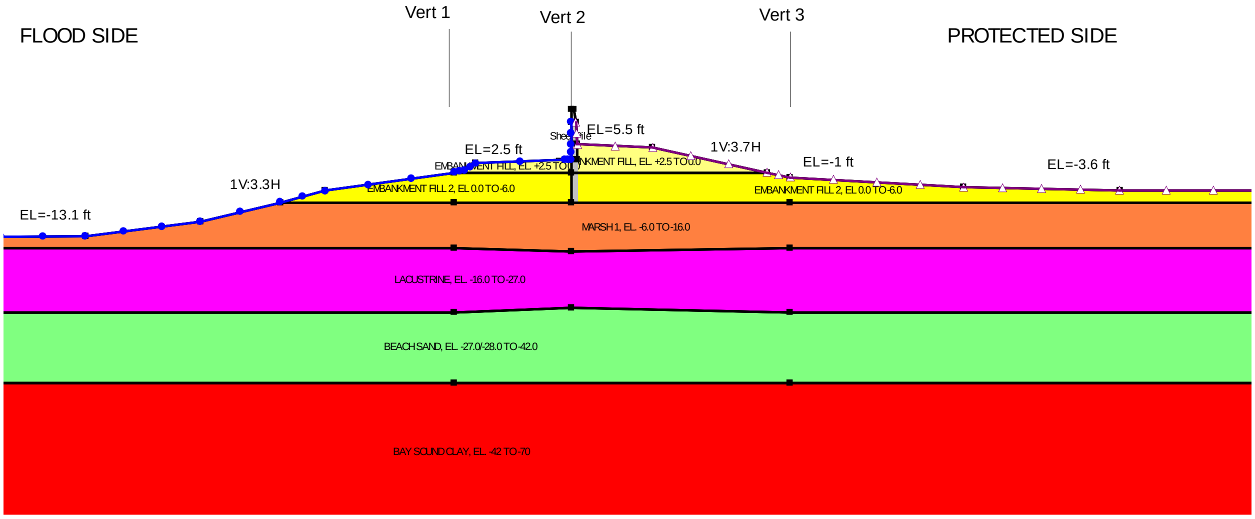

Figure D-1. Geo-Studio model for 17th Street Outfall Canal Reach 11

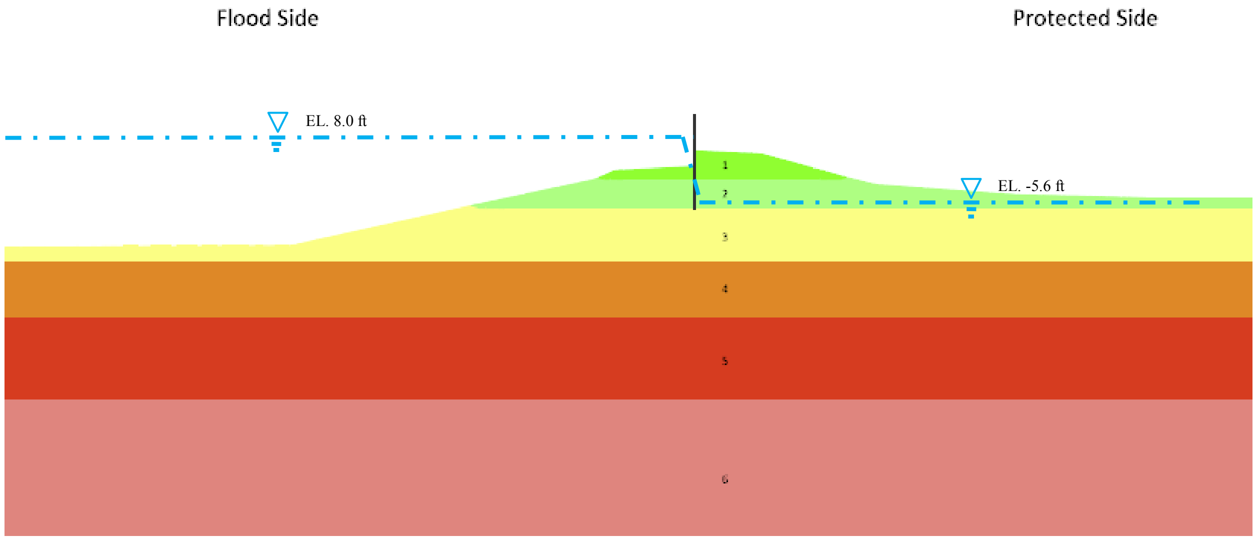

Figure D-2. FLAC Model for 17th Street Outfall Canal Reach 11

Foundation Parameters

The FLAC analyses are based on simple Mohr-Coulomb constitutive models (elastic-perfectly plastic soil behavior). Unit weight and shear strength parameters for the various soil layers were based on the information in the MOWL Report. The cross section used is the Seep/W file from the MOWL report. As-built drawings were examined for the properties of the I-Wall.

Soil modulus values were determined or selected assuming the soils are linearly elastic and isotropic with Poisson's ratio based on expected drainage conditions during loading. The parameters used for analysis are presented in Tables D-1 thru D-4. The soil modulus values were selected using the same G/Su ratios selected for the FLAC model calibrated to the London Load Test (LLT) results. The soil modulus values used in the LLT FLAC model were primarily based on pressuremeter testing and relationships for G/Su. At London Avenue Canal, the shear modulus values are determined by multiplying the G/Su ratio for a given soil by its undrained shear strength. Young's Modulus for the levee and sand were assigned the same value used in the LLT calibration. The at-rest earth pressure coefficients are computed only to initialize stresses during model development so equilibrium can be reached in fewer computational steps.

At 17th Street Outfall Canal, seepage conditions were modeled as steady state using the Seep/W model, and previously accepted material seepage properties and protected side boundary conditions, from the MOWL report. The flood side canal total head boundary was incrementally raised from a starting water level of EL +0.4 ft to EL +1.0 ft and then by 1 ft. The water table was assumed to be constant for the protected side two feet below the ground surface -5.6 ft and 8.0 ft for the flood side. The water table elevations are presented on figure D-2.

Table D-1. Summary of Centerline Soil Parameters

Material	Strata top elevation (NAVD88)	Strata bottom elevation (NAVD88)	unit wt. (pcf)	unit wt/g	Su (psf)*	ϕ' (deg)
1 – Embankment 1	5.5	0.0	118	3.665	800	0
2 – Embankment 2	0.0	-6.0	108	3.354	425	0
3 – Marsh	-6.0	-16.0	99	3.075	275	0
4 – Silty Sand	-16.0	-27.0	103	3.199	275	0
5 – Beach Sand	-27.0	-42.0	122	3.789	0	30
6 – Bay Sound Clay	-42.0	-70.0	104	3.230	700	0

Table D-2. Centerline Most Likely Value Modulus

Material	E/Su	E (psf)	Poisson	G (psf)	K (psf)	ko
1 – Embankment 1	197	1.58E+05	0.40	56250	262500	0.84
2 – Embankment 2	371	1.58E+05	0.40	56250	262500	0.86
3 – Marsh	200	5.50E+04	0.47	18707	305556	0.96
4 – Lacustrine	300	8.25E+04	0.47	28061	458333	0.96
5 – Beach Sand	–	7.32E+05	0.33	275188	732000	0.75
6 – Bay Sound Clay	600	4.20E+05	0.495	140468	14000000	0.99

Table D-3. Summary of Toe Soil Parameters

Material	Strata top elevation (NAVD88)	Strata bottom elevation (NAVD88)	unit wt. (pcf)	unit wt/g	Su (psf) *	ϕ' (deg)
1 – Embankment 1	5.5	0.0	106	3.292	400	0
2 – Embankment 2	0.0	-6.0	106	3.292	400	0
3 – Marsh	-6.0	-16.0	105	3.261	200	0
4 – Lacustrine	-16.0	-27.0	102	3.168	200	0
5 – Beach Sand	-27.0	-42.0	122	3.789	0	30
6 – Bay Sound Clay	-42.0	-70.0	102	3.168	700	0

Table D-4. Toe Most Likely Value Modulus

Material	E/Su	E (psf)	Poisson	G (psf)	K (psf)	ko
1 – Embankment 1	394	1.58E+05	0.40	56250	262500	0.86
2 – Embankment 2	394	1.58E+05	0.40	56250	262500	0.86
3 – Marsh	200	4.00E+04	0.47	13605	222222	0.95
4 – Lacustrine	300	6.00E+04	0.47	20408	333333	0.96
5 – Beach Sand	–	7.32E+05	0.33	275188	732000	0.75
6 – Bay Sound Clay	600	4.20E+05	0.495	140468	14000000	0.99

Structural Parameters

The current I-wall structure was modeled as two beam elements: (1) the upper concrete portion of the I-wall and (2) the supporting sheet pile beneath the concrete. Interface elements were applied to the wall below the ground surface. These elements allow slip and separation between the soil and wall. The shear strength of the interfaces was set at 90% of the shear strength of the strongest cohesive soil layer.

In FLAC the structural beam properties are formulated in plane stress (like a plate) and are adjusted for plane strain conditions by dividing Young's modulus by $1-\nu^2$ (ν =Poisson's ratio). The structural parameters are included in Table D-5.

Table D-5. Summary of Structural Parameters

Member	E (psi)	E* (psi)	E* (psf)	I (in4/ft)	E*I (lbft2/ft)	A (in2/ft)	E*A (lb/ft)	ν
Concrete	3.00E+06	3.13E+06	4.50E+08	1728	3.75E+07	144	4.50E+08	0.2
Frodingham 1B	2.90E+07	3.19E+07	4.59E+09	36.02	7.97E+06	7.87	2.51E+08	0.3

E = Young's Modulus
E* = Adj. Young's Modulus for Plain Strain
I = Moment of Inertia per foot of wall
A = Cross Sectional Area per foot of wall
ν = Poisson's Ratio

Loading Conditions and Gap Formation

Canal water loadings are modeled as mechanical pressures acting normal to the ground surface and normal to the wall face. When a gap is included between the soil and I-wall a horizontal mechanical pressure is added to both the soil and the wall to the depth of the gap.

Gap development is modeled following the step-by-step procedure outlined in the London Avenue Outfall Canal Reevaluation report as well as the IPET report. The total horizontal stress in the element adjacent to the wall is compared to the hydrostatic pressure that would exist if a gap were present. If the hydrostatic water pressure exceeds the total horizontal stress it is

assumed that a gap would form. Each zone is checked as canal water levels are raised from the normal pool elevation of 0.4 ft to the maximum operating level of 8 ft in 1 ft increments. Gaps were deepened in 1 ft increments as they developed.

At lower canal water levels, it is believed the higher soil level on the protected side of the wall serves to increase the horizontal stresses along the flood side of the sheet pile which slows the progression of the gap.

Results

The gap depth calculations prepared by Black and Veatch which follow IPET guidance was checked and compared with the FLAC results. The gap depth extends to the tip of the sheet pile for both methods. The FLAC and hand calculation analysis had the gap extending to approximate EL -6.0 ft. It should be noted that for even the shallower water depths, the hand calculation resulted in a gap to approximate EL -6.0 ft. The gap tip is 21.0 ft above the sand interface.

The maximum protected side ground displacement for the MLV at water level EL 8.0 ft was about 1.069 inches. The maximum developed crack depth was 9.0 ft. Graphs of the top of protected side ground and top of wall displacement and gap propagation versus canal water elevation can be found in Figures D-4 and D-5.

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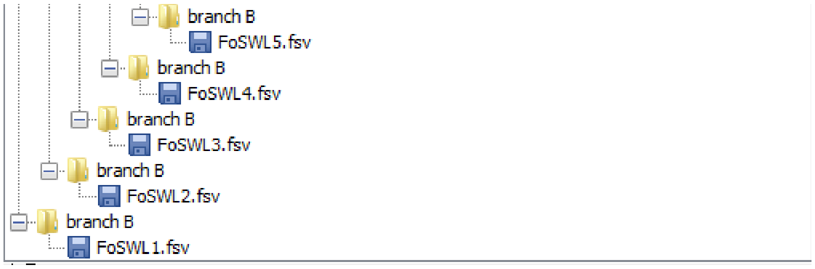

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Figure D-3. FLAC model progression of water loading and gap development for Reach 11

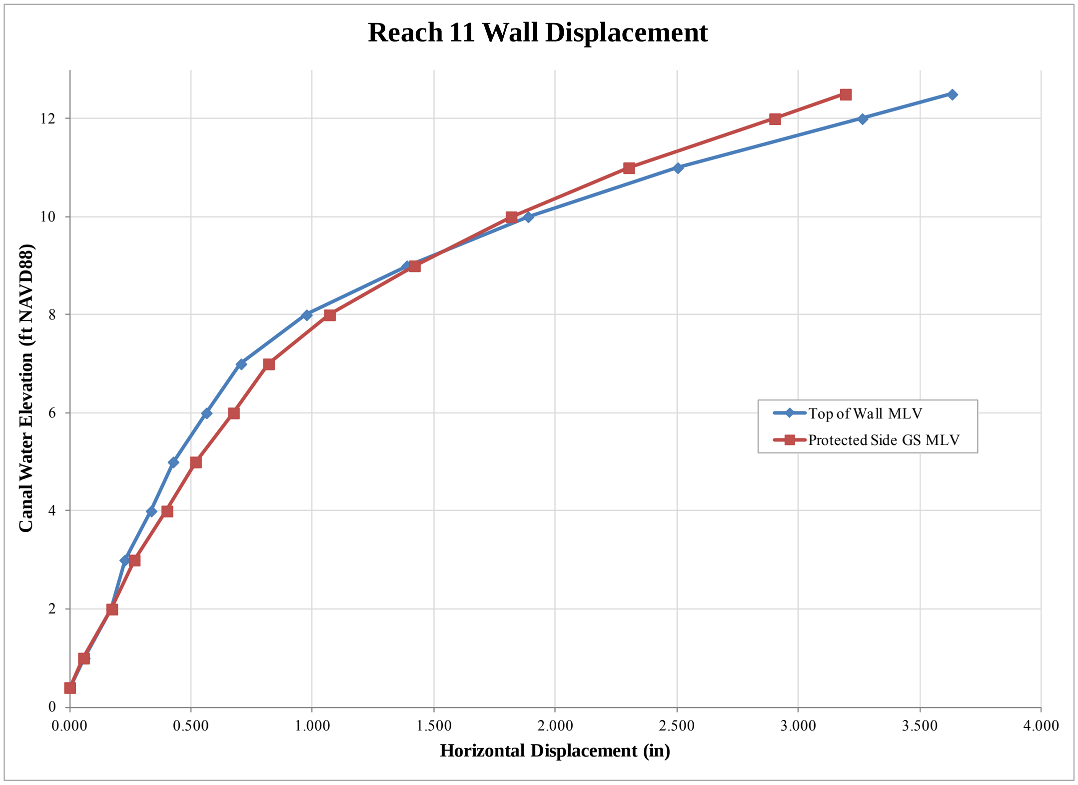

Figure D-4. FLAC computed I-wall displacement.

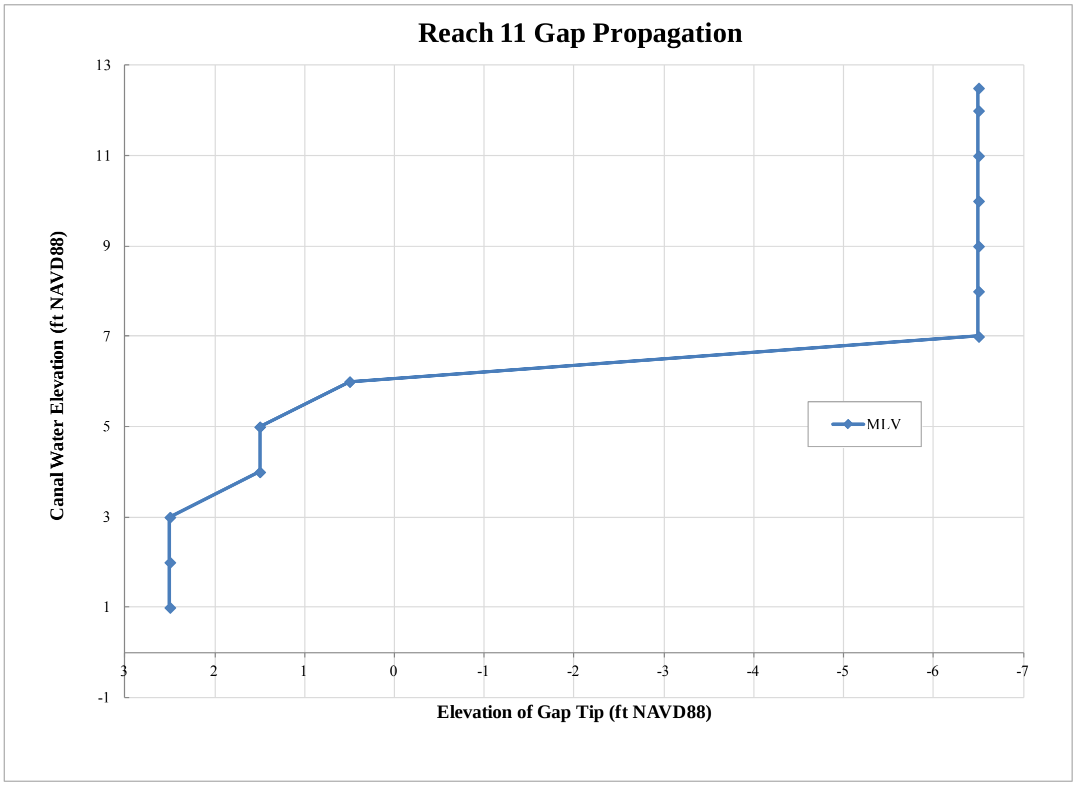

Figure D-5. FLAC computed gap propagation

The automated c-ϕ reduction technique in FLAC was used for all factor of safety (FoS) calculations. Figure D-6 presents the computed factors of safety for differing canal water levels and Figures D-7 through D-14 show the shear strain increment (ssi) and wall locations (original and displaced) for factor of safety at varying water levels. A summary of the FoS and controlling failure mode (global stability or wall rotation) are presented in Table D-6.

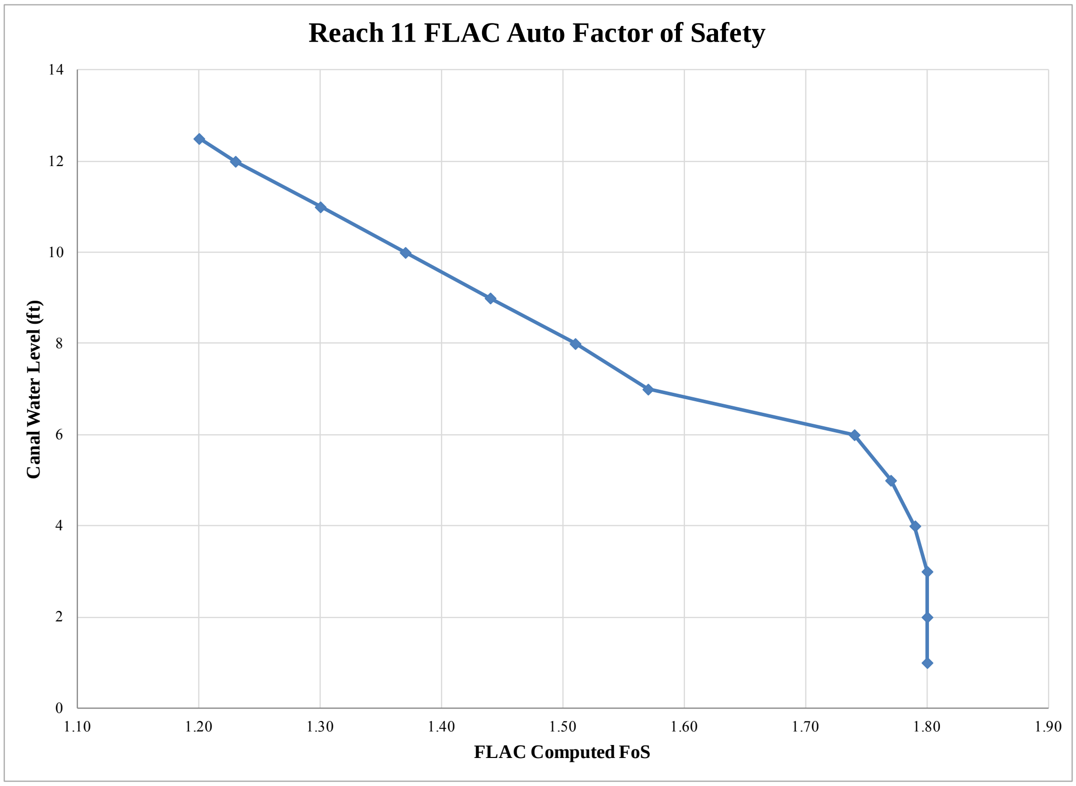

Figure D-6. FLAC computed factor of safety (automated c-ϕ reduction technique).

Table D-6. Summary of FLAC FoS and Controlling Failure Mode.

Canal WL (ft)	FLACAUTO FoS	Controlling Failure Mode
1	1.80	Global Stability
2	1.80	Global Stability
3	1.80	Global Stability
4	1.79	Global Stability
5	1.77	Global Stability
6	1.74	Global Stability
7	1.57	Global Stability
8	1.51	Global Stability
9	1.44	Global Stability
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11	1.30	Global Stability
12	1.23	Global Stability
12.5	1.20	Global Stability

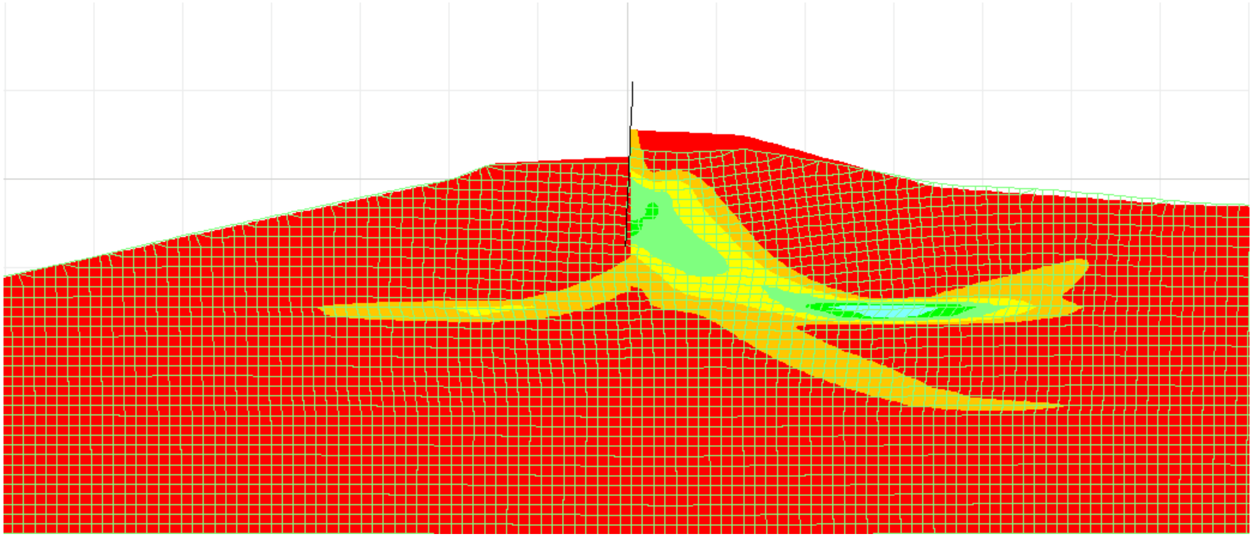

Figure D-7. WL+1 ft, FoS ssi and wall displacement magnified 5X.

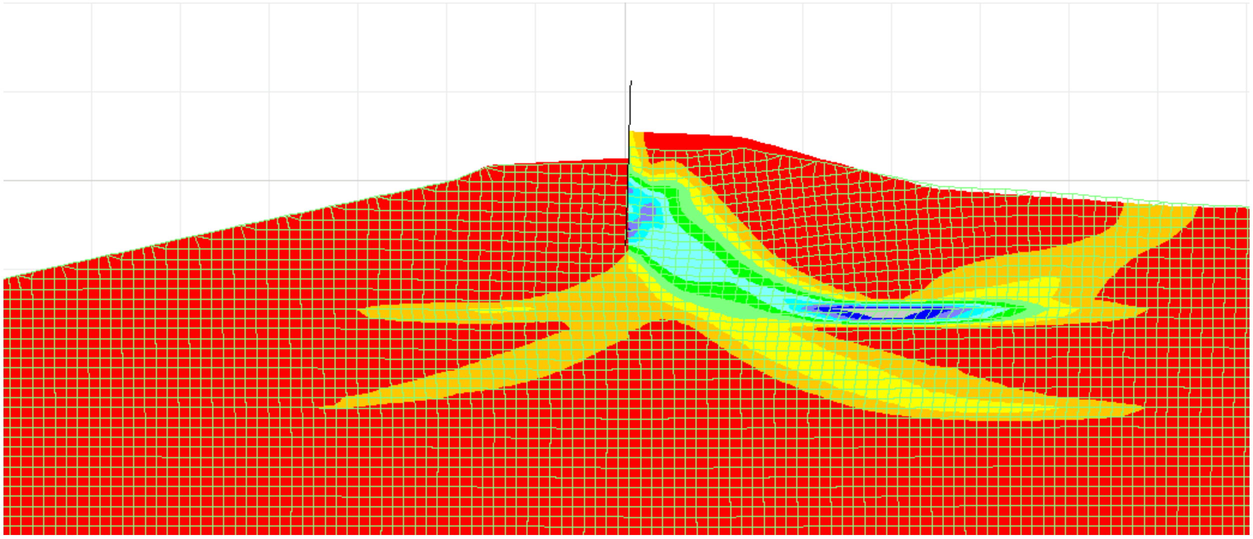

Figure D-8. WL+2 ft, FoS ssi and wall displacement magnified 5X.

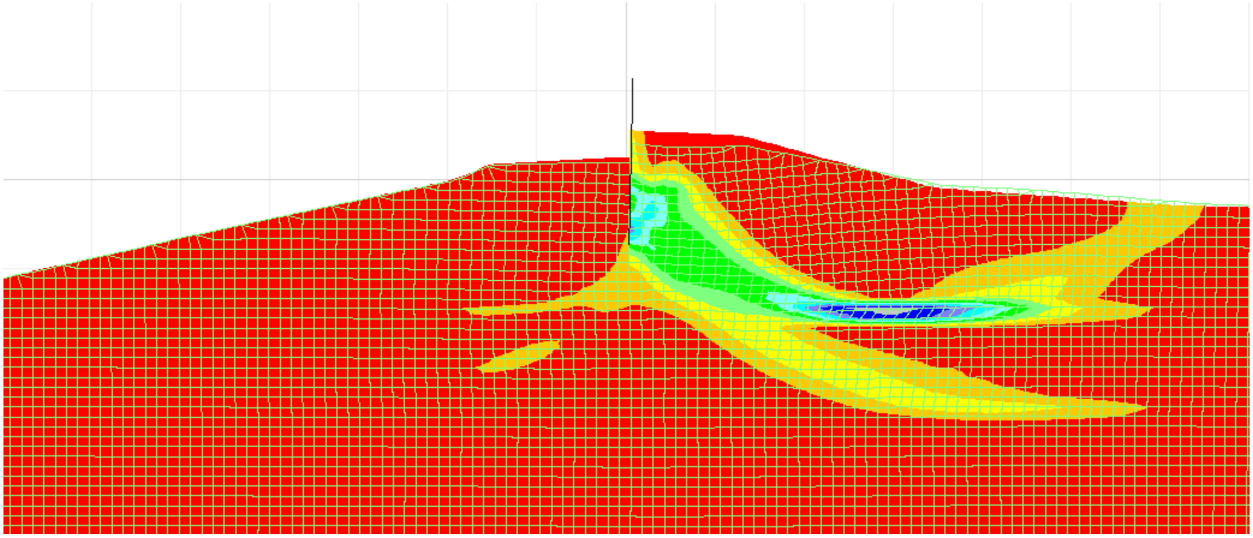

Figure D-9. WL+3 ft, FoS ssi and wall displacement magnified 5X.

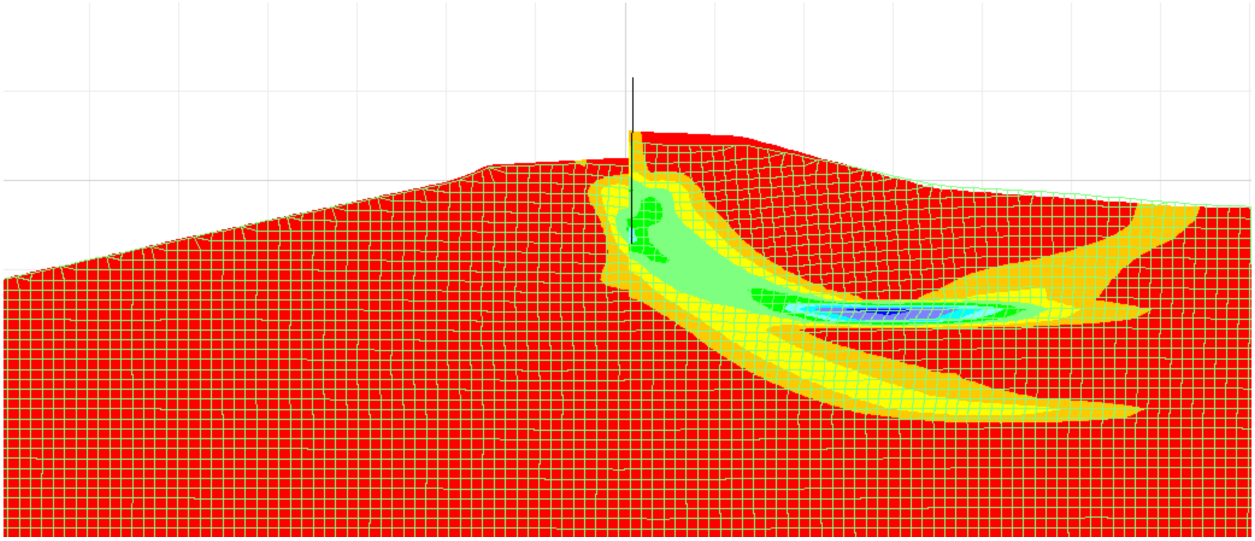

Figure D-10. WL+4 ft, FoS ssi and wall displacement magnified 5X.

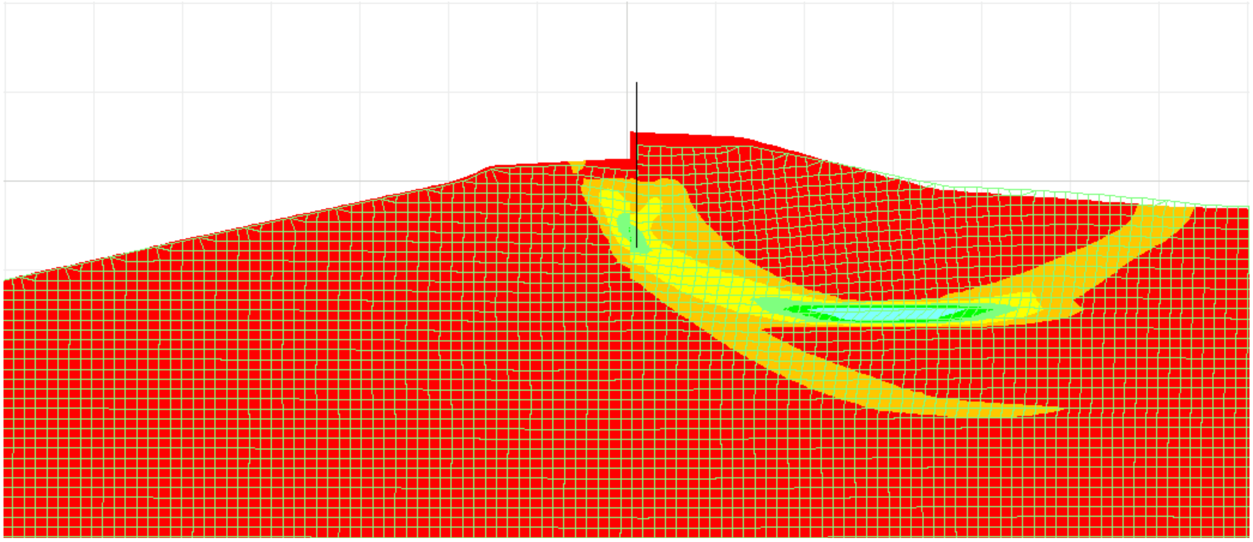

Figure D-11. WL+5 ft, FoS ssi and wall displacement magnified 5X.

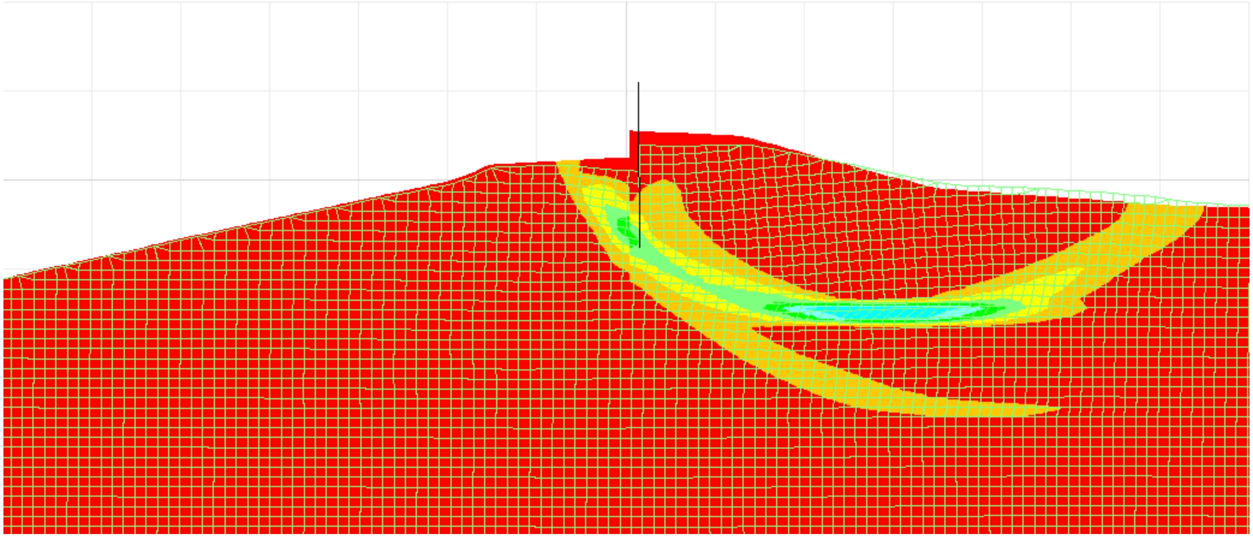

Figure D-12. WL+6 ft, FoS ssi and wall displacement magnified 5X.

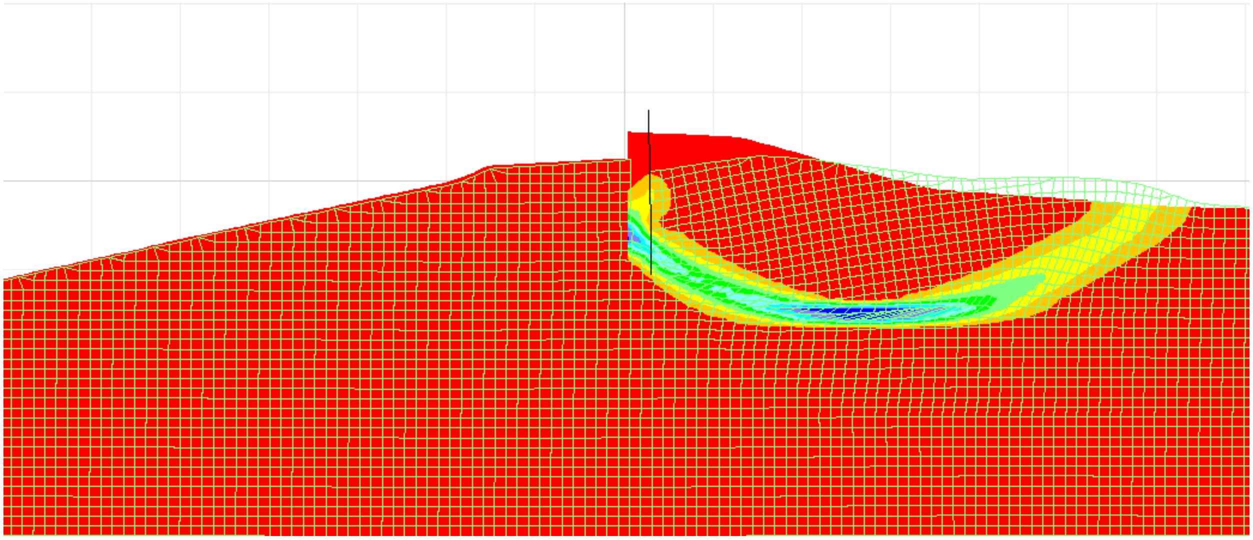

Figure D-13. WL+7 ft, FoS ssi and wall displacement magnified 5X.

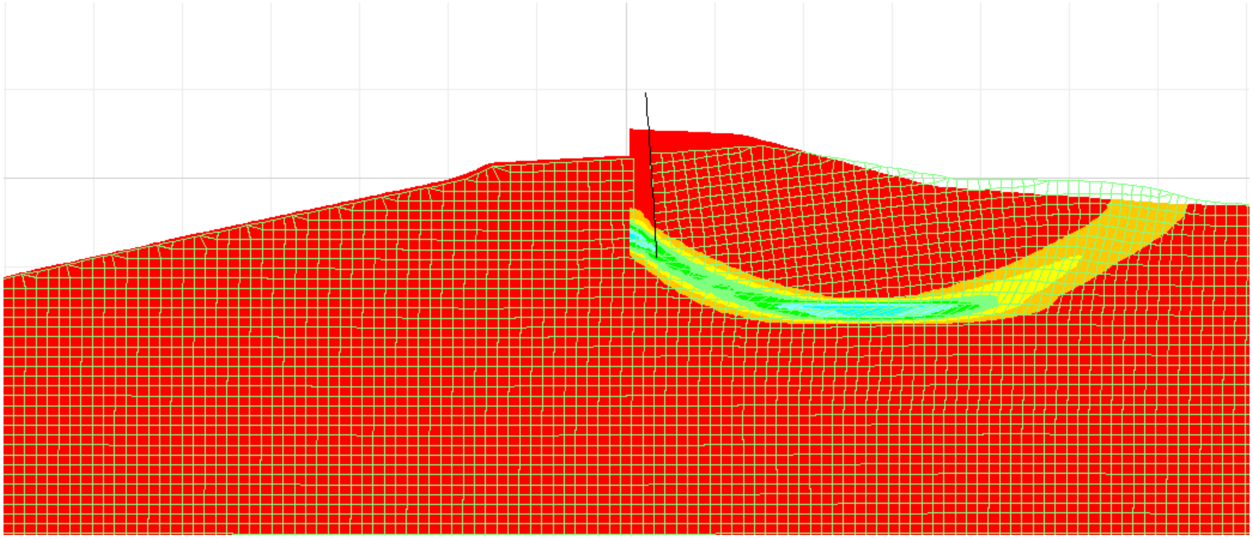

Figure D-14. WL+8 ft, FoS ssi and wall displacement magnified 5X.

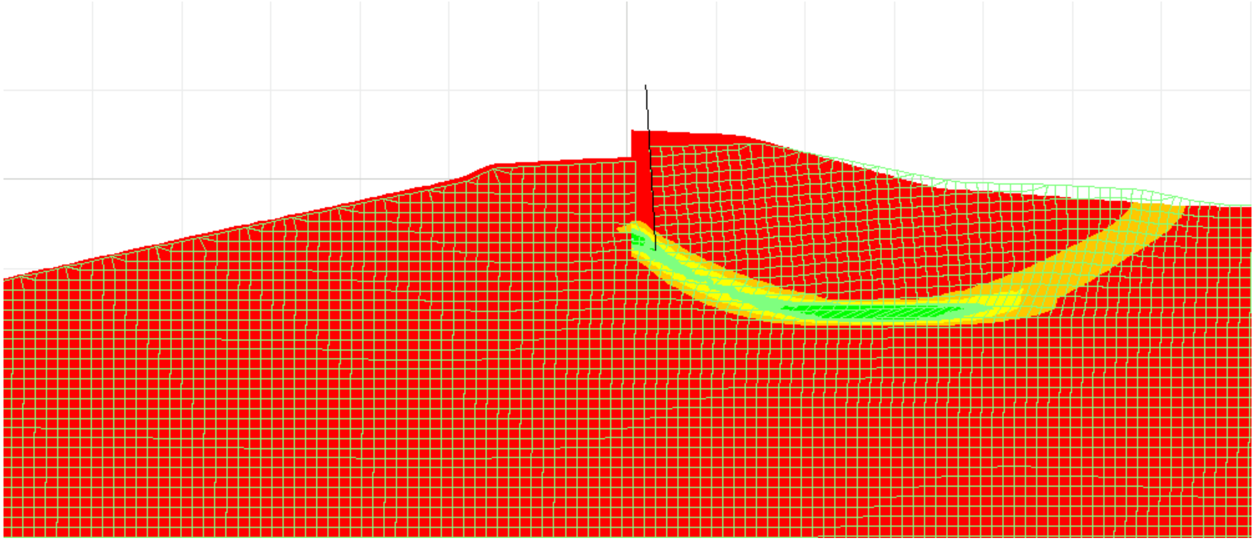

Figure D-15. WL+9 ft, FoS ssi and wall displacement magnified 5X.

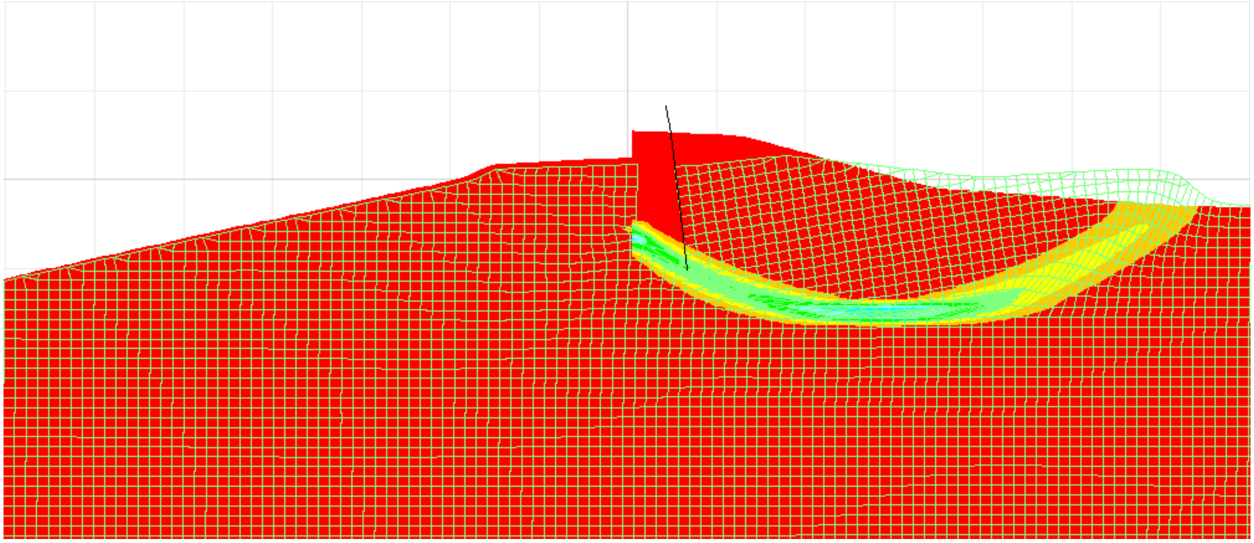

Figure D-16. WL+10 ft, FoS ssi and wall displacement magnified 5X.

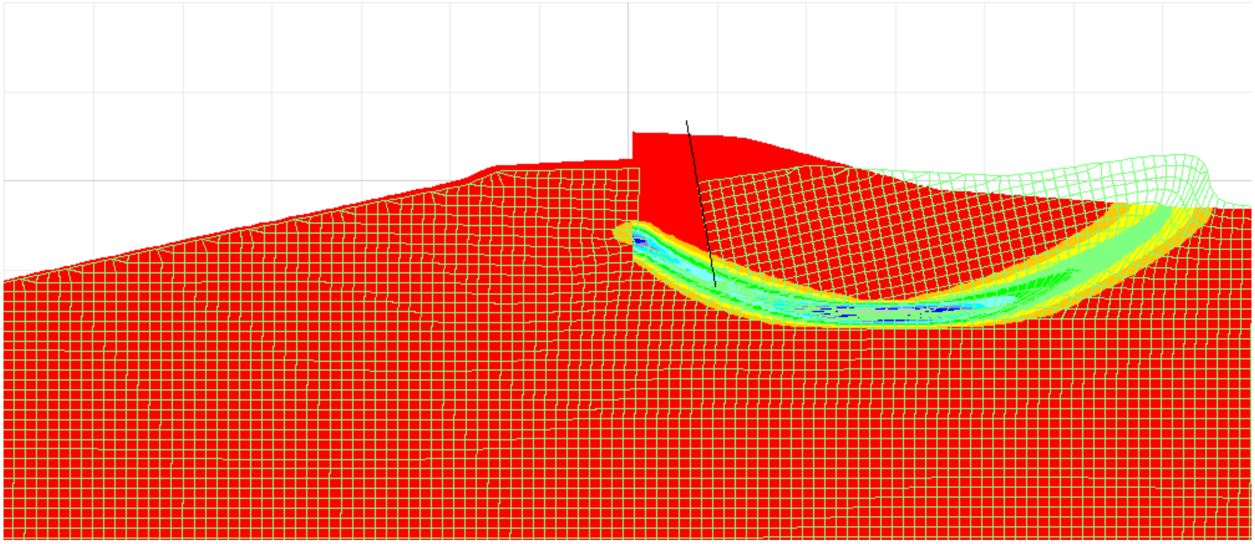

Figure D-17. WL+11 ft, FoS ssi and wall displacement magnified 5X.

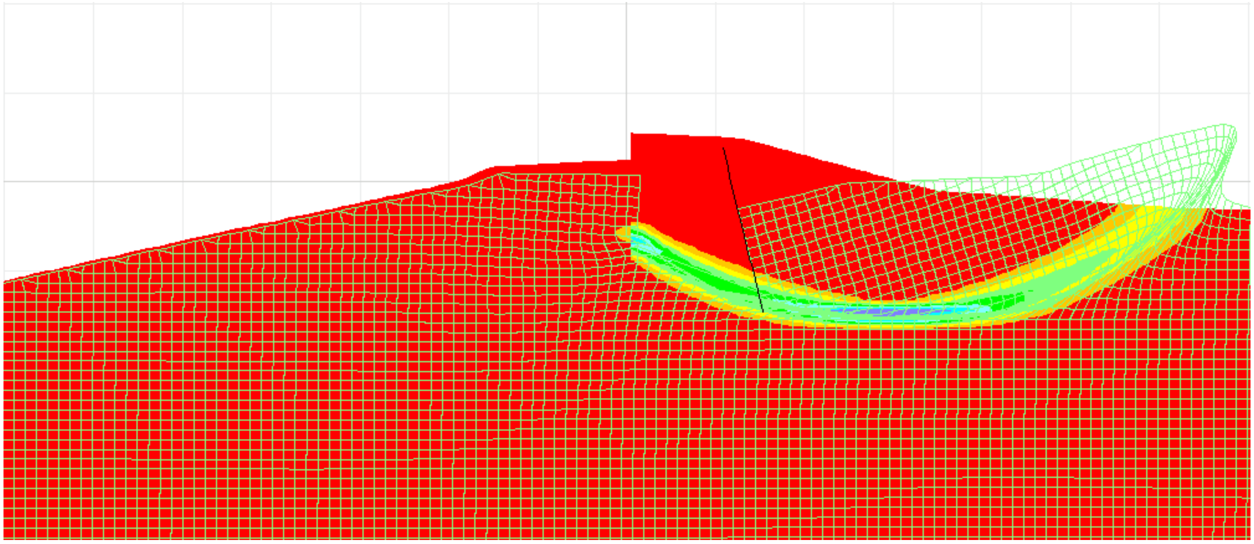

Figure D-18. WL+12 ft, FoS ssi and wall displacement magnified 5X.

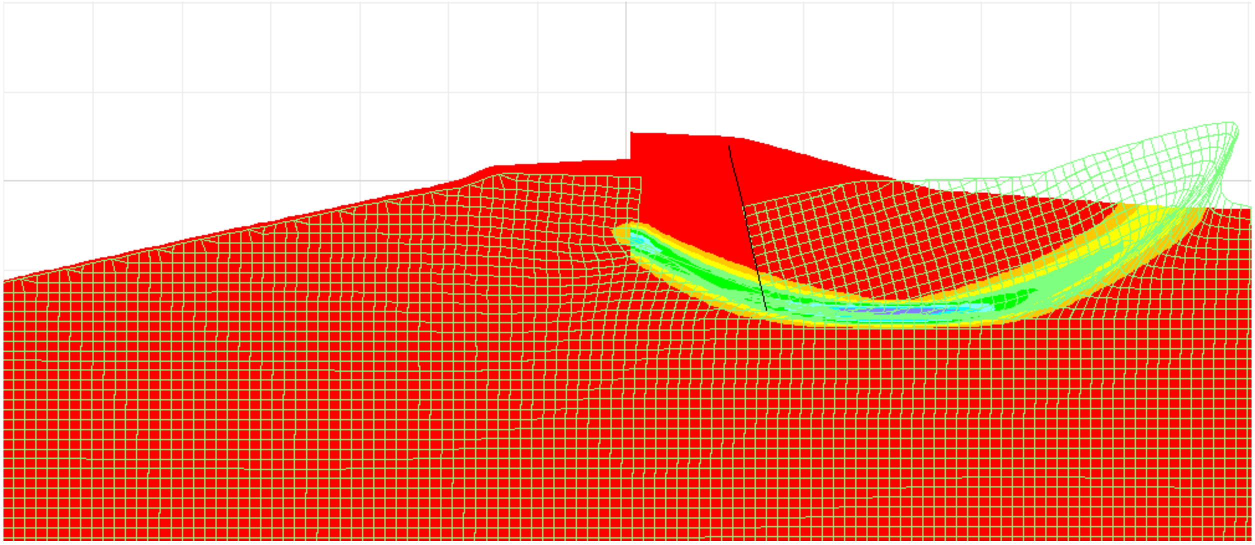

Figure D-19. WL+12.5 ft, FoS ssi and wall displacement magnified 5X.

Reach 14

Introduction

The design section includes: clay embankment (EL +6.0 ft), underlain by a shallow marsh deposit (EL -7.0 ft to EL -16.0 ft). The shallow marsh is underlain by a Silty Sand stratum (EL -16.0 to -19.0 ft) which mantles a lower Sand deposit located at EL -19.0 ft to -46.0 ft. Beneath the Sand stratum lies a Bay Sound Clay layer that extends to an EL of -70.0 ft. The upper clay embankment material was assigned a unit weight of 112 pcf with a cohesion of 860 psf. The shear strength values used for the clay embankment are higher than those in the underlying marsh deposit. The elevation of the flood side ground line at the wall face is approximately EL 4.2 ft resulting in 1.8 ft difference in soil elevation across the wall. The existing I-wall has a top elevation of 12.5 ft consisting of a concrete cap and Frodingham 1B sheet pile to tip elevation of -2.0 ft. Figures D-1 and D-2 show the Geo-Studio and FLAC model cross sections. The FLAC model created by the template is constrained to use horizontal soil layers so the top of the upper marsh strata was set at EL -7 ft, as it is shown on the flood side of the I-Wall in Figure D-2, without sloping to the levee toe to best capture the wall displacement behavior.

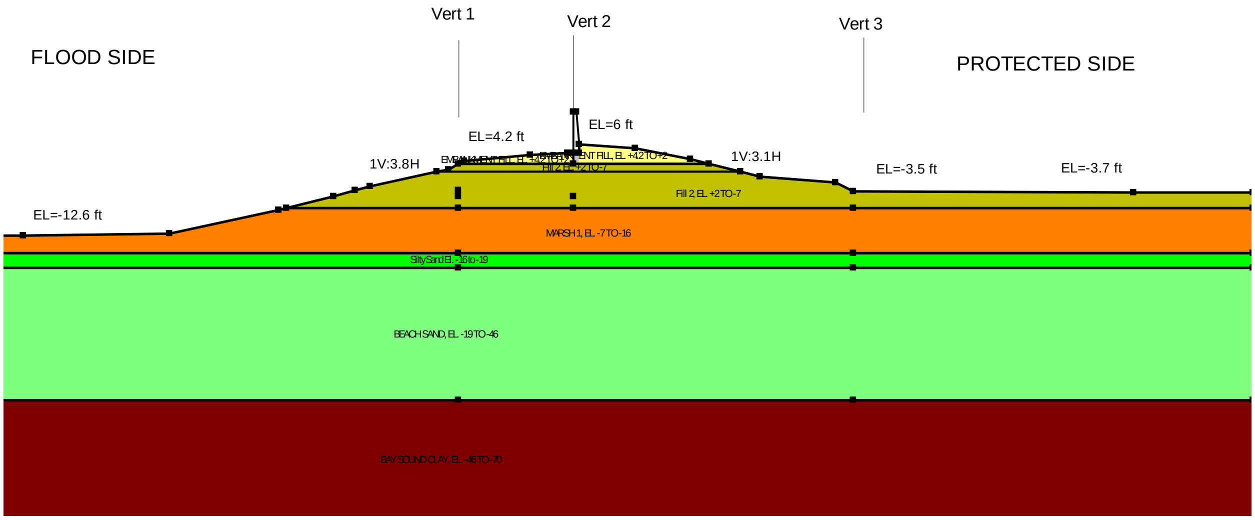

Figure D-1. Geo-Studio model for 17th Street Outfall Canal Reach 14

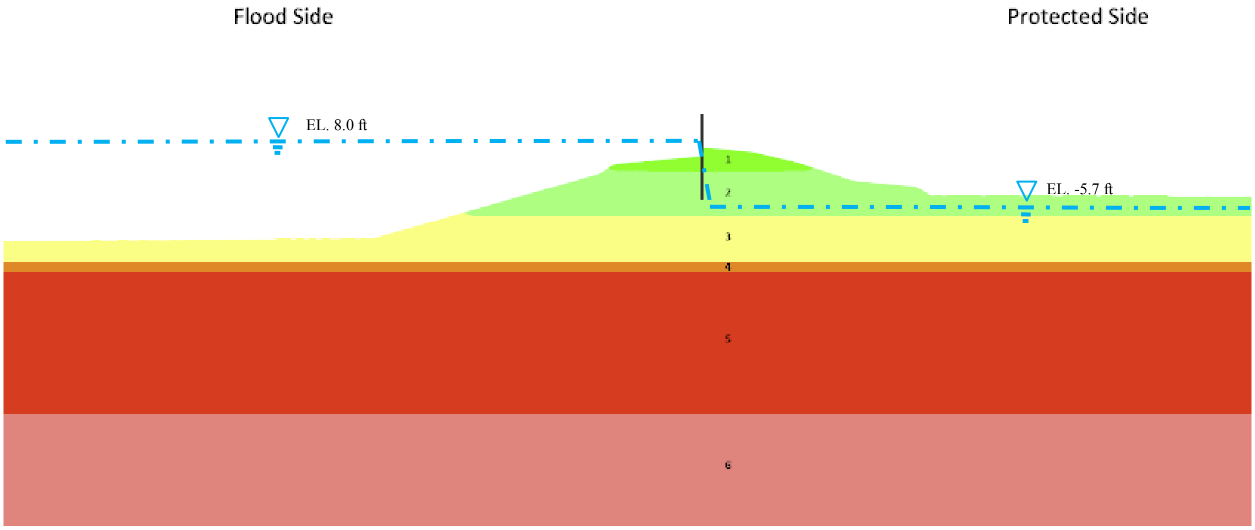

Figure D-2. FLAC Model for 17th Street Outfall Canal Reach 14

Foundation Parameters

The FLAC analyses are based on simple Mohr-Coulomb constitutive models (elastic-perfectly plastic soil behavior). Unit weight and shear strength parameters for the various soil layers were based on the information in the MOWL Report. The cross section used is the Seep/W file from the MOWL report. As-built drawings were examined for the properties of the I-Wall.

Soil modulus values were determined or selected assuming the soils are linearly elastic and isotropic with Poisson's ratio based on expected drainage conditions during loading. The parameters used for analysis are presented in Tables D-1 thru D-4. The soil modulus values were selected using the same G/Su ratios selected for the FLAC model calibrated to the London Load Test (LLT) results. The soil modulus values used in the LLT FLAC model were primarily based on pressuremeter testing and relationships for G/Su. At London Avenue Canal, the shear modulus values are determined by multiplying the G/Su ratio for a given soil by its undrained shear strength. Young's Modulus for the levee and sand were assigned the same value used in the LLT calibration. The at-rest earth pressure coefficients are computed only to initialize stresses during model development so equilibrium can be reached in fewer computational steps.

At 17th Street Outfall Canal, seepage conditions were modeled as steady state using the Seep/W model, and previously accepted material seepage properties and protected side boundary conditions, from the MOWL report. The flood side canal total head boundary was incrementally raised from a starting water level of EL +0.4 ft to EL +1.0 ft and then by 1 ft. The water table was assumed to be constant for the protected side two feet below the ground surface -5.7 ft and 8.0 ft for the flood side. The water table elevations are presented on figure D-2.

Table D-1. Summary of Centerline Soil Parameters

Material	Strata top elevation (NAVD88)	Strata bottom elevation (NAVD88)	unit wt. (pcf)	unit wt/g	Su (psf)*	ϕ' (deg)
1 – Embankment 1	6.0	2.0	112	3.48	860	0
2 – Embankment 2	2.0	-7.0	105	3.26	450	0
3 – Marsh	-7.0	-16.0	94	2.92	350	0
4 – Silty Sand	-16.0	-19.0	122	3.79	0	30
5 – Sand	-19.0	-46.0	122	3.79	0	30
6 – Bay Sound Clay	-46.0	-70.0	102	3.17	710	0

Table D-2. Centerline Most Likely Value Modulus

Material	E/Su	E (psf)	Poisson	G (psf)	K (psf)	ko
1 – Embankment 1	183	1.58E+05	0.40	5.63E+04	2.63E+05	0.85
2 – Embankment 2	350	1.58E+05	0.40	5.63E+04	2.63E+05	0.86
3 – Marsh	200	7.00E+04	0.47	2.38E+04	3.89E+05	0.96
4 – Silty Sand	–	4.85E+05	0.33	2.50E+05	6.52E+05	0.75
5 – Sand	–	7.32E+05	0.33	2.75E+05	7.32E+05	0.75
6 – Bay Sound Clay	600	4.26E+05	0.495	1.42E+05	1.42E+07	0.99

Table D-3. Summary of Toe Soil Parameters

Material	Strata top elevation (NAVD88)	Strata bottom elevation (NAVD88)	unit wt. (pcf)	unit wt/g	Su (psf) *	ϕ' (deg)
1 – Embankment 1	6.0	2.0	112	3.48	860	0
2 – Embankment 2	2.0	-7.0	105	3.26	500	0
3 – Marsh	-7.0	-16.0	94	2.92	150	0
4 – Silty Sand	-16.0	-19.0	122	3.79	0	30
5 – Sand	-19.0	-46.0	122	3.79	0	30
6 – Bay Sound Clay	-46.0	-70.0	102	3.17	490	0

Table D-4. Toe Most Likely Value Modulus

Material	E/Su	E (psf)	Poisson	G (psf)	K (psf)	ko
1 – Embankment 1	183	1.58E+05	0.40	5.63E+04	2.63E+05	0.85
2 – Embankment 2	315	1.58E+05	0.40	5.63E+04	2.63E+05	0.86
3 – Marsh	200	3.00E+04	0.47	1.02E+04	1.67E+05	0.96
4 – Silty Sand	–	4.85E+05	0.33	2.50E+05	6.52E+05	0.75
5 –Sand	–	7.32E+05	0.33	2.75E+05	7.32E+05	0.75
6 – Bay Sound Clay	600	2.94E+05	0.495	9.83E+04	9.80E+06	0.99

Structural Parameters

The current I-wall structure was modeled as two beam elements: (1) the upper concrete portion of the I-wall and (2) the supporting sheet pile beneath the concrete. Interface elements were applied to the wall below the ground surface. These elements allow slip and separation between the soil and wall. The shear strength of the interfaces was set at 90% of the shear strength of the strongest cohesive soil layer.

In FLAC the structural beam properties are formulated in plane stress (like a plate) and are adjusted for plane strain conditions by dividing Young's modulus by $1-\nu^2$ (ν =Poisson's ratio). The structural parameters are included in Table D-5.

Table D-5. Summary of Structural Parameters

Member	E (psi)	E* (psi)	E* (psf)	I (in4/ft)	E*I (lbft2/ft)	A (in2/ft)	E*A (lb/ft)	ν
Concrete	3.00E+06	3.13E+06	4.50E+08	1728	3.75E+07	144	4.50E+08	0.2
Frodingham 1 B	2.90E+07	3.19E+07	4.59E+09	36.02	7.97E+06	7.87	2.51E+08	0.3

E = Young's Modulus
E* = Adj. Young's Modulus for Plain Strain
I = Moment of Inertia per foot of wall
A = Cross Sectional Area per foot of wall
ν = Poisson's Ratio

Loading Conditions and Gap Formation

Canal water loadings are modeled as mechanical pressures acting normal to the ground surface and normal to the wall face. When a gap is included between the soil and I-wall a horizontal mechanical pressure is added to both the soil and the wall to the depth of the gap.

Gap development is modeled following the step-by-step procedure outlined in the London Avenue Outfall Canal Reevaluation report as well as the IPET report. The total horizontal stress in the element adjacent to the wall is compared to the hydrostatic pressure that would exist if a gap were present. If the hydrostatic water pressure exceeds the total horizontal stress it is assumed that a gap would form. Each zone is checked as canal water levels are raised from the normal pool elevation of 0.4 ft to the maximum operating level of 8 ft in 1 ft increments. Gaps were deepened in 1 ft increments as they developed.

At lower canal water levels, it is believed the higher soil level on the protected side of the wall serves to increase the horizontal stresses along the flood side of the sheet pile which slows the progression of the gap.

Results

The gap depth calculations prepared by Black and Veatch which follow IPET guidance was checked and compared with the FLAC results. The gap depth extends to the tip of the sheet pile for both methods. The FLAC and hand calculation analysis had the gap extending to approximate EL -4.5 ft. It should be noted that for even the shallower water depths, the hand calculation resulted in a gap to approximate EL -4.5 ft. The gap tip is 11.5 ft above the sand interface.

The maximum protected side ground displacement for the MLV at water level EL 8.0 ft was about 0.645 inches. The maximum developed crack depth was 8.0 ft. Graphs of the top of protected side ground and top of wall displacement and gap propagation versus canal water elevation can be found in Figures D-4 and D-5.

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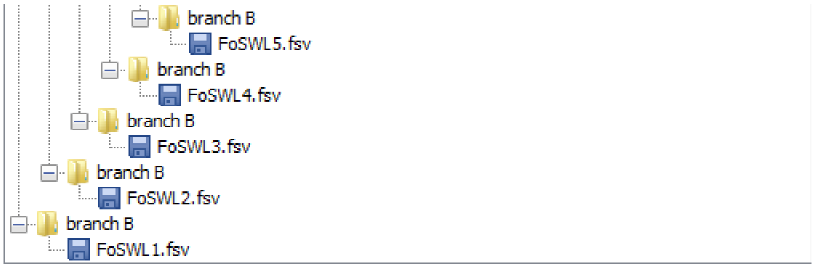

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Figure D-3. FLAC model progression of water loading and gap development for Reach 14

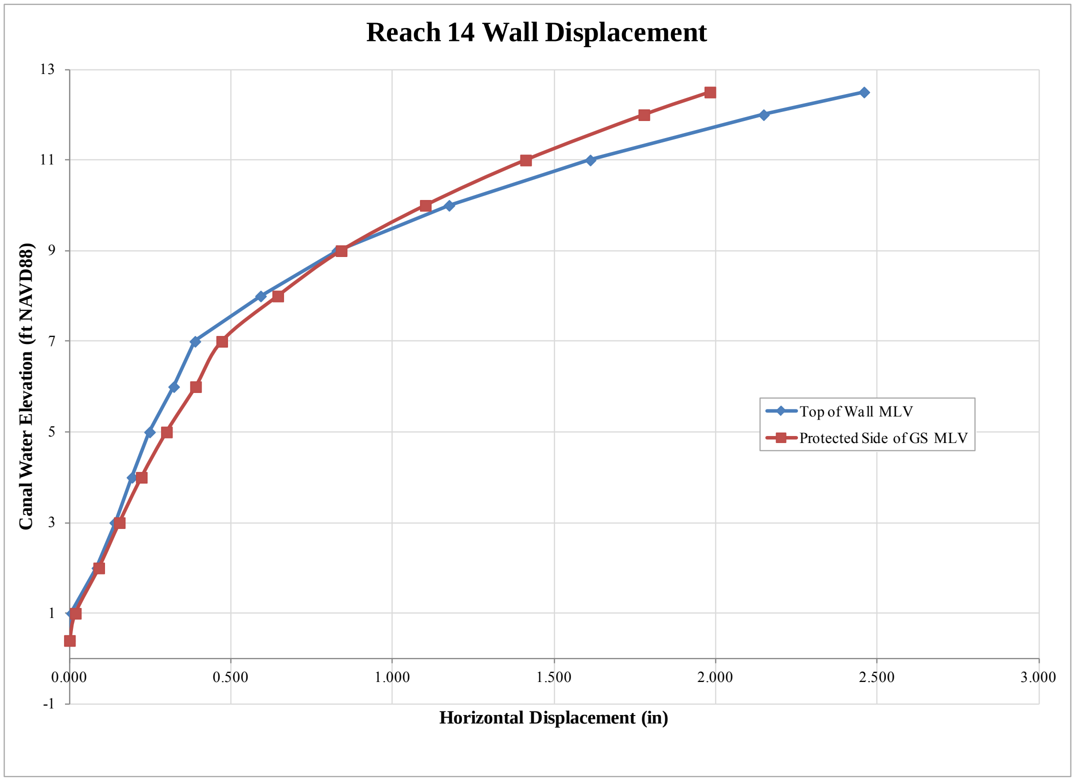


Figure D-4. FLAC computed I-wall displacement.

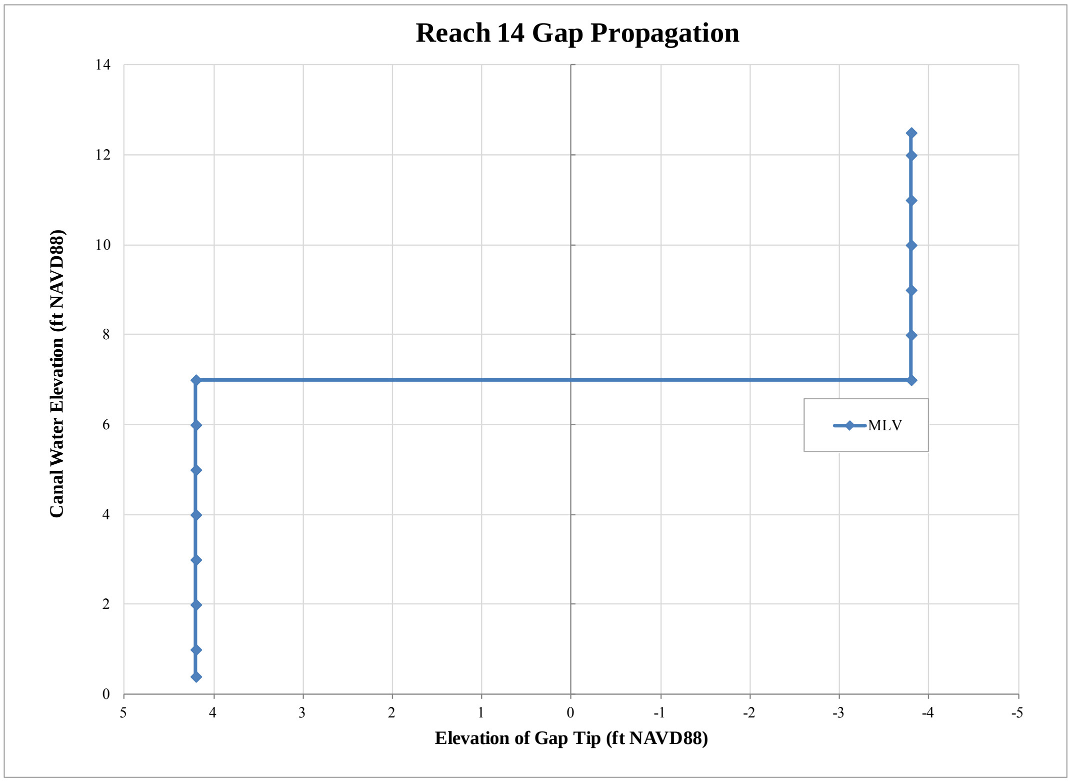


Figure D-5. FLAC computed gap propagation

The automated c-ϕ reduction technique in FLAC was used for all factor of safety (FoS) calculations. Figure D-6 presents the computed factors of safety for differing canal water levels and Figures D-7 through D-14 show the shear strain increment (ssi) and wall locations (original and displaced) for factor of safety at varying water levels. A summary of the FoS and controlling failure mode (global stability or wall rotation) are presented in Table D-6.

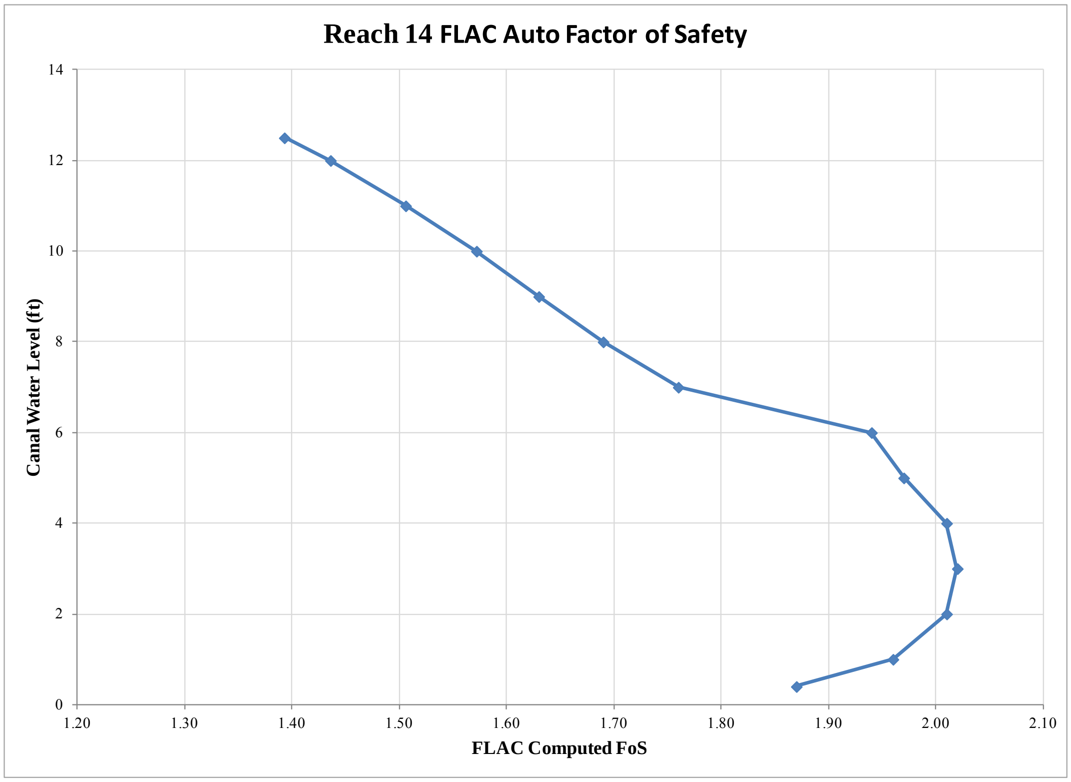


Figure D-6. FLAC computed factor of safety (automated c-ϕ reduction technique).

Table D-6. Summary of FLAC FoS and Controlling Failure Mode.

Canal WL (ft)	FLACAUTO FoS	Controlling Failure Mode
1	1.96	Global Stability
2	2.01	Global Stability
3	2.02	Global Stability
4	2.01	Global Stability
5	1.97	Global Stability
6	1.94	Global Stability
7	1.76	Global Stability
8	1.69	Global Stability
8.9	1.64	Global Stability
9	1.63	Global Stability
10	1.57	Global Stability
11	1.51	Global Stability
12	1.44	Global Stability
12.5	1.39	Global Stability

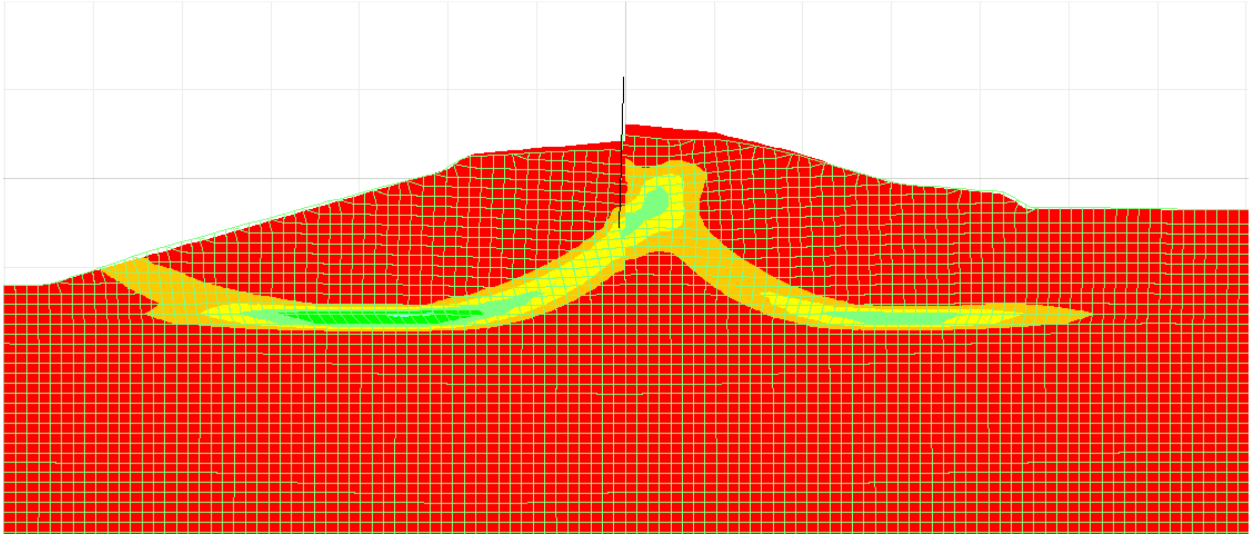


Figure D-7. WL+1 ft, FoS ssi and wall displacement magnified 5X.

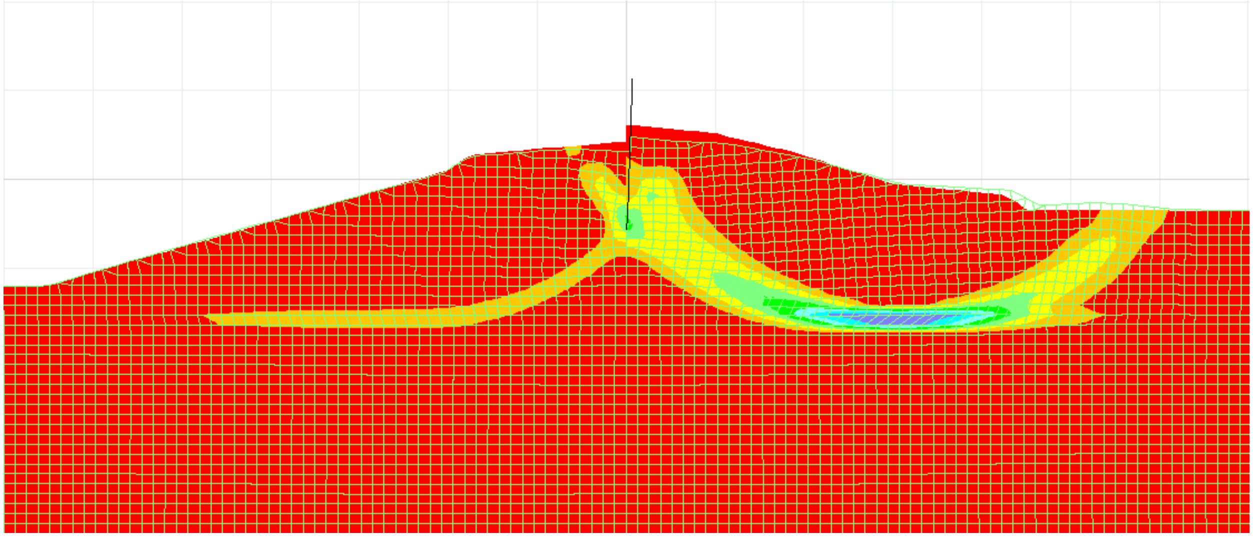


Figure D-8. WL+2 ft, FoS ssi and wall displacement magnified 5X.

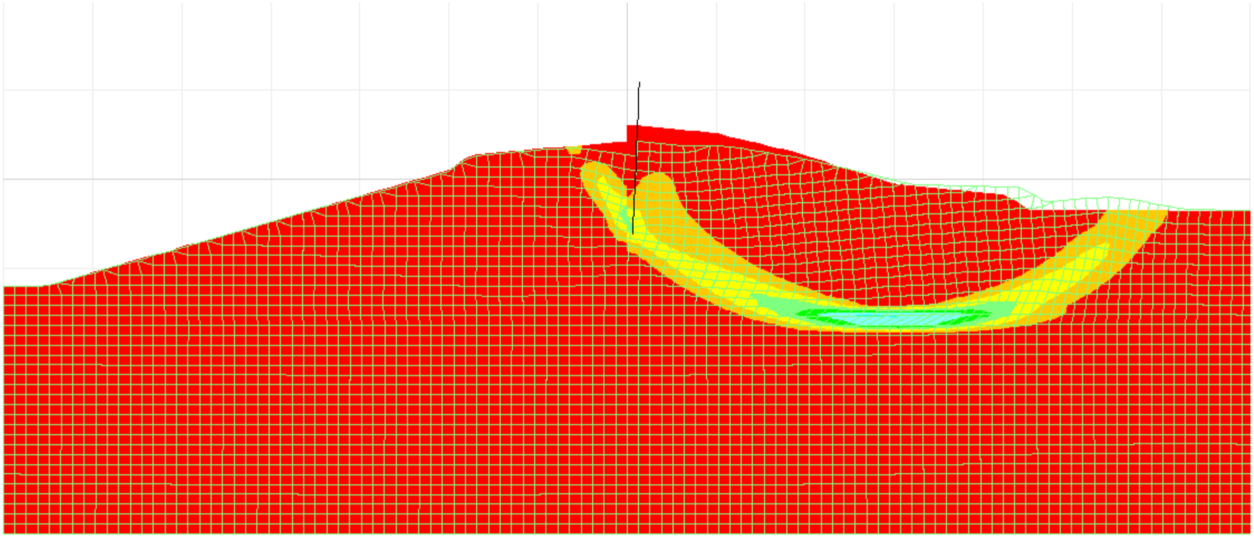


Figure D-9. WL+3 ft, FoS ssi and wall displacement magnified 5X.

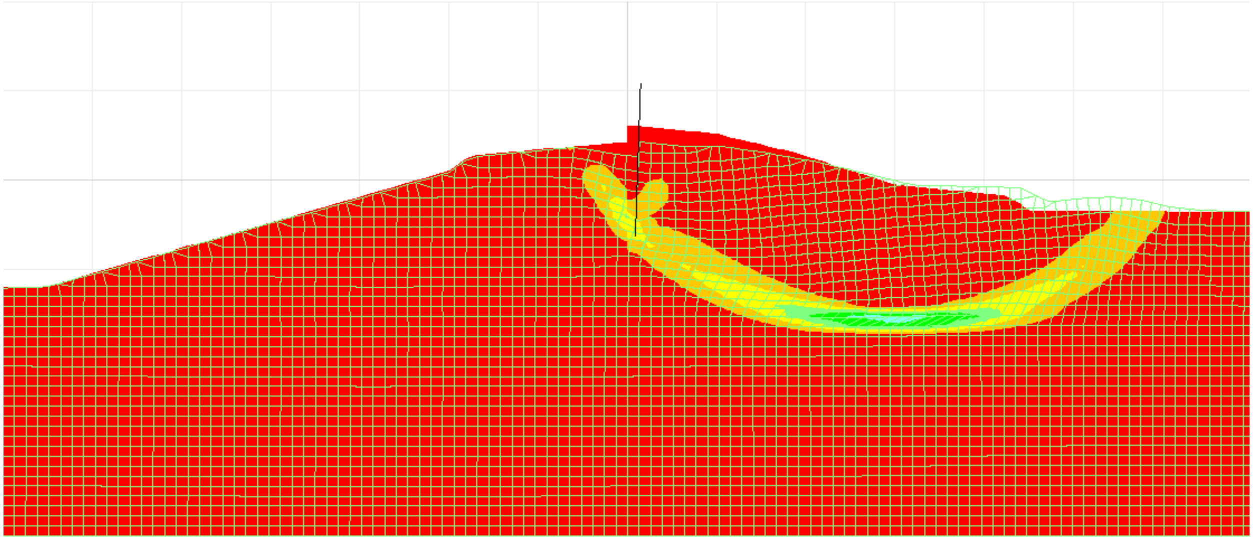


Figure D-10. WL+4 ft, FoS ssi and wall displacement magnified 5X.

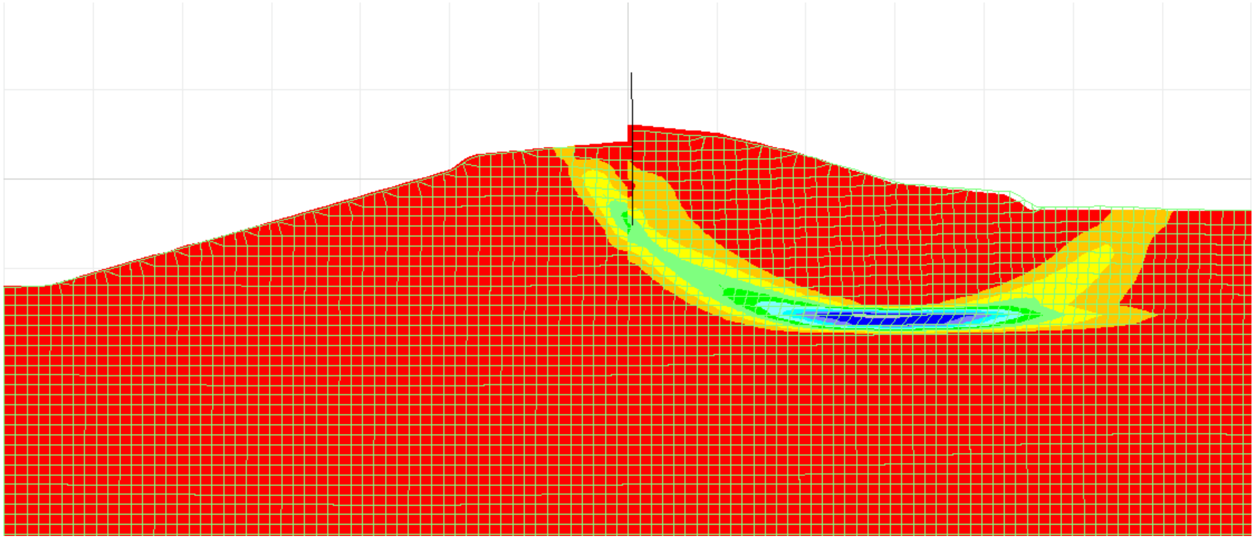


Figure D-11. WL+5 ft, FoS ssi and wall displacement magnified 5X.

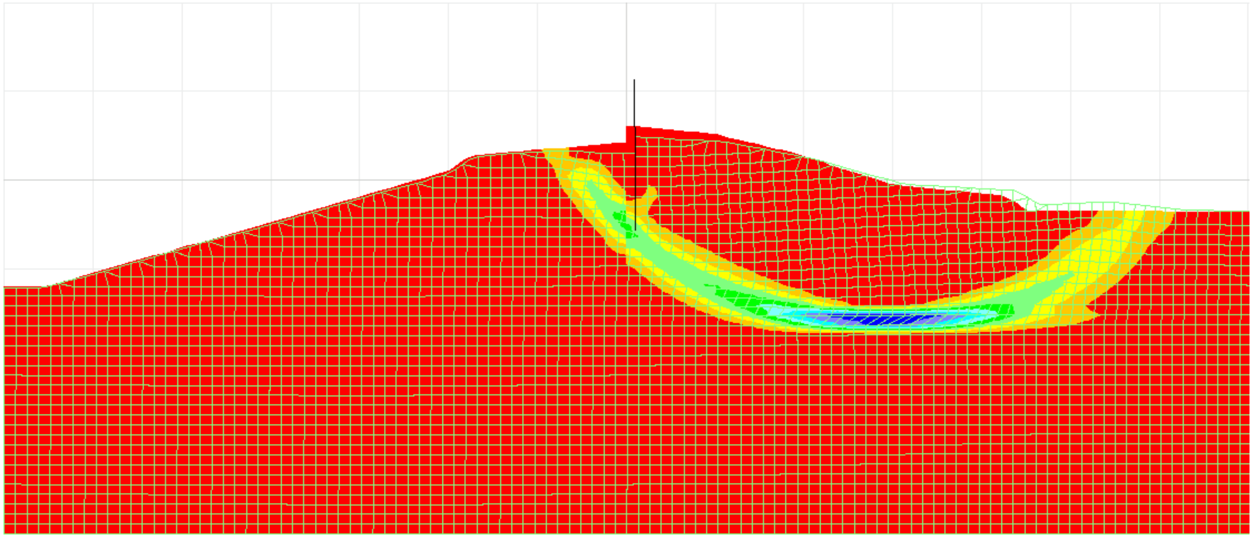


Figure D-12. WL+6 ft, FoS ssi and wall displacement magnified 5X.

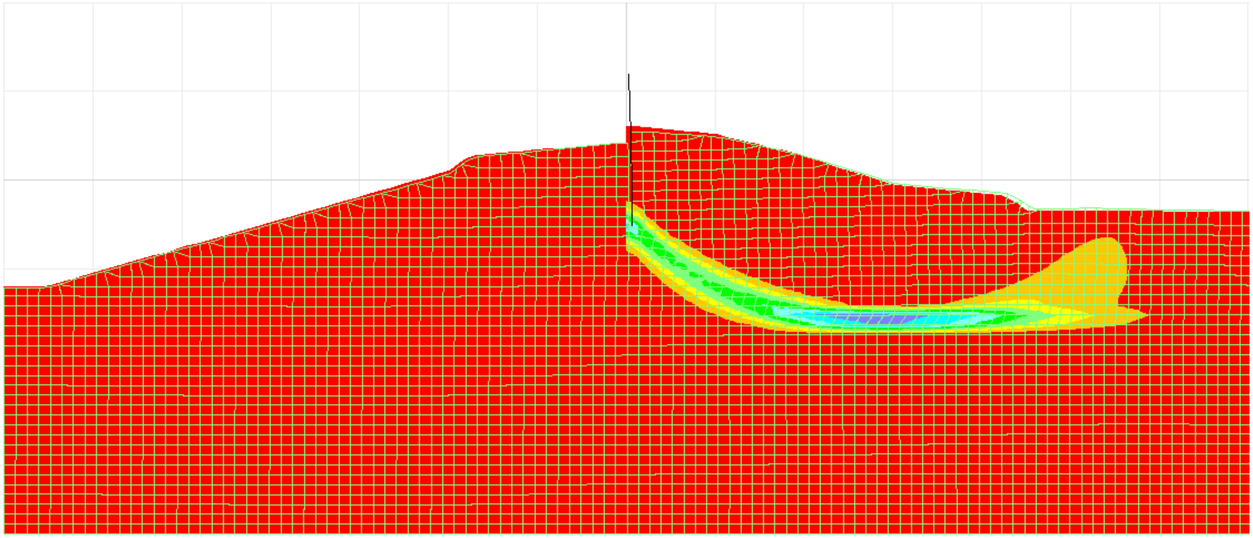


Figure D-13. WL+7 ft, FoS ssi and wall displacement magnified 5X.

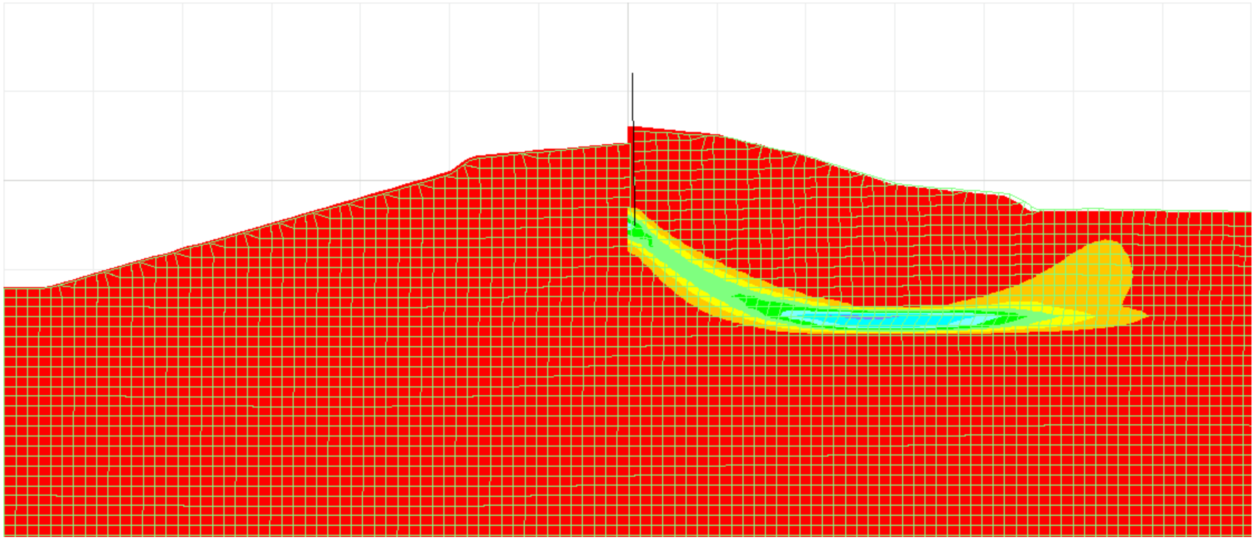


Figure D-14. WL+8 ft, FoS ssi and wall displacement magnified 5X.

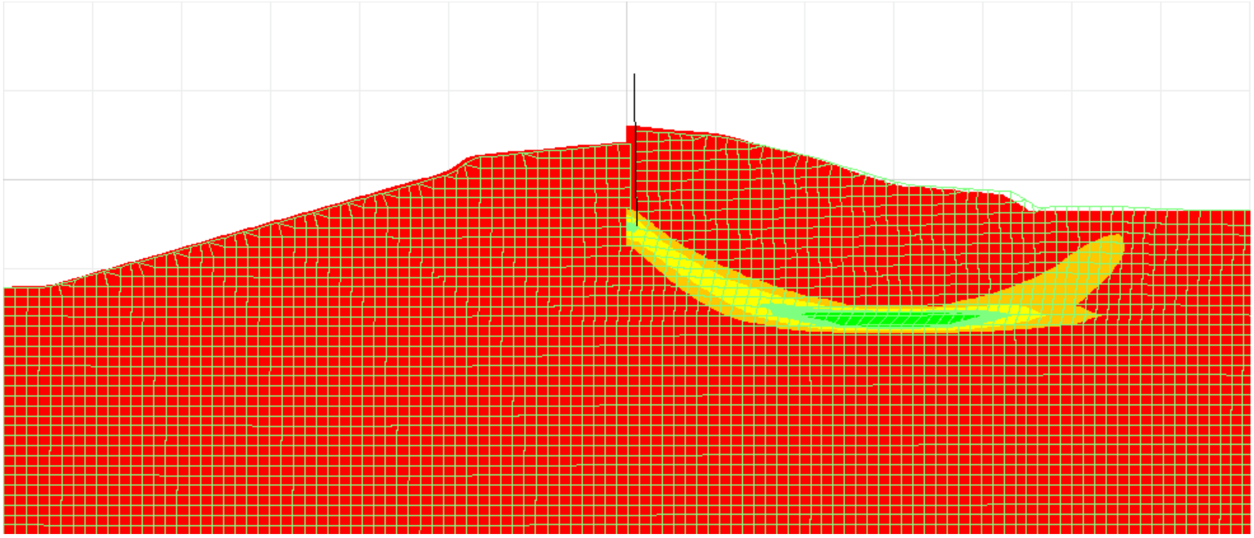


Figure D-15. WL+9 ft, FoS ssi and wall displacement magnified 5X.

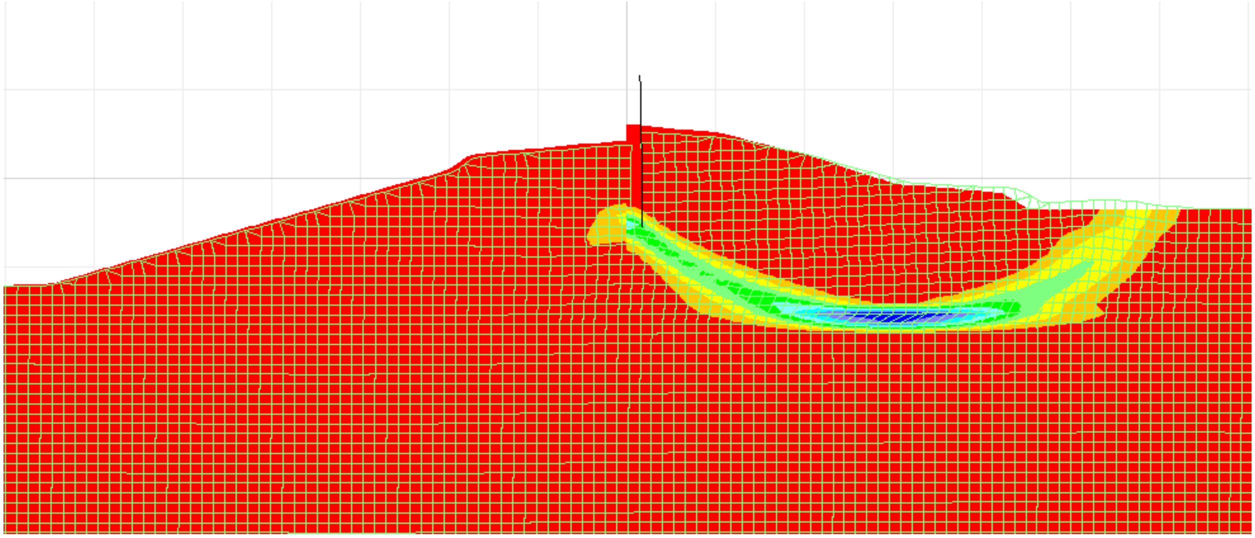


Figure D-16. WL+10 ft, FoS ssi and wall displacement magnified 5X.

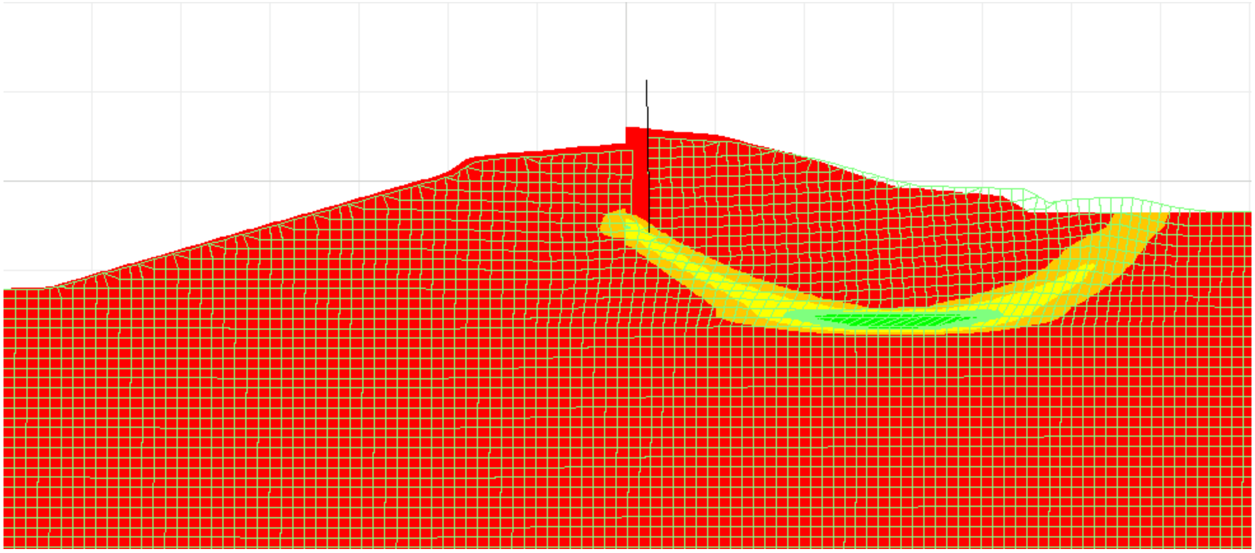


Figure D-17. WL+11 ft, FoS ssi and wall displacement magnified 5X.

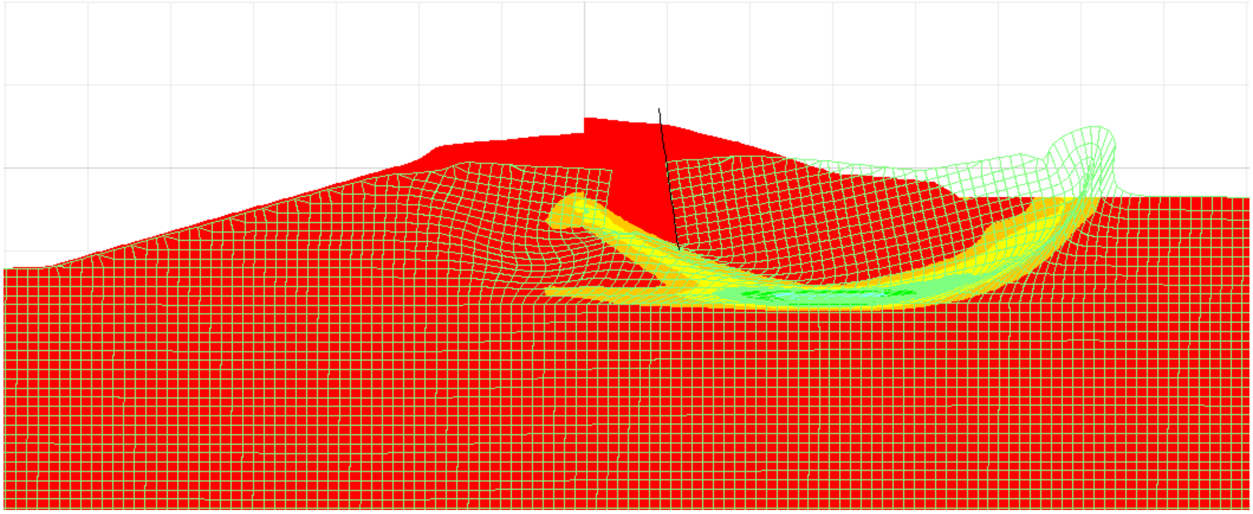


Figure D-18. WL+12 ft, FoS ssi and wall displacement magnified 5X.

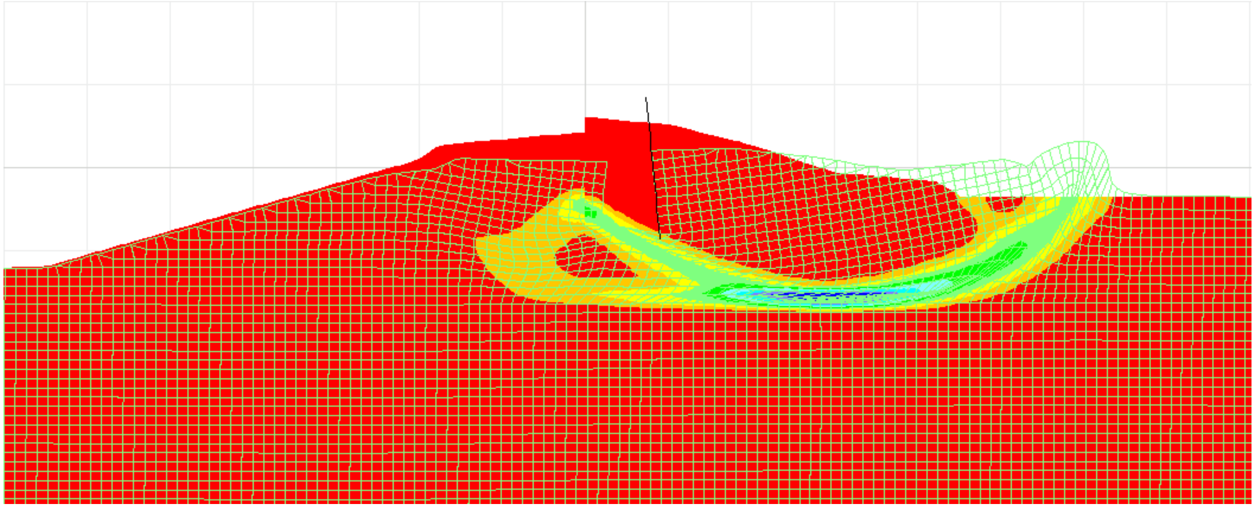


Figure D-19. WL+12.5 ft, FoS ssi and wall displacement magnified 5X.

Reach 15A

Introduction

The design section includes: clay embankment (EL +6.5 ft), underlain by a shallow Marsh deposit (EL -5.0 ft to EL -13.0 ft). The shallow Marsh is underlain by a Beach Sand stratum (EL -13.0 to -46.0 ft) which mantles a lower Bay Sound Clay deposit which extends to an EL of -70.0 ft. The upper clay embankment material was assigned a unit weight of 114 pcf with a cohesion of 800 psf. The shear strength values used for the clay embankment are higher than those in the underlying marsh deposit. The elevation of the flood side ground line at the wall face is approximately EL 3.6 ft resulting in 2.9 ft difference in soil elevation across the wall. The existing I-wall has a top elevation of 13.0 ft consisting of a concrete cap and Frodingham 1B sheet pile to tip elevation of -4.5 ft. Figures D-1 and D-2 show the Geo-Studio and FLAC model cross sections. The FLAC model created by the template is constrained to use horizontal soil layers so the top of the upper marsh strata was set at EL -5 ft, as it is shown on the flood side of the I-Wall in Figure D-2, without sloping to the levee toe to best capture the wall displacement behavior.

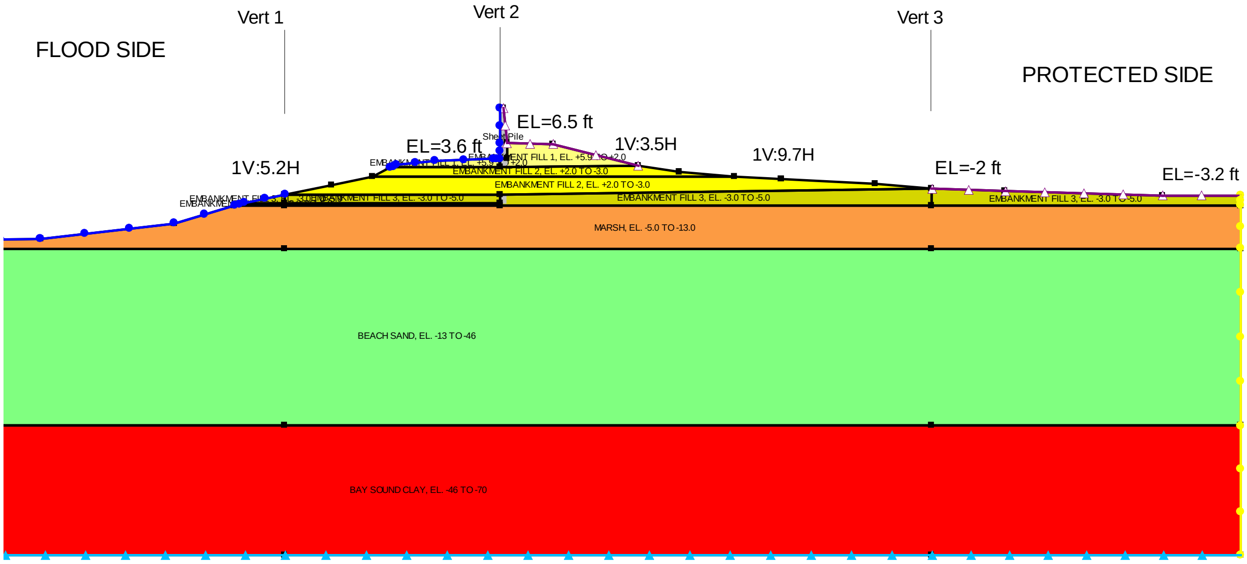


Figure D-1. Geo-Studio model for 17th Street Outfall Canal Reach 15A

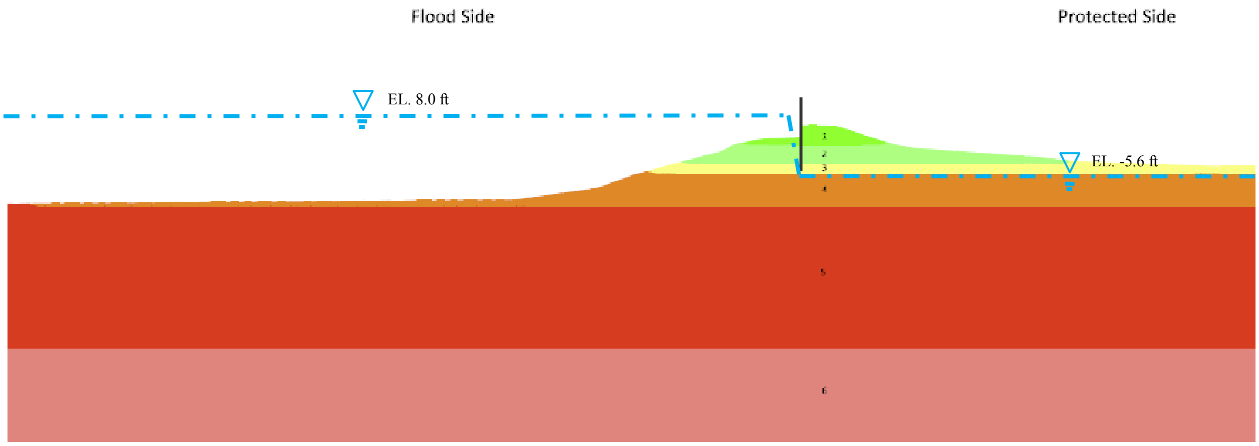


Figure D-2. FLAC Model for 17th Street Outfall Canal Reach 15A

Foundation Parameters

The FLAC analyses are based on simple Mohr-Coulomb constitutive models (elastic-perfectly plastic soil behavior). Unit weight and shear strength parameters for the various soil layers were based on the information in the MOWL Report. The cross section used is the Seep/W file from the MOWL report. As-built drawings were examined for the properties of the I-Wall.

Soil modulus values were determined or selected assuming the soils are linearly elastic and isotropic with Poisson's ratio based on expected drainage conditions during loading. The parameters used for analysis are presented in Tables D-1 thru D-2. The soil modulus values were selected using the same G/Su ratios selected for the FLAC model calibrated to the London Load Test (LLT) results. The soil modulus values used in the LLT FLAC model were primarily based on pressuremeter testing and relationships for G/Su. At London Avenue Canal, the shear modulus values are determined by multiplying the G/Su ratio for a given soil by its undrained shear strength. Young's Modulus for the levee and sand were assigned the same value used in the LLT calibration. The at-rest earth pressure coefficients are computed only to initialize stresses during model development so equilibrium can be reached in fewer computational steps.

At 17th Street Outfall Canal, seepage conditions were modeled as steady state using the Seep/W model, and previously accepted material seepage properties and protected side boundary conditions, from the MOWL report. The flood side canal total head boundary was incrementally raised from a starting water level of EL +0.4 ft to EL +1.0 ft and then by 1 ft. The water table was assumed to be constant for the protected side two feet below the ground surface -5.6 ft and 8.0 ft for the flood side. The water table elevations are presented on figure D-2.

Table D-1. Summary of Centerline Soil Parameters

Material	**Strata top elevation (NAVD88)**	**Strata bottom elevation (NAVD88)**	**unit wt. (pcf)**	**unit wt/g**	**Su (psf)***	**ϕ' (deg)**
1 – Embankment 1	6.5	2.0	114	3.540	800	0
2 – Embankment 2	2.0	-3.0	114	3.540	375	0
3 – Embankment 3	-3.0	-5.0	114	3.540	500	0
4 – Marsh	-5.0	-13.0	94	2.919	350	0
5 – Beach Sand	-13.0	-46.0	122	3.789	0	30
6 – Bay Sound Clay	-46.0	-70.0	102	3.168	735	0

Table D-2. Centerline Most Likely Value Modulus

Material	***E/Su***	**E (psf)**	***Poisson***	**G (psf)**	**K (psf)**	**ko**
1 – Embankment 1	*197*	1.58E+05	*0.40*	56250	262500	0.85
2 – Embankment 2	*420*	1.58E+05	*0.40*	56250	262500	0.85
3 – Embankment 3	*315*	1.58E+05	*0.40*	56250	262500	0.85
4 – Marsh	*200*	7.00E+04	0.47	23810	388889	0.96
5 – Beach Sand	–	7.32E+05	*0.31*	275188	732000	0.75
6 – Bay Sound Clay	*600*	4.41E+05	*0.495*	147492	14700000	0.99

Table D-3. Summary of Toe Soil Parameters

Material	**Strata top elevation (NAVD88)**	**Strata bottom elevation (NAVD88)**	**unit wt. (pcf)**	**unit wt/g**	**Su (psf)**	**ϕ' (deg)**
1 – Embankment 1	6.5	2.0	114	3.540	500	0
2 – Embankment 2	2.0	-3.0	114	3.540	500	0
3 – Embankment 3	-3.0	-5.0	114	3.540	500	0
4 – Marsh	-5.0	-13.0	94	2.919	200	0
5 – Beach Sand	-13.0	-46.0	122	3.789	0	30
6 – Bay Sound Clay	-46.0	-70.0	102	3.230	522	0

Table D-4. Toe Most Likely Value Modulus

Material	***E/Su***	**E (psf)**	***Poisson***	**G (psf)**	**K (psf)**	**ko**
1 – Embankment 1	*315*	1.58E+05	*0.40*	56250	262500	0.85
2 – Embankment 2	*315*	1.58E+05	*0.40*	56250	262500	0.85
3 – Embankment 3	*315*	1.58E+05	*0.40*	56250	262500	0.85
4 – Marsh	*200*	4.00E+04	0.47	13605	222222	0.96
5 – Beach Sand	–	7.32E+05	*0.33*	275188	732000	0.75
6 – Bay Sound Clay	*600*	3.13E+05	*0.495*	104749	10440000	0.99

Structural Parameters

The current I-wall structure was modeled as two beam elements: (1) the upper concrete portion of the I-wall and (2) the supporting sheet pile beneath the concrete. Interface elements were applied to the wall below the ground surface. These elements allow slip and separation between the soil and wall. The shear strength of the interfaces was set at 90% of the shear strength of the strongest cohesive soil layer.

In FLAC the structural beam properties are formulated in plane stress (like a plate) and are adjusted for plane strain conditions by dividing Young's modulus by $1-\nu^2$ (ν =Poisson's ratio). The structural parameters are included in Table D-5.

Table D-5. Summary of Structural Parameters

Member	**E (psi)**	**E* (psi)**	**E* (psf)**	**I (in4/ft)**	**E*I (lbft2/ft)**	**A (in2/ft)**	**E*A (lb/ft)**	**ν**
Concrete	3.00E+06	3.13E+06	4.50E+08	1728	3.75E+07	144	4.50E+08	0.2
Frodingham 1B	2.90E+07	3.19E+07	4.59E+09	36.02	7.97E+06	7.87	2.51E+08	0.3

E = Young's Modulus
E* = Adj. Young's Modulus for Plain Strain
I = Moment of Inertia per foot of wall
A = Cross Sectional Area per foot of wall
ν = Poisson's Ratio

Loading Conditions and Gap Formation

Canal water loadings are modeled as mechanical pressures acting normal to the ground surface and normal to the wall face. When a gap is included between the soil and I-wall a horizontal mechanical pressure is added to both the soil and the wall to the depth of the gap.

Gap development is modeled following the step-by-step procedure outlined in the London Avenue Outfall Canal Reevaluation report as well as the IPET report. The total horizontal stress in the element adjacent to the wall is compared to the hydrostatic pressure that would exist if a gap were present. If the hydrostatic water pressure exceeds the total horizontal stress it is

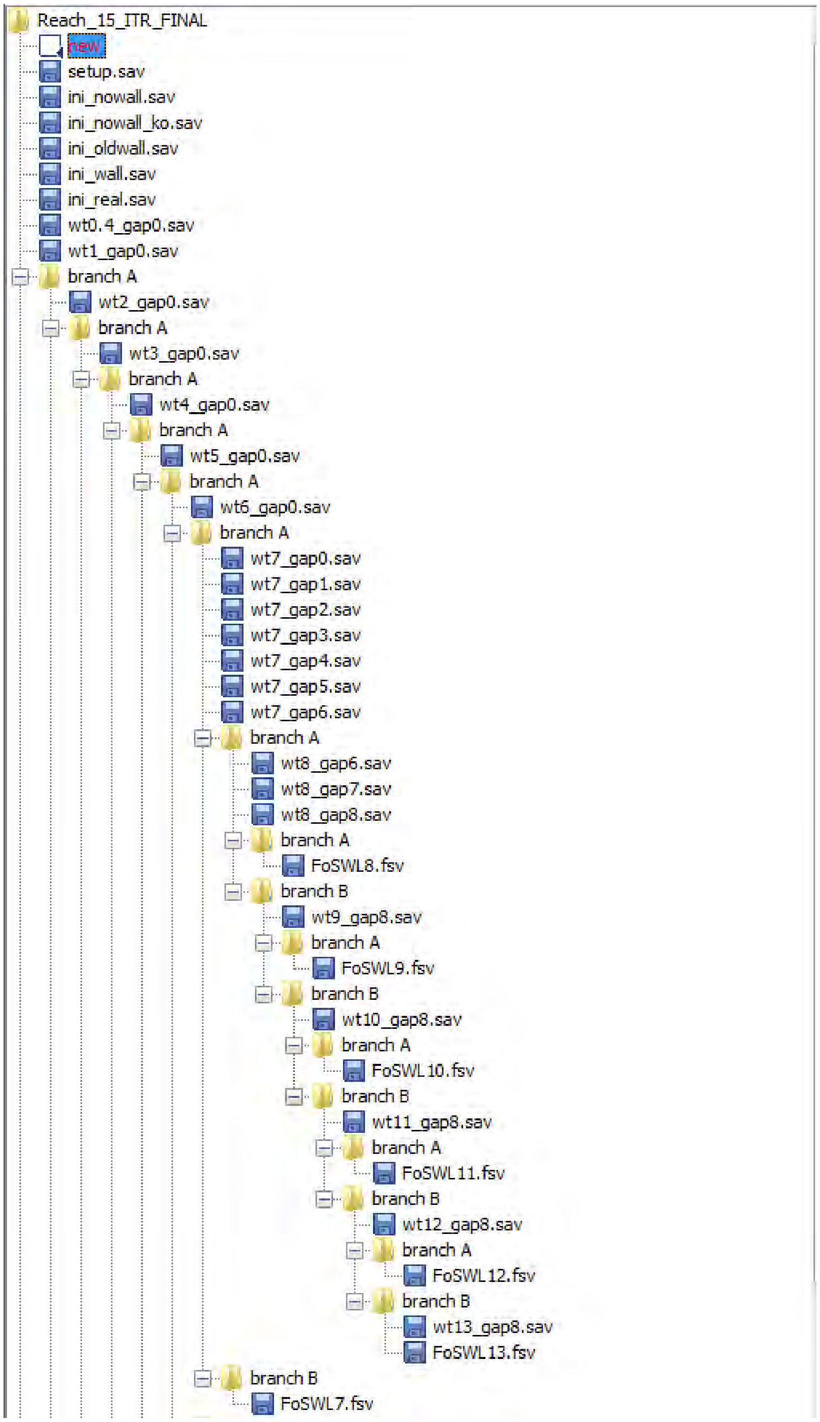
assumed that a gap would form. Each zone is checked as canal water levels are raised from the normal pool elevation of 0.4 ft to the maximum operating level of 8 ft in 1 ft increments. Gaps were deepened in 1 ft increments as they developed.

At lower canal water levels, it is believed the higher soil level on the protected side of the wall serves to increase the horizontal stresses along the flood side of the sheet pile which slows the progression of the gap.

Results

The gap depth calculations prepared by Black and Veatch which follow IPET guidance was checked and compared with the FLAC results. The gap depth extends to the tip of the sheet pile for both methods. The FLAC and hand calculation analysis had the gap extending to approximate EL -4.5 ft. It should be noted that for even the shallower water depths, the hand calculation resulted in a gap to approximate EL -4.5 ft. The gap tip is 8.5 ft above the sand interface.

The maximum protected side ground displacement for the MLV at water level EL 8.0 ft was about 0.509 inches. The maximum developed crack depth was 9.5 ft. Graphs for the top of protected side ground and top of wall displacement and gap propagation versus canal water elevation can be found in Figures D-4 and D-5.



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  - ini_real.sav
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  - branch A
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    - branch A
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        - wt4_gap0.sav
        - branch A
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          - branch A
            - wt6_gap0.sav
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              - wt7_gap0.sav
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              - wt7_gap3.sav
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                  - wt9_gap8.sav
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                    - FoSWL9.fsv
                  - branch B
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                    - branch A
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                    - branch B
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                        - FoSWL11.fsv
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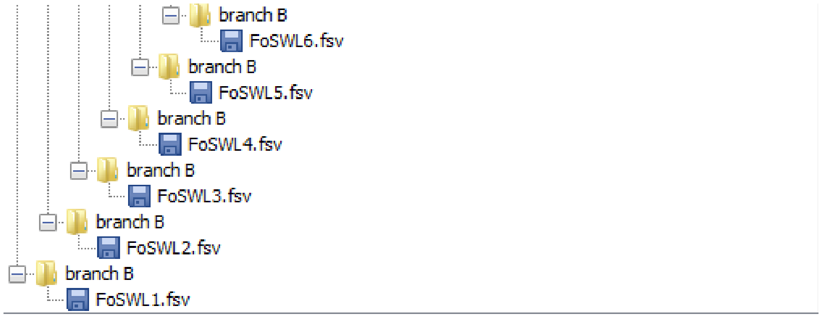

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branch B
FoSWL1.fsv

Figure D-3. FLAC model progression of water loading and gap development for Reach 15A

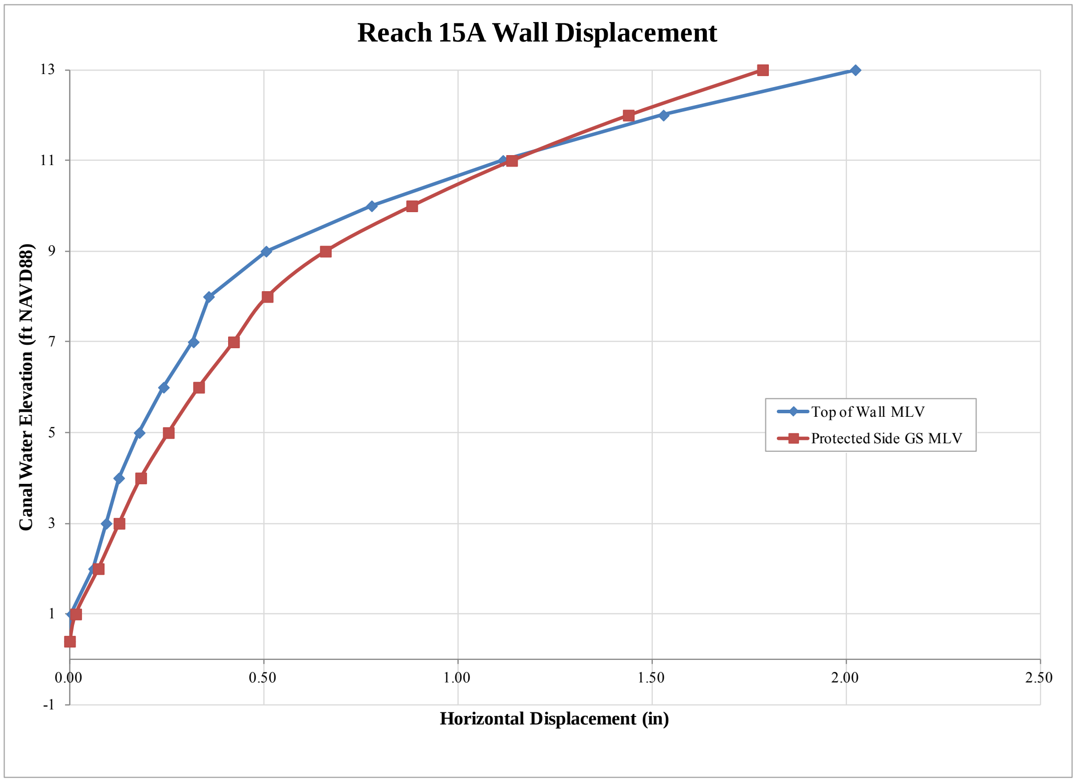

Figure D-4. FLAC computed I-wall displacement.

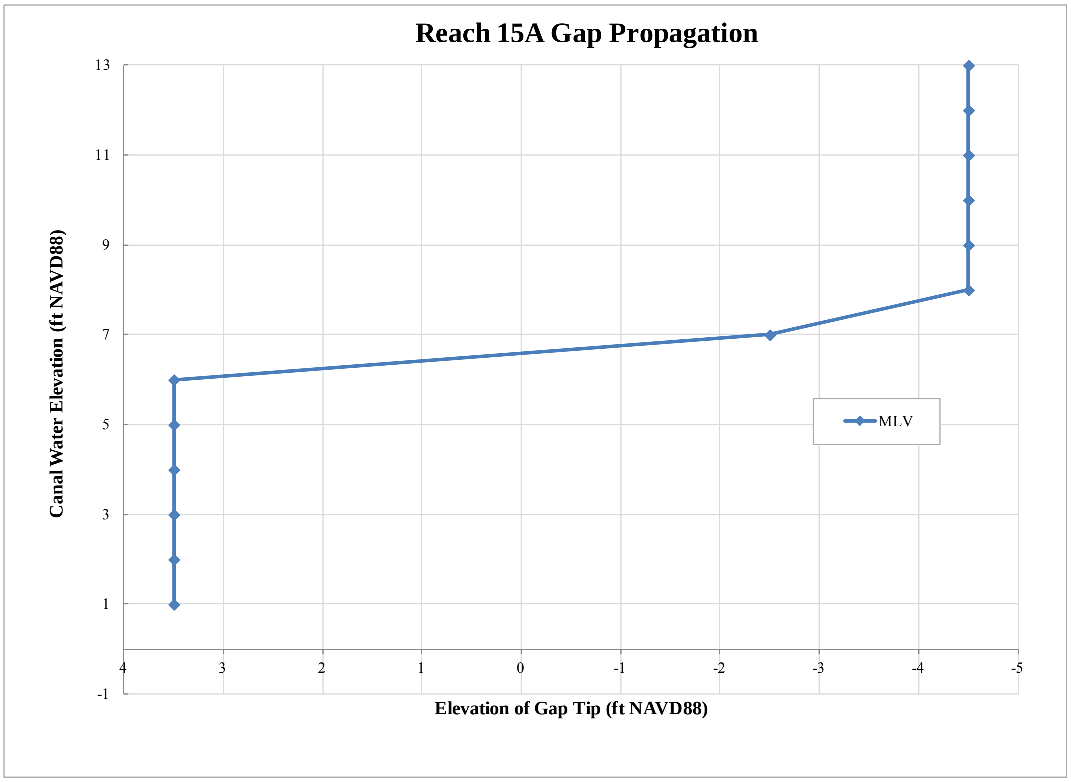

Figure D-5. FLAC computed gap propagation

The automated c-ϕ reduction technique in FLAC was used for all factor of safety (FoS) calculations. Figure D-6 presents the computed factors of safety for differing canal water levels and Figures D-7 through D-14 show the shear strain increment (ssi) or and wall locations (original and displaced) for factor of safety at varying water levels. A summary of the FoS and controlling failure mode (global stability or wall rotation) are presented in Table D-6.

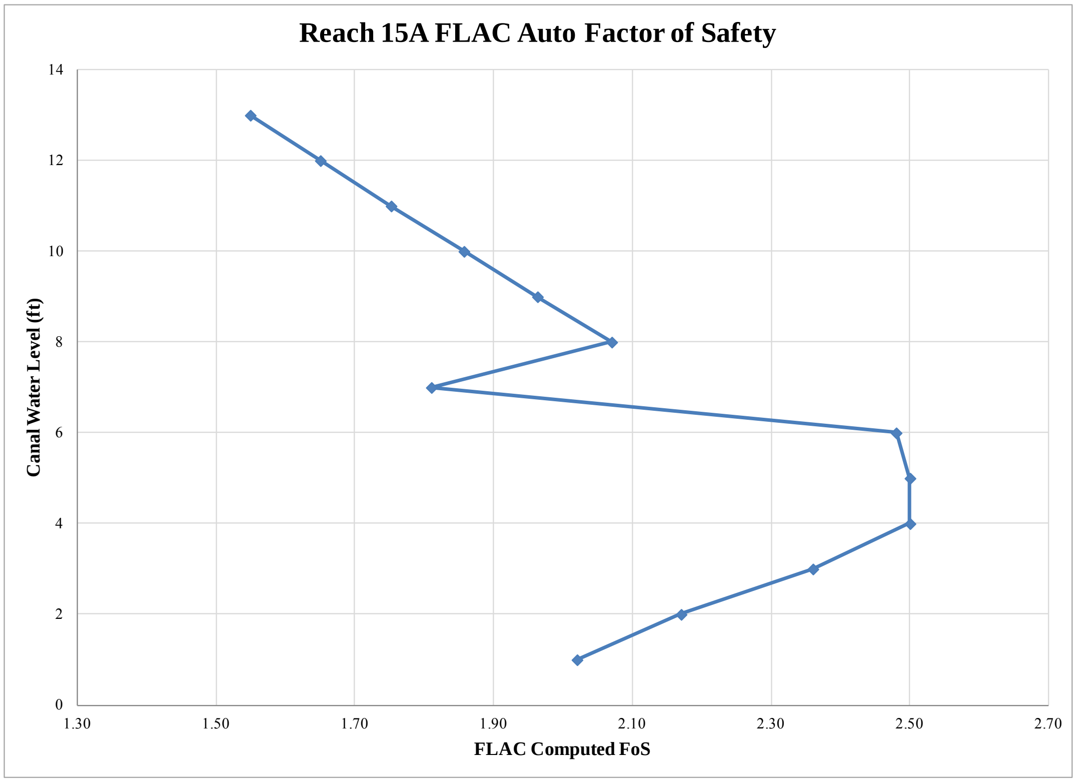

Figure D-6. FLAC computed factor of safety (automated c-ϕ reduction technique).

Table D-6. Summary of FLAC FoS and Controlling Failure Mode.

Canal WL (ft)	FLACAUTO FoS	Controlling Failure Mode
1	2.02	Global Stability
2	2.17	Global Stability
3	2.36	Global Stability
4	2.50	Global Stability
5	2.50	Global Stability
6	2.48	Global Stability
7	1.81	Global Stability
8	2.07	Global Stability
9	1.96	Global Stability
10	1.86	Global Stability
11	1.75	Global Stability
12	1.65	Global Stability
13	1.55	Global Stability

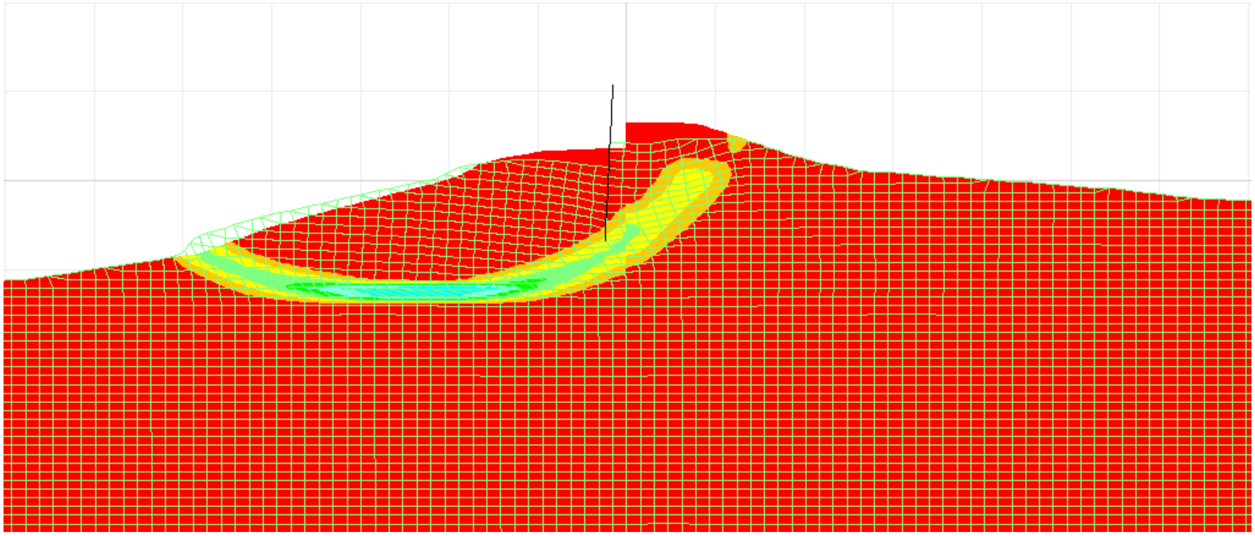

Figure D-7. WL+1 ft, FoS ssi and wall displacement magnified 5X.

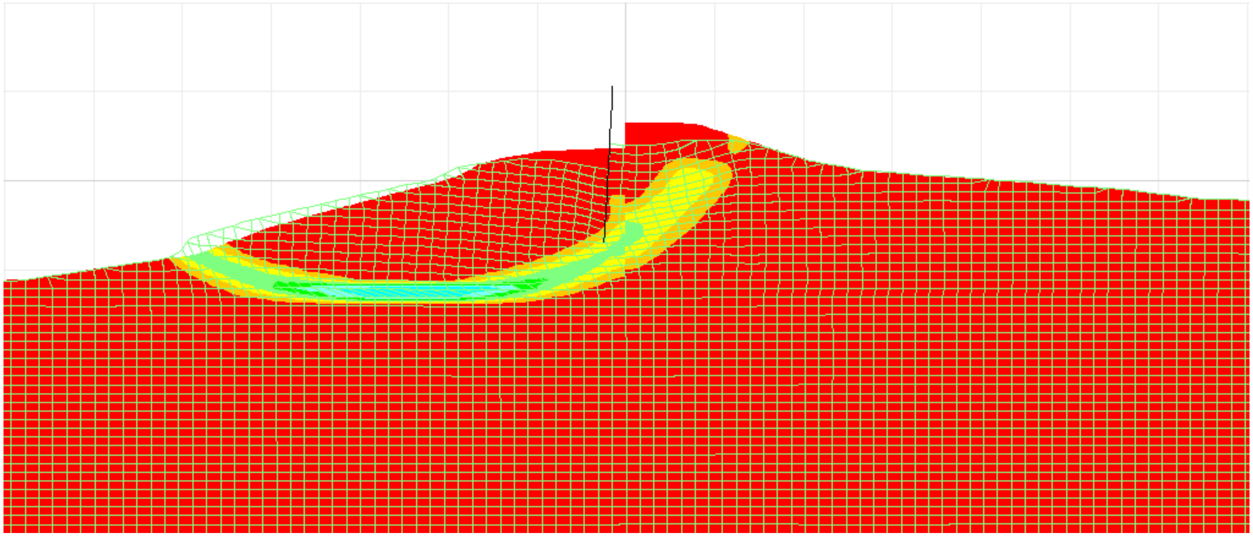

Figure D-8. WL+2 ft, FoS ssi and wall displacement magnified 5X.

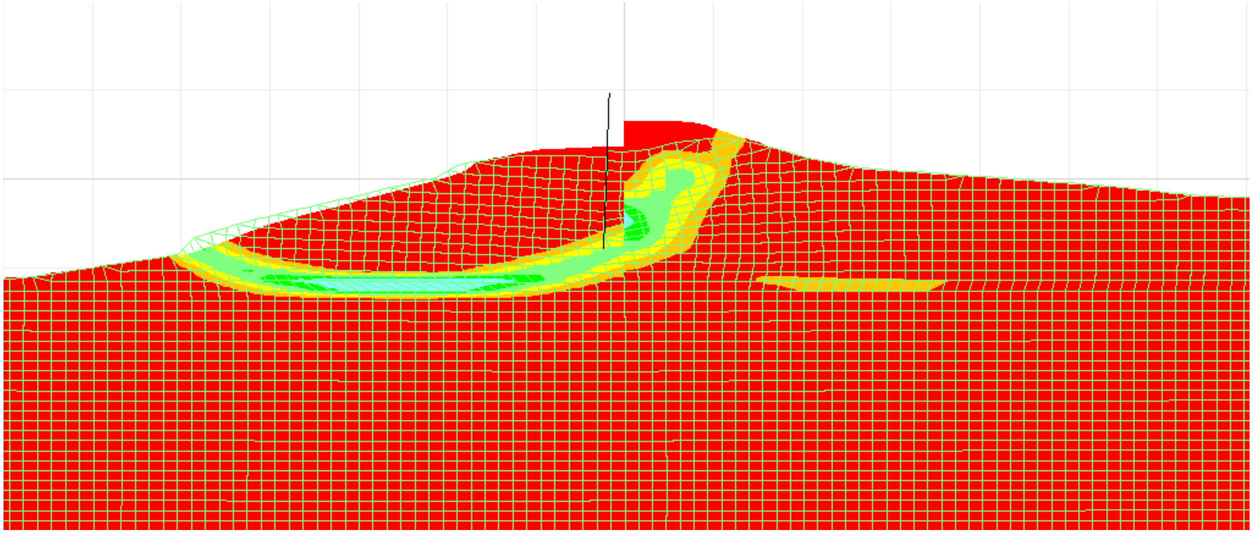

Figure D-9. WL+3 ft, FoS ssi and wall displacement magnified 5X.

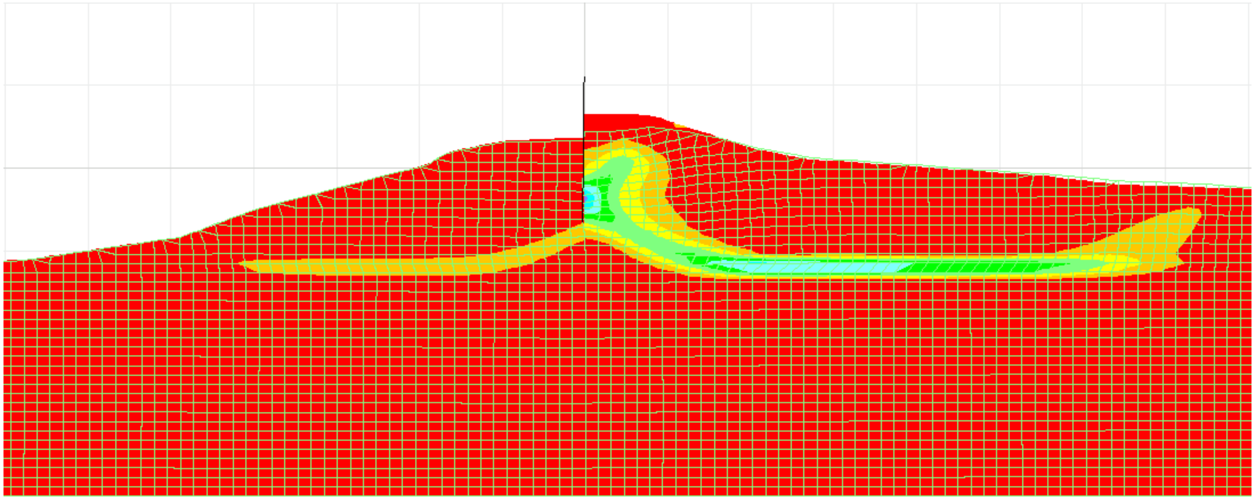

Figure D-10. WL+4 ft, FoS ssi and wall displacement magnified 5X.

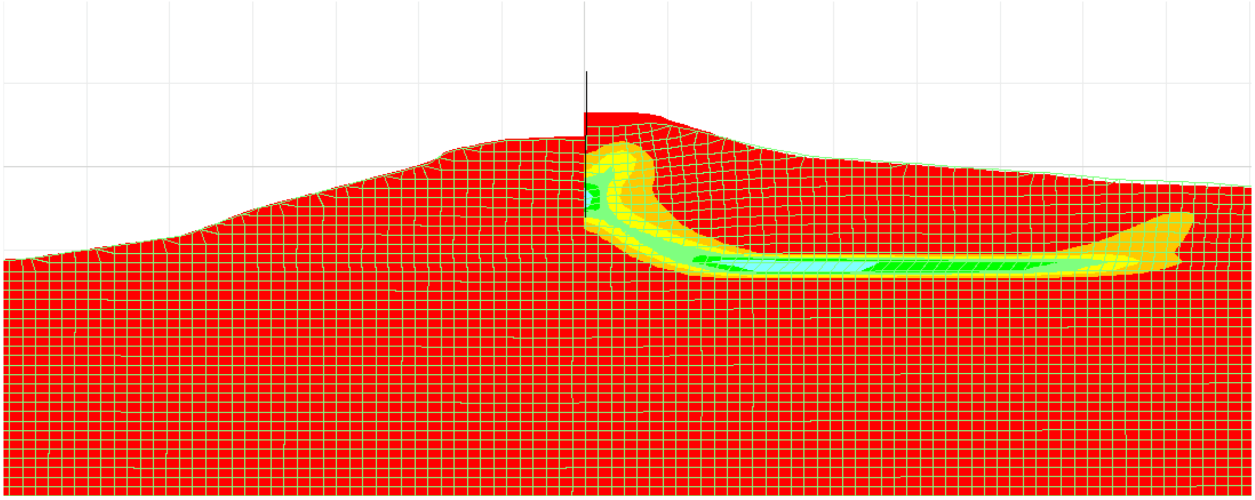

Figure D-11. WL+5 ft, FoS ssi and wall displacement magnified 5X.

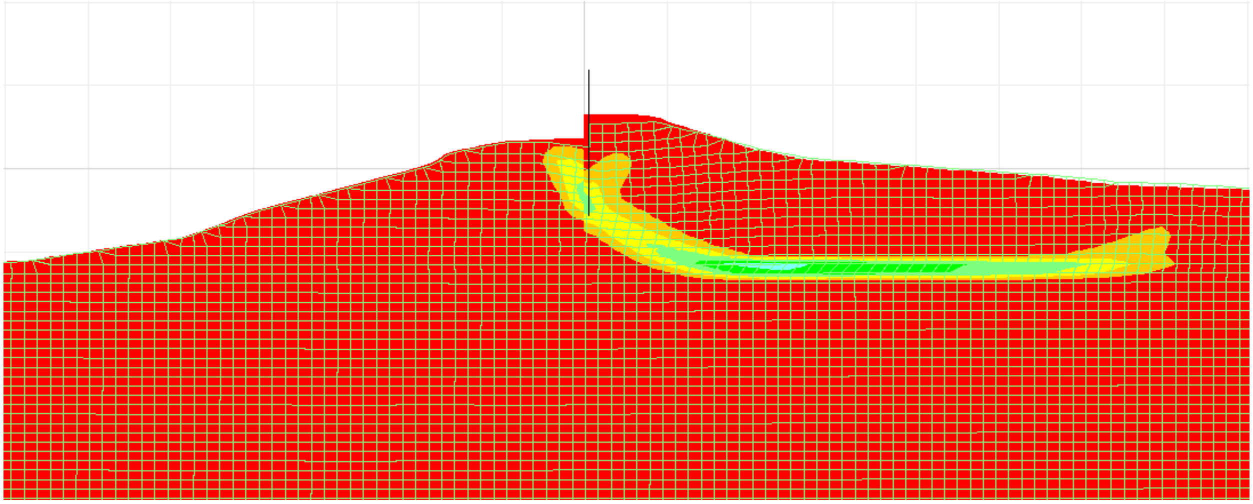

Figure D-12. WL+6 ft, FoS ssi and wall displacement magnified 5X.

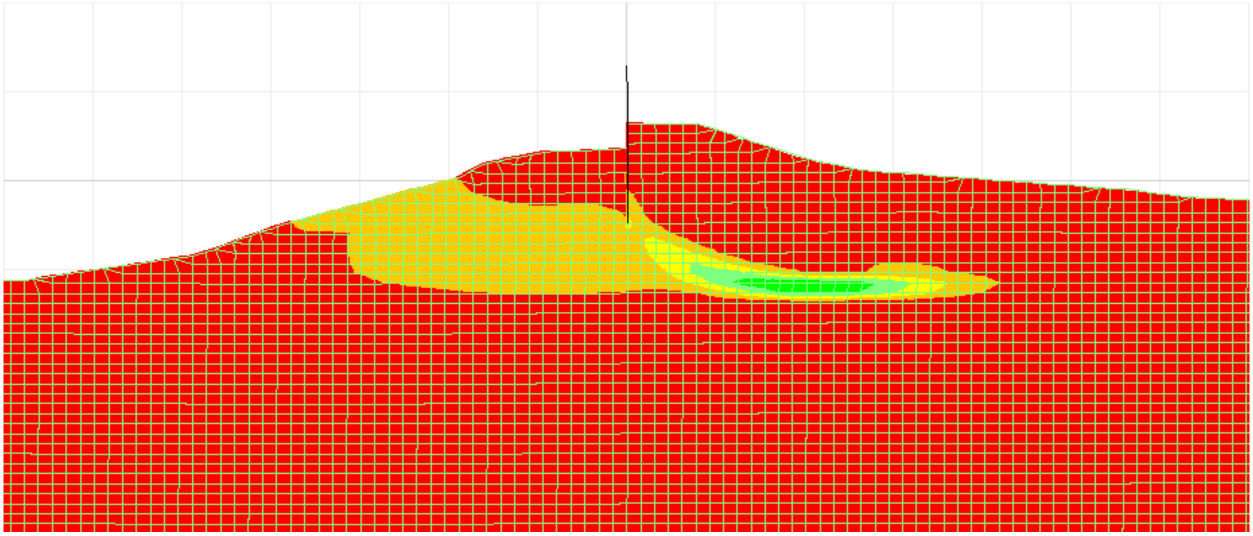

Figure D-13. WL+7 ft, FoS ssi and wall displacement magnified 5X.

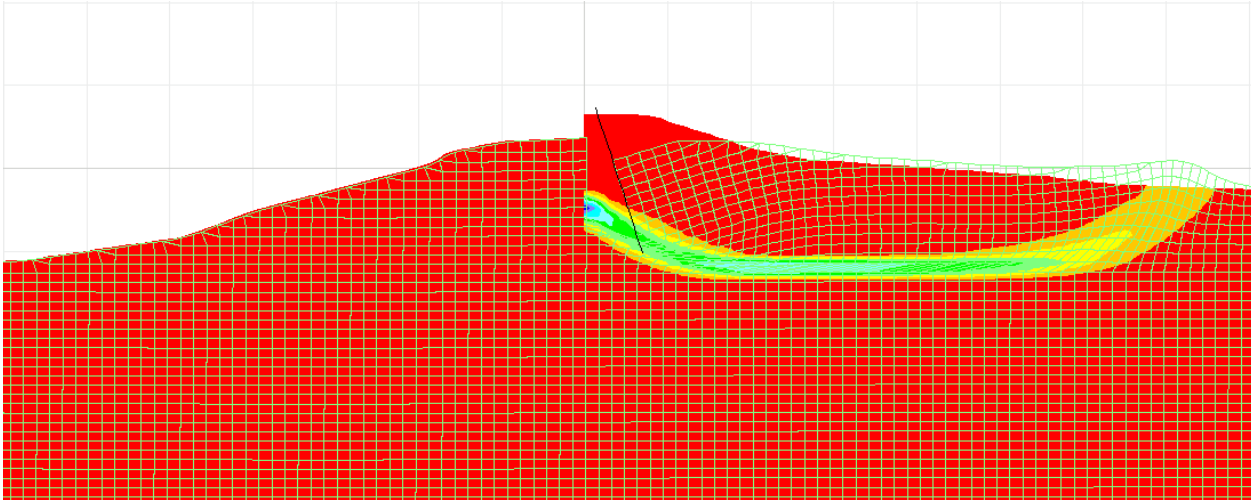

Figure D-14. WL+8 ft, FoS ssi and wall displacement magnified 5X.

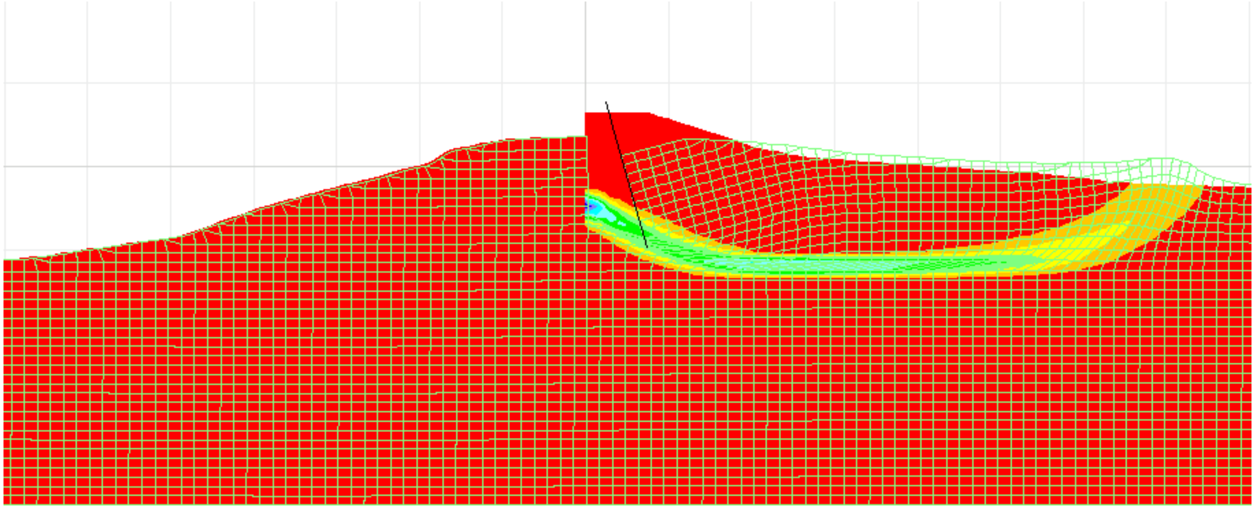

Figure D-15. WL+9 ft, FoS ssi and wall displacement magnified 5X.

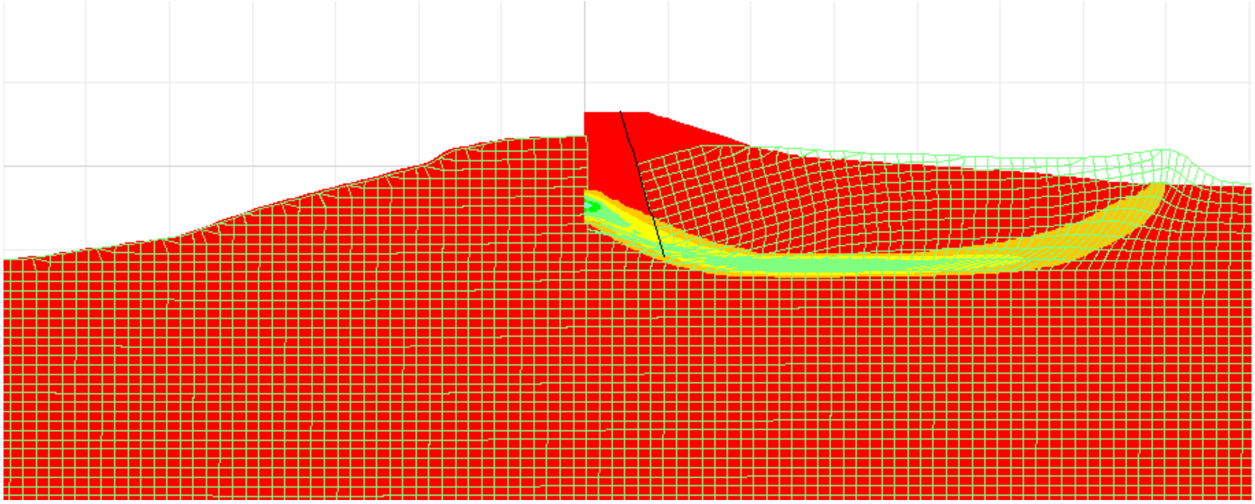

Figure D-16. WL+10 ft, FoS ssi and wall displacement magnified 5X.

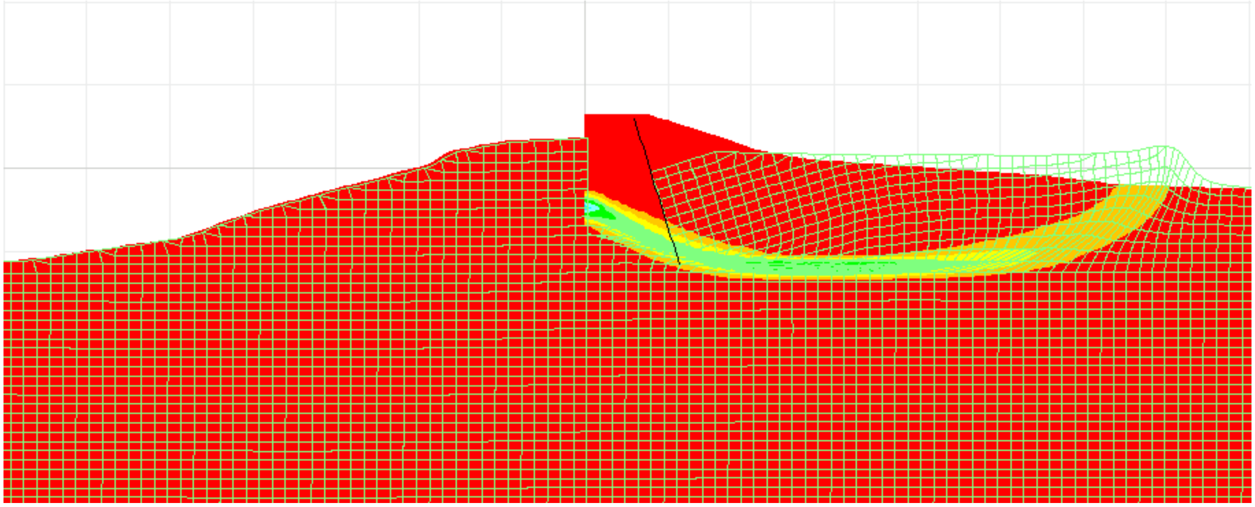

Figure D-17. WL+11 ft, FoS ssi and wall displacement magnified 5X.

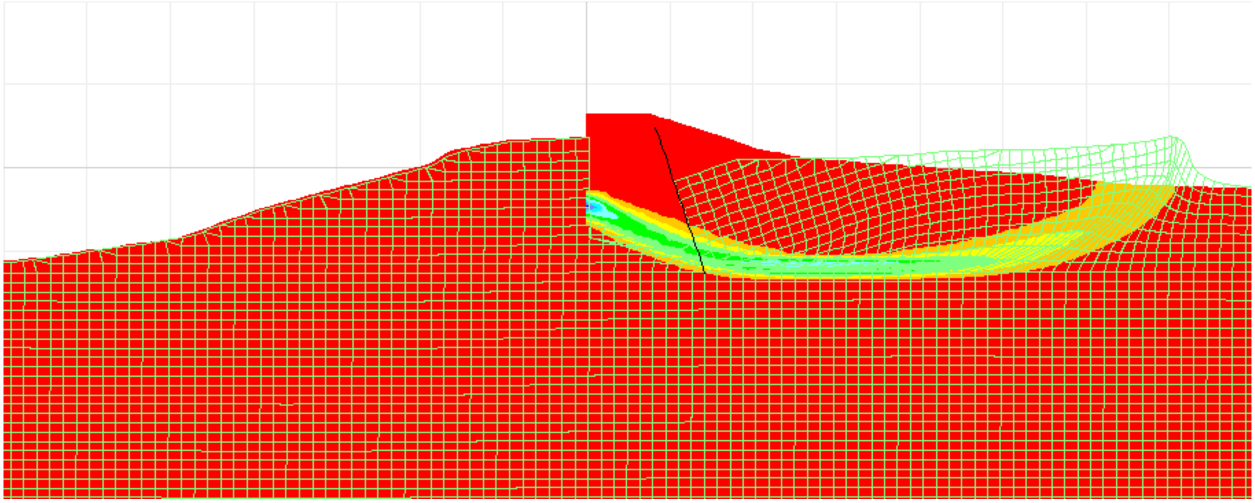

Figure D-18. WL+12 ft, FoS ssi and wall displacement magnified 5X.

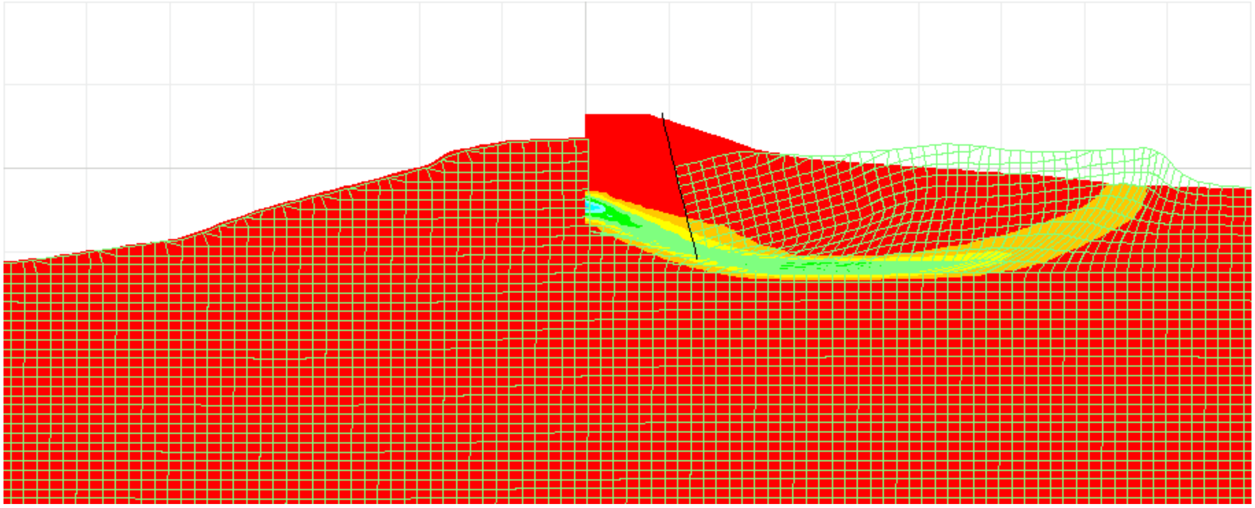

Figure D-19. WL+13 ft, FoS ssi and wall displacement magnified 5X.

Reach 17

Introduction

The design section includes: clay embankment (EL +9.9 ft), underlain by a shallow Marsh deposit (EL -3.0 ft to EL -12.0 ft). The shallow Marsh is underlain by a Beach Sand stratum (EL -12.0 to -46.0 ft) which mantles a lower Bay Sound Clay deposit which extends to an EL of -70.0 ft. The upper clay embankment material was assigned a unit weight of 116 pcf with a cohesion of 800 psf. The shear strength values used for the clay embankment are higher than those in the underlying marsh deposit. The elevation of the flood side ground line at the wall face is approximately EL 9.9 ft resulting in 0.0 ft difference in soil elevation across the wall. The existing I-wall has a top elevation of 13.5 ft consisting of a concrete cap and Frodingham1B sheet pile to tip elevation of -2.5 ft. Figures D-1 and D-2 show the Geo-Studio and FLAC model cross sections. The FLAC model created by the template is constrained to use horizontal soil layers so the top of the upper marsh strata was set at EL -3 ft, as it is shown on the flood side of the I-Wall in Figure D-2, without sloping to the levee toe to best capture the wall displacement behavior.

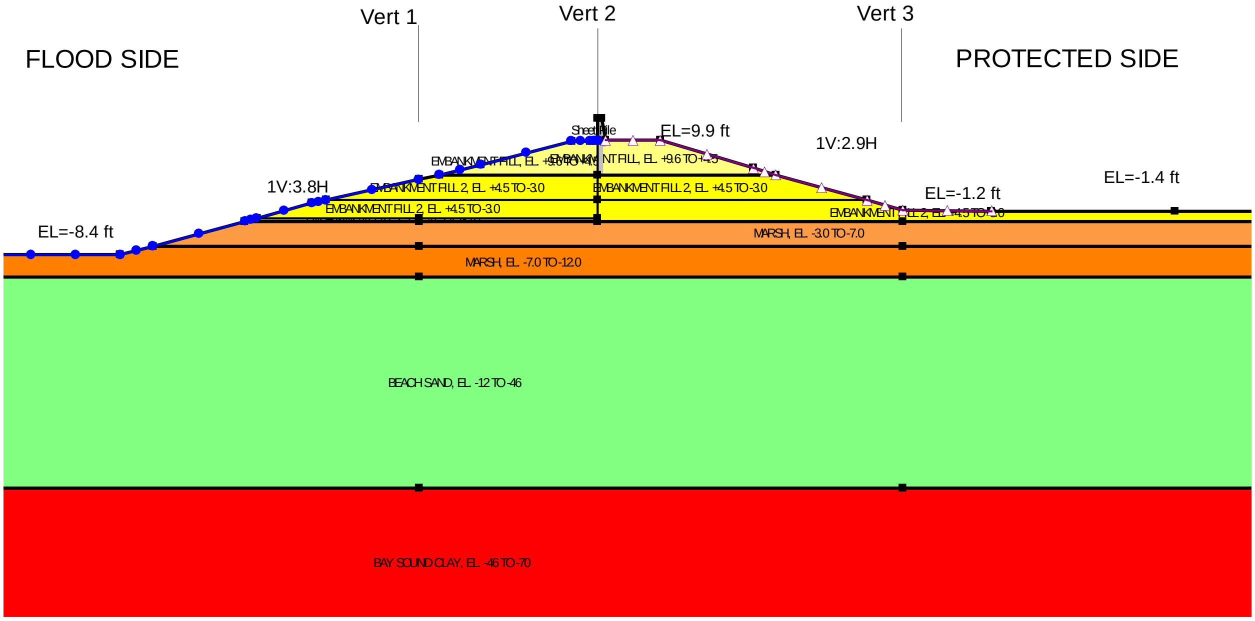

Figure D-1. Geo-Studio model for 17th Street Outfall Canal Reach 17

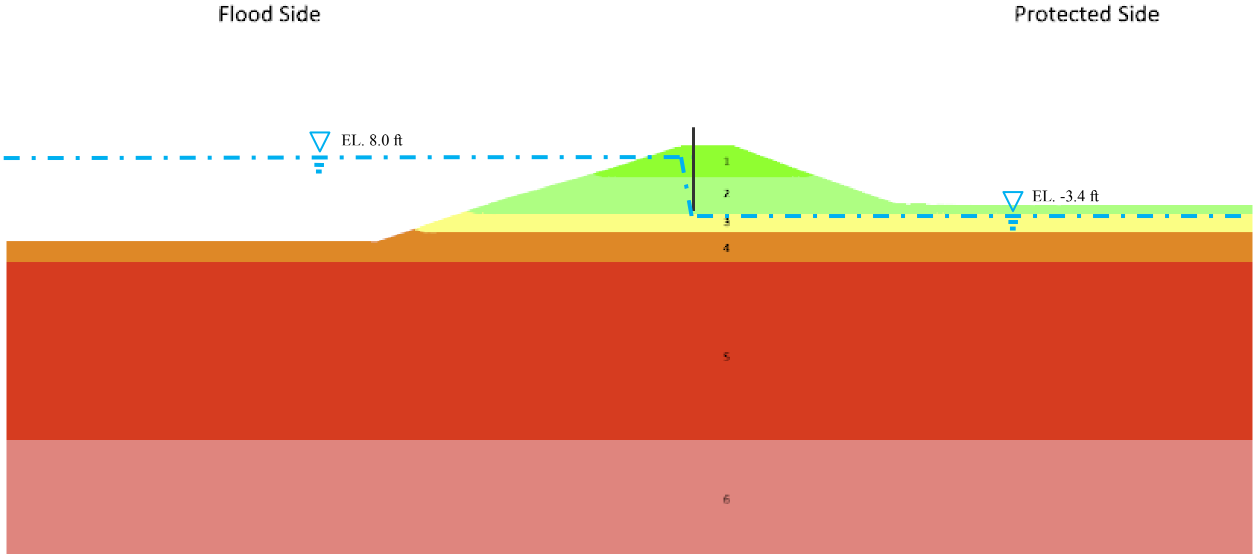

Figure D-2. FLAC Model for 17th Street Outfall Canal Reach 17

Foundation Parameters

The FLAC analyses are based on simple Mohr-Coulomb constitutive models (elastic-perfectly plastic soil behavior). Unit weight and shear strength parameters for the various soil layers were based on the information in the MOWL Report. The cross section used is the Seep/W file from the MOWL report. As-built drawings were examined for the properties of the I-Wall.

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At 17th Street Outfall Canal, seepage conditions were modeled as steady state using the Seep/W model, and previously accepted material seepage properties and protected side boundary conditions, from the MOWL report. The flood side canal total head boundary was incrementally raised from a starting water level of EL +0.4 ft to EL +1.0 ft and then by 1 ft. The water table was assumed to be constant for the protected side two feet below the ground surface -3.4 ft and 10.0 ft for the flood side. The water table elevations are presented on figure D-2.

Table D-1. Summary of Centerline Soil Parameters

Material	**Strata top elevation (NAVD88)**	**Strata bottom elevation (NAVD88)**	**unit wt. (pcf)**	**unit wt/g**	**Su (psf)***	**ϕ' (deg)**
1 – Embankment 1	9.9	4.5	116	3.60	800	0
2 – Embankment 2	4.5	-3.0	113	3.51	650	0
3 – Marsh 1	-3.0	-7.0	108	3.35	450	0
4 – Marsh 2	-7.0	-12.0	108	3.35	450	0
5 – Beach Sand	-12.0	-46.0	122	3.79	0	30
6 – Bay Sound Clay	-46.0	-70.0	107	3.32	835	0

Table D-2. Centerline Most Likely Value Modulus

Material	***E/Su***	**E (psf)**	***Poisson***	**G (psf)**	**K (psf)**	**ko**
1 – Embankment 1	*197*	1.58E+05	*0.40*	56250	262500	0.85
2 – Embankment 2	*242*	1.58E+05	*0.40*	56250	262500	0.85
3 – Marsh 1	*200*	9.00E+04	*0.47*	30612	500000	0.95
4 – Marsh 2	*200*	9.00E+04	0.47	30612	500000	0.95
5 – Beach Sand	–	7.32E+05	*0.33*	275188	732000	0.75
6 – Bay Sound Clay	*600*	5.00E+05	*0.495*	167559	16700000	0.99

Table D-3. Summary of Toe Soil Parameters

Material	**Strata top elevation (NAVD88)**	**Strata bottom elevation (NAVD88)**	**unit wt. (pcf)**	**unit wt/g**	**Su (psf)***	**ϕ' (deg)**
1 – Embankment 1	9.9	4.5	116	3.60	800	0
2 – Embankment 2	4.5	-3.0	113	3.51	600	0
3 – Marsh 1	-3.0	-7.0	108	3.35	425	0
4 – Marsh 2	-7.0	-12.0	108	2.35	320	0
5 – Beach Sand	-12.0	-46.0	122	3.79	0	30
6 – Bay Sound Clay	-46.0	-70.0	107	3.32	555	0

Table D-4. Toe Most Likely Value Modulus

Material	***E/Su***	**E (psf)**	***Poisson***	**G (psf)**	**K (psf)**	**ko**
1 – Embankment 1	*197*	1.58E+05	*0.40*	56250	262500	0.85
2 – Embankment 2	*263*	1.58E+05	*0.40*	56250	262500	0.85
3 – Marsh 1	*200*	8.50E+04	*0.47*	28912	472222	0.95
4 – Marsh 2	*200*	6.40E+04	0.47	21769	355556	0.95
5 – Beach Sand	–	7.32E+05	*0.33*	275188	732000	0.75
6 – Bay Sound Clay	*600*	3.30E+05	*0.495*	111371	11100000	0.99

Structural Parameters

The current I-wall structure was modeled as two beam elements: (1) the upper concrete portion of the I-wall and (2) the supporting sheet pile beneath the concrete. Interface elements were applied to the wall below the ground surface. These elements allow slip and separation between the soil and wall. The shear strength of the interfaces was set at 90% of the shear strength of the strongest cohesive soil layer.

In FLAC the structural beam properties are formulated in plane stress (like a plate) and are adjusted for plane strain conditions by dividing Young's modulus by $1-\nu^2$ (ν =Poisson's ratio). The structural parameters are included in Table D-5.

Table D-5. Summary of Structural Parameters

Member	**E (psi)**	**E* (psi)**	**E* (psf)**	**I (in4/ft)**	**E*I (lbft2/ft)**	**A (in2/ft)**	**E*A (lb/ft)**	**ν**
Concrete	3.00E+06	3.13E+06	4.50E+08	1728	3.75E+07	144	4.50E+08	0.2
Frodingham1B	2.90E+07	3.19E+07	4.59E+09	36.02	7.97E+06	7.87	2.51E+08	0.3

E = Young's Modulus
E* = Adj. Young's Modulus for Plain Strain
I = Moment of Inertia per foot of wall
A = Cross Sectional Area per foot of wall
ν = Poisson's Ratio

Loading Conditions and Gap Formation

Canal water loadings are modeled as mechanical pressures acting normal to the ground surface and normal to the wall face. When a gap is included between the soil and I-wall a horizontal mechanical pressure is added to both the soil and the wall to the depth of the gap.

Gap development is modeled following the step-by-step procedure outlined in the London Avenue Outfall Canal Reevaluation report as well as the IPET report. The total horizontal stress in the element adjacent to the wall is compared to the hydrostatic pressure that would exist if a gap were present. If the hydrostatic water pressure exceeds the total horizontal stress it is

assumed that a gap would form. Each zone is checked as canal water levels are raised from the normal pool elevation of 0.4 ft to the maximum operating level of 10.0 ft in 1 ft increments. Gaps were deepened in 1 ft increments as they developed.

At lower canal water levels, it is believed the higher soil level on the protected side of the wall serves to increase the horizontal stresses along the flood side of the sheet pile which slows the progression of the gap.

Results

The gap depth calculations prepared by Black and Veatch which follow IPET guidance was checked and compared with the FLAC results. The gap depth extends to the tip of the sheet pile for the hand calculation analysis but not for the FLAC analysis. The hand calculation analysis had the gap extending to approximately EL -4.5 ft with the gap tip for the hand calculation being 11.5 ft above the sand interface. It should be noted that even for the shallower water depths, the hand calculations resulted in a gap developing to approximate EL -4.5 ft. Figure D-3 shows the total horizontal stresses and water pressures plotted against depth in FLAC. This data representation of the two lines never intersecting accurately depicts that a gap did not develop.

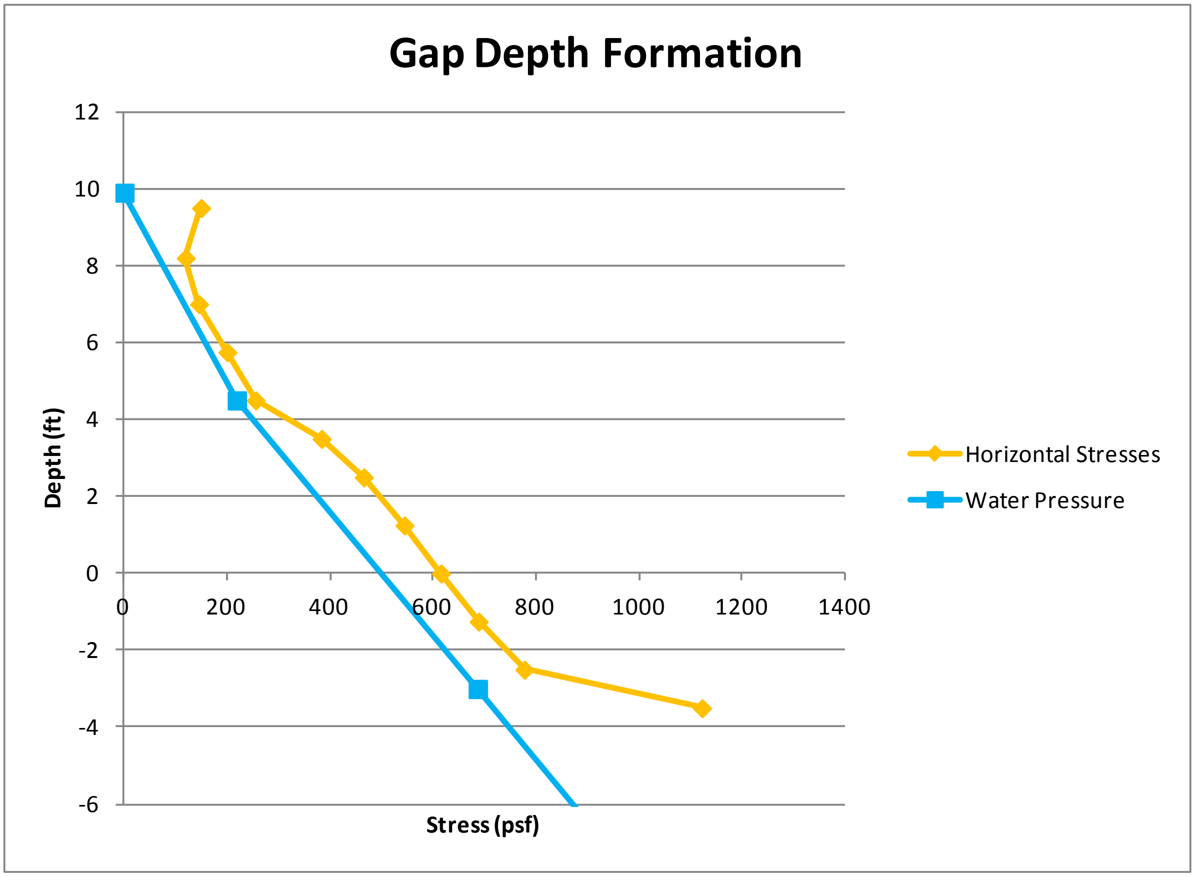
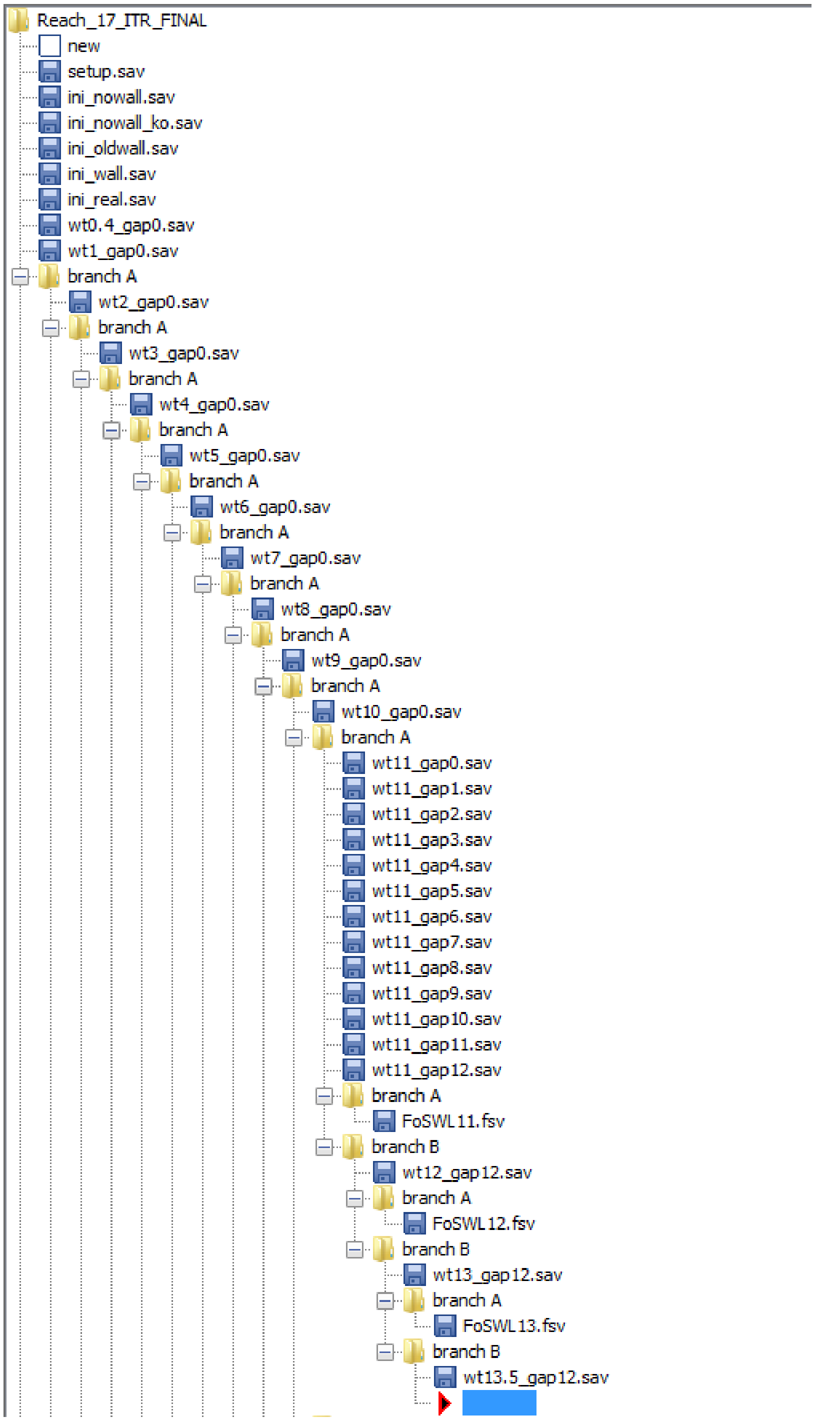
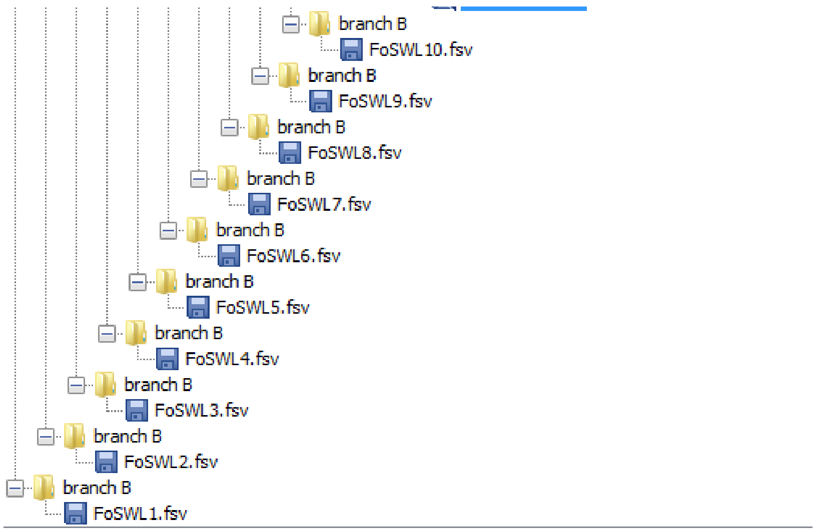


Figure D-3. Geo-Studio model for 17th Street Outfall Canal Reach 17

The maximum protected side ground displacement for the MLV at water level EL 10.0 ft was about 0.59 inches. The maximum developed crack depth was 0 ft. The undeveloped crack depth leading to a gap formation was not initiated due to insignificant hydrostatic forces acting on the wall. The elevation of the flood side ground surface at the wall face is approximately EL 9.9 ft resulting in 0.1 ft difference between the resulting water level and ground surface elevation. Graphs for the top of protected side ground and top of wall displacement and gap propagation versus canal water elevation can be found in Figures D-5 and D-6.



- Reach_17_ITR_FINAL
  - new
  - setup.sav
  - ini_nowall.sav
  - ini_nowall_ko.sav
  - ini_oldwall.sav
  - ini_wall.sav
  - ini_real.sav
  - wt0.4_gap0.sav
  - wt1_gap0.sav
  - branch A
    - wt2_gap0.sav
    - branch A
      - wt3_gap0.sav
      - branch A
        - wt4_gap0.sav
        - branch A
          - wt5_gap0.sav
          - branch A
            - wt6_gap0.sav
            - branch A
              - wt7_gap0.sav
              - branch A
                - wt8_gap0.sav
                - branch A
                  - wt9_gap0.sav
                  - branch A
                    - wt10_gap0.sav
                    - branch A
                      - wt11_gap0.sav
                      - wt11_gap1.sav
                      - wt11_gap2.sav
                      - wt11_gap3.sav
                      - wt11_gap4.sav
                      - wt11_gap5.sav
                      - wt11_gap6.sav
                      - wt11_gap7.sav
                      - wt11_gap8.sav
                      - wt11_gap9.sav
                      - wt11_gap10.sav
                      - wt11_gap11.sav
                      - wt11_gap12.sav
                      - branch A
                        - FoSWL11.fsv
                      - branch B
                        - wt12_gap12.sav
                        - branch A
                          - FoSWL12.fsv
                        - branch B
                          - wt13_gap12.sav
                          - branch A
                            - FoSWL13.fsv
                          - branch B
                            - wt13.5_gap12.sav



branch B
FoSWL10.fsv
branch B
FoSWL9.fsv
branch B
FoSWL8.fsv
branch B
FoSWL7.fsv
branch B
FoSWL6.fsv
branch B
FoSWL5.fsv
branch B
FoSWL4.fsv
branch B
FoSWL3.fsv
branch B
FoSWL2.fsv
branch B
FoSWL1.fsv

Figure D-4. FLAC model progression of water loading and gap development for Reach 17

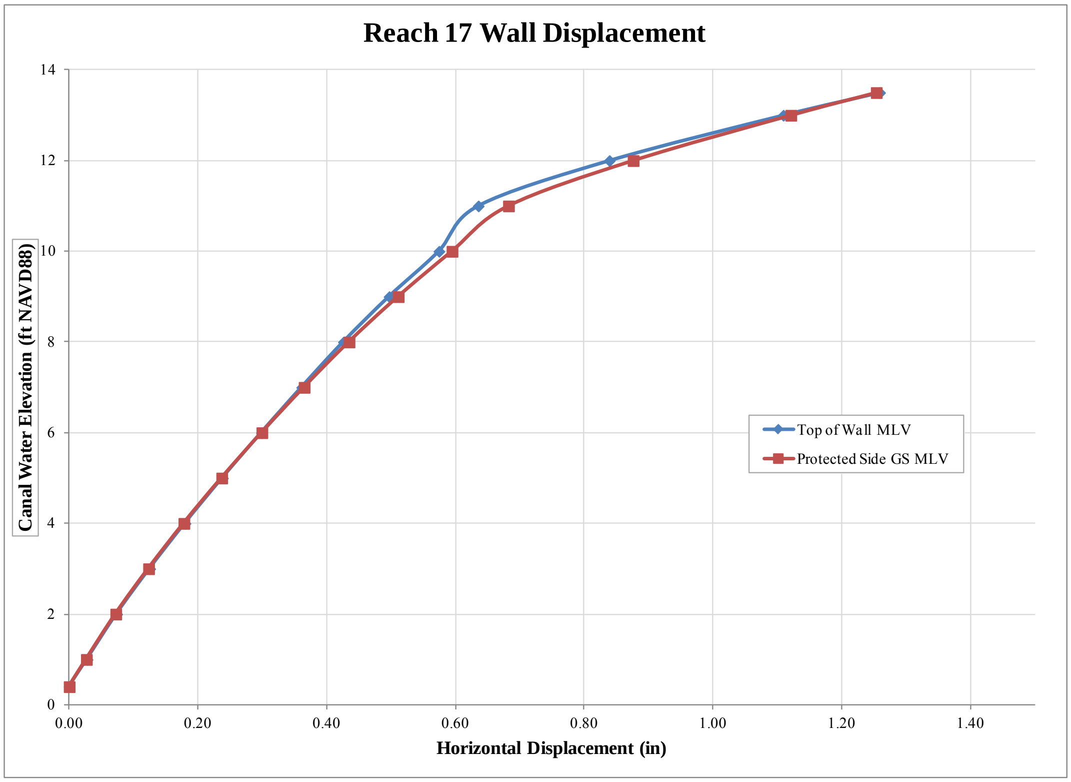


Figure D-5. FLAC computed I-wall displacement.

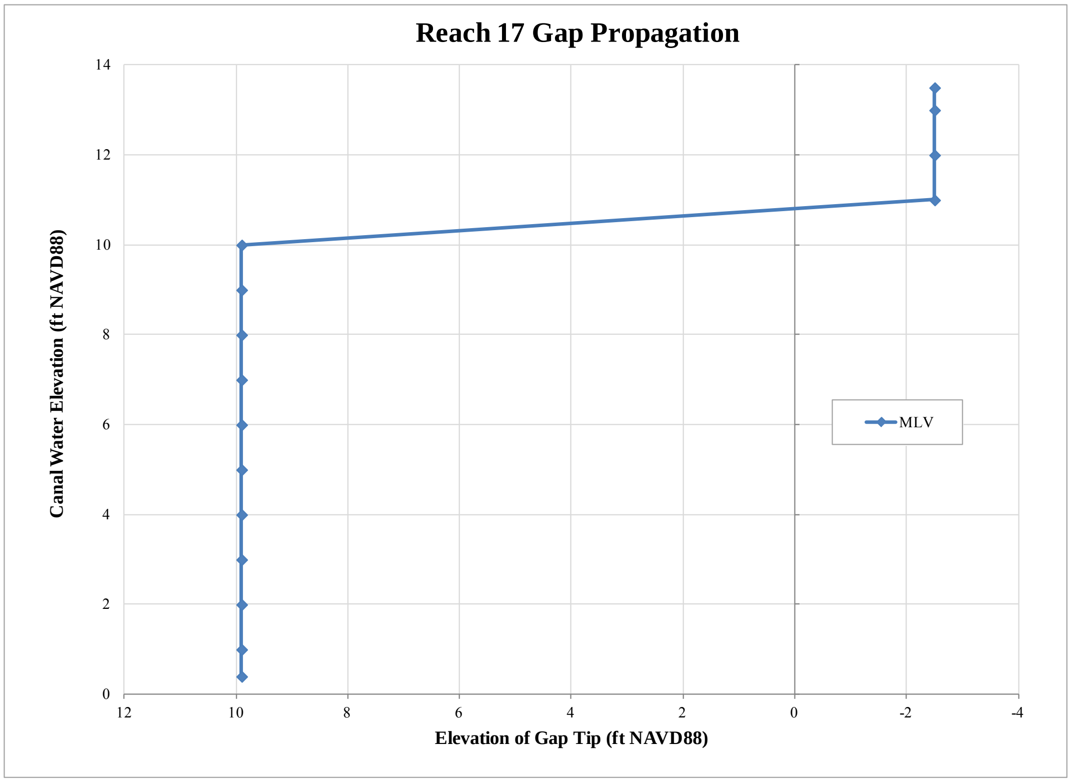


Figure D-6. FLAC computed gap propagation

The automated c-ϕ reduction technique in FLAC was used for all factor of safety (FoS) calculations. Figure D-7 presents the computed factors of safety for differing canal water levels and Figures D-8 through D-17 show the shear strain increment (ssi) and wall locations (original and displaced) for factor of safety at varying water levels. A summary of the FoS and controlling failure mode (global stability or wall rotation) are presented in Table D-6.

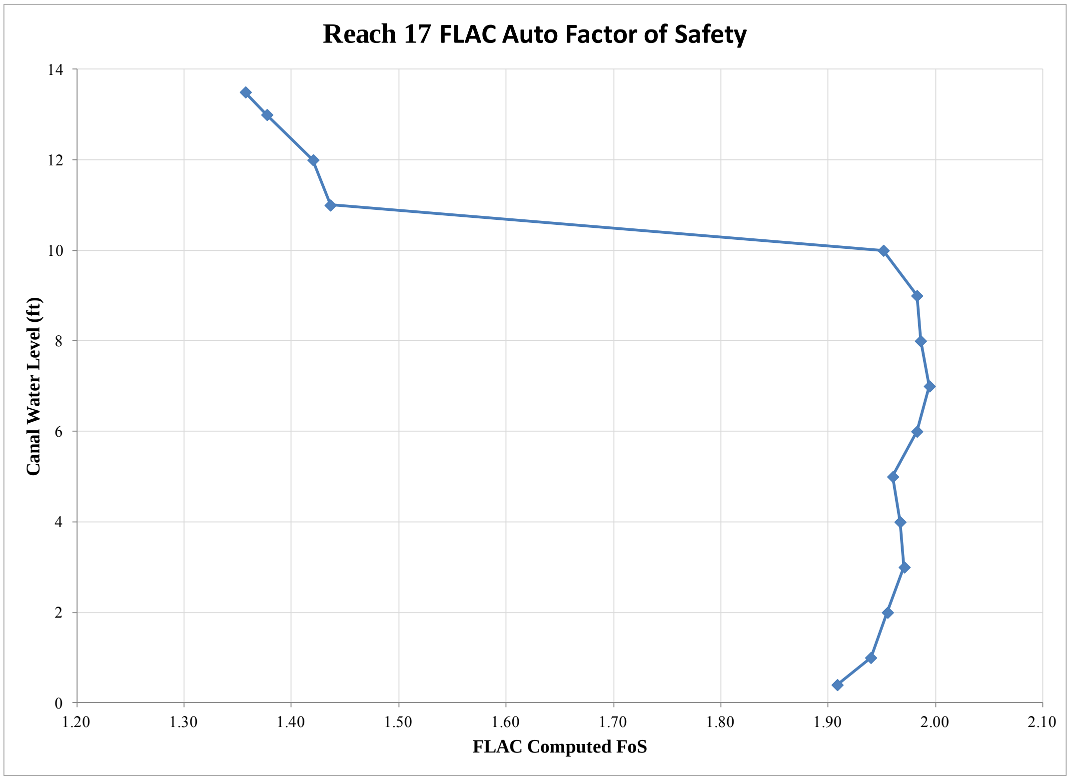


Figure D-7. FLAC computed factor of safety (automated c-ϕ reduction technique).

Table D-6. Summary of FLAC FoS and Controlling Failure Mode.

Canal WL (ft)	FLACAUTO FoS	Controlling Failure Mode
1	1.94	Global Stability
2	1.96	Global Stability
3	1.97	Global Stability
4	1.97	Global Stability
5	1.97	Global Stability
6	1.98	Global Stability
7	1.99	Global Stability
8	1.99	Global Stability
9	1.98	Global Stability
10	1.95	Global Stability
11	1.44	Global Stability
12	1.42	Global Stability
13	1.38	Global Stability
13.5	1.36	Global Stability

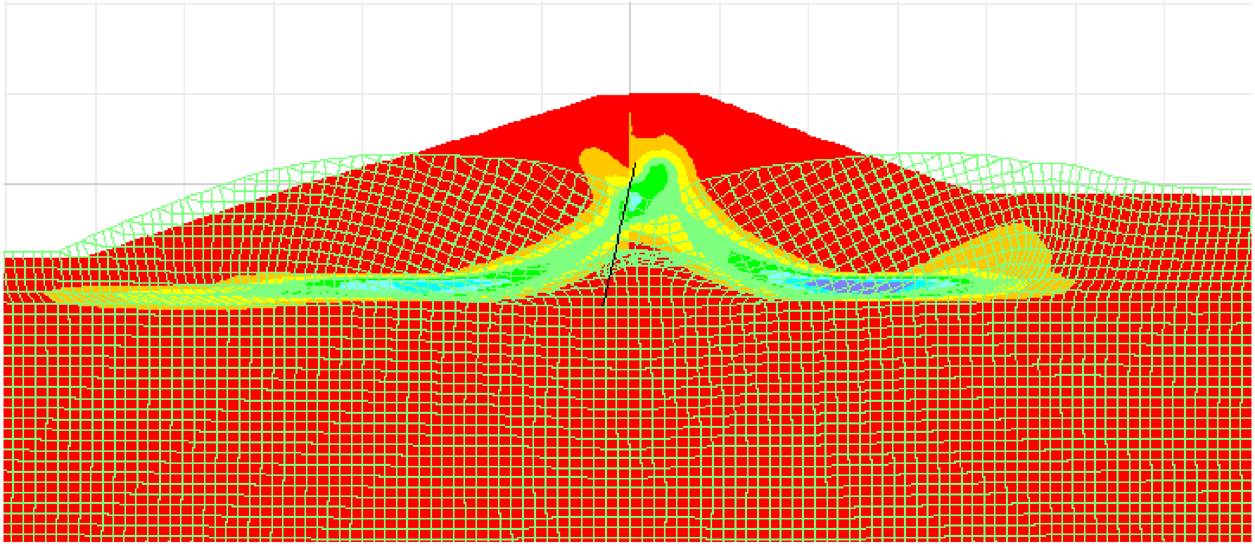


Figure D-8. WL+1 ft, FoS ssi and wall displacement magnified 60X.

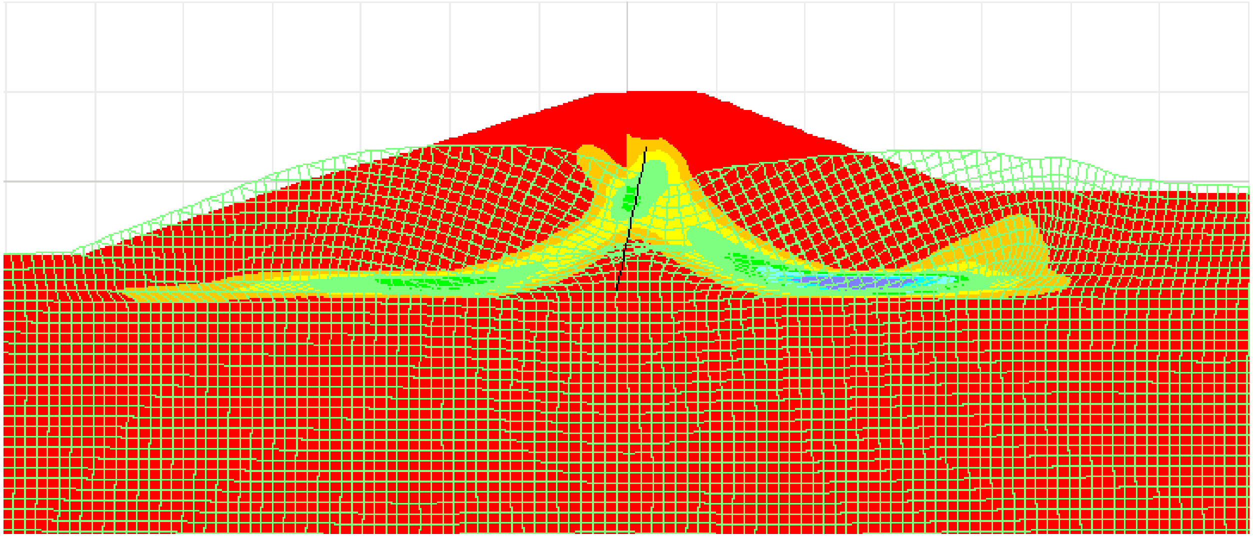


Figure D-9. WL+2 ft, FoS ssi and wall displacement magnified 60X.

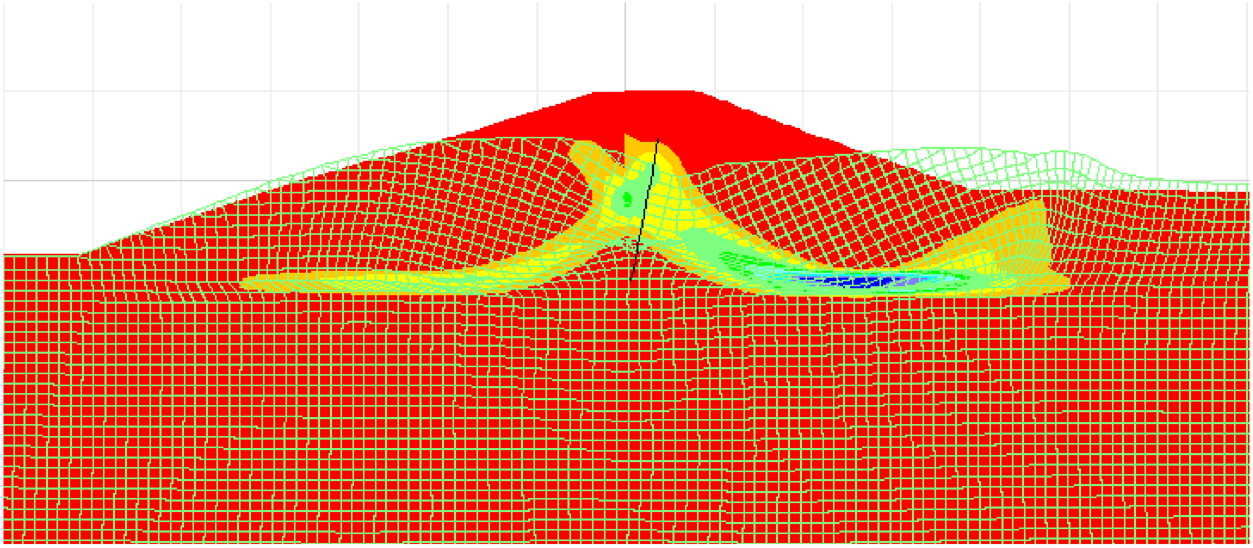


Figure D-10. WL+3 ft, FoS ssi and wall displacement magnified 60X.

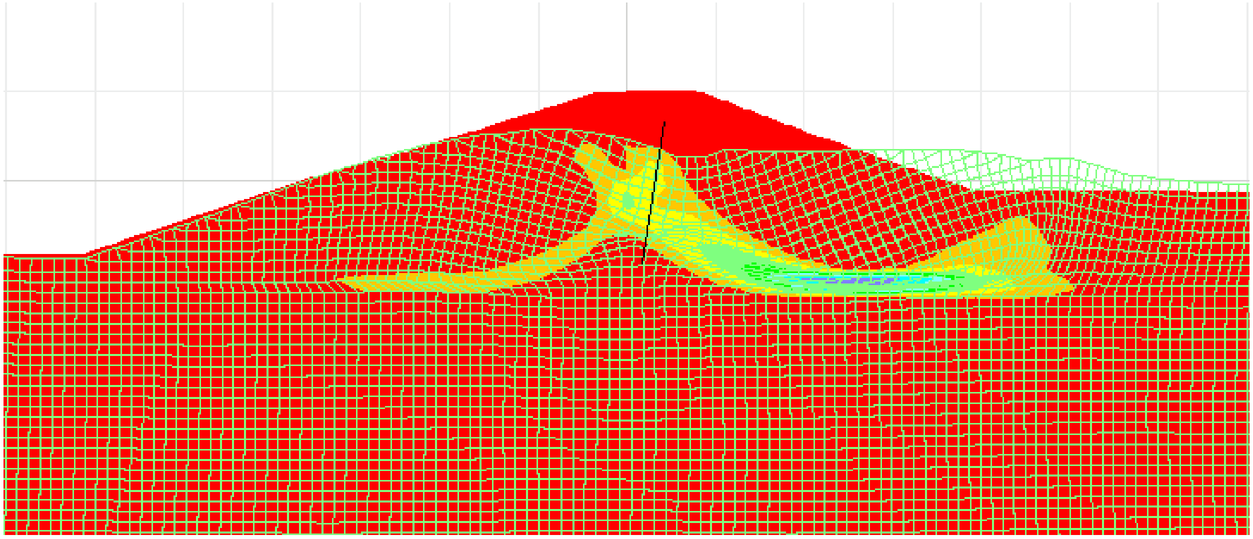


Figure D-11. WL+4 ft, FoS ssi and wall displacement magnified 60X.

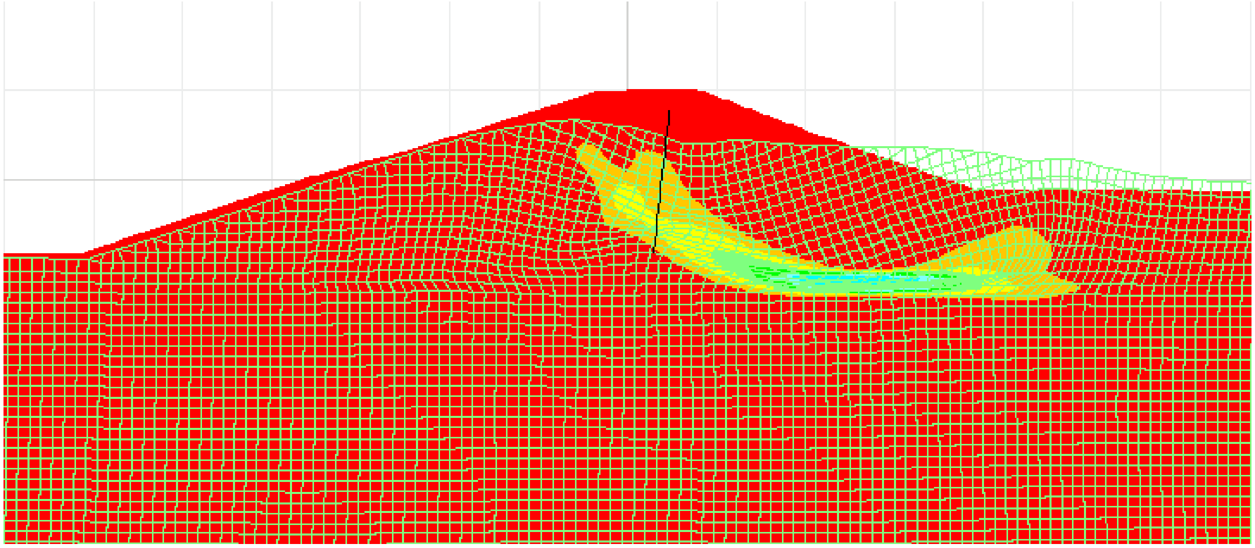


Figure D-12. WL+5 ft, FoS ssi and wall displacement magnified 60X.

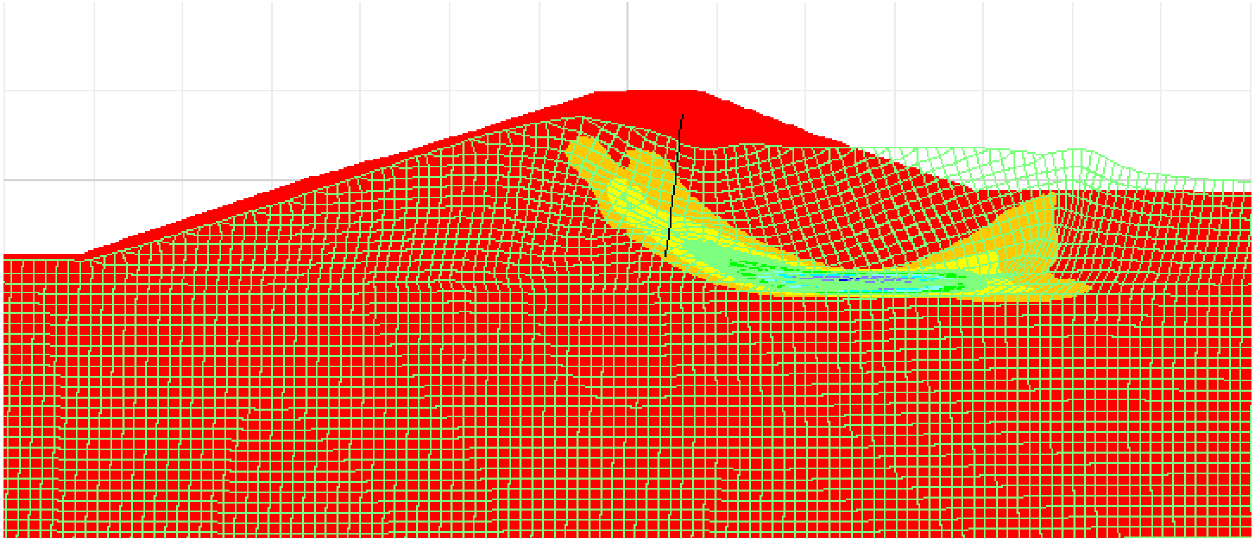


Figure D-13. WL+6 ft, FoS ssi and wall displacement magnified 60X.

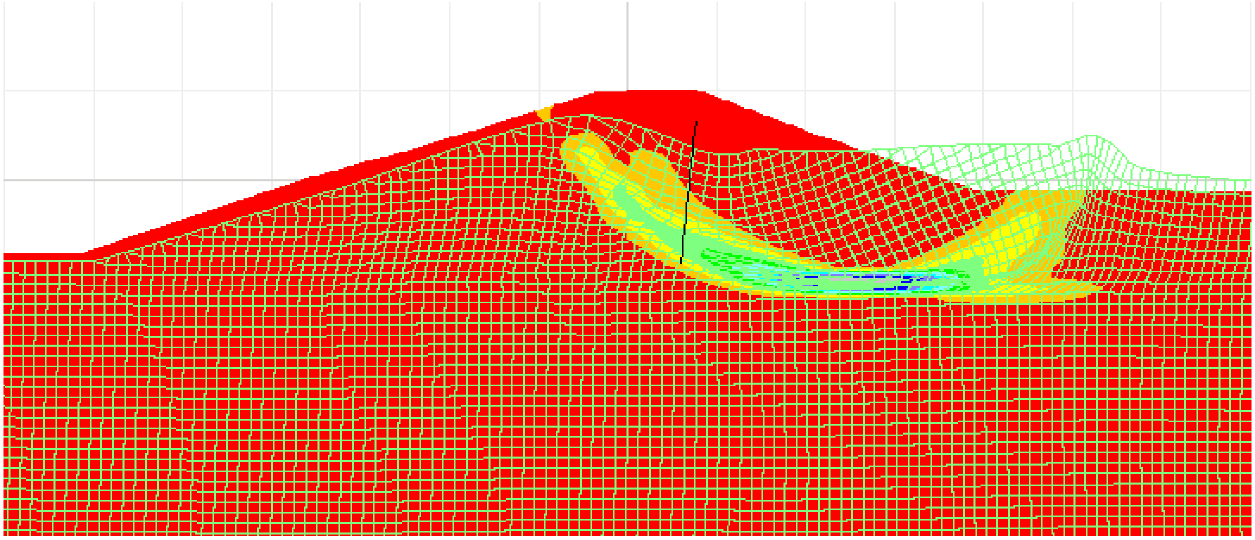


Figure D-14. WL+7 ft, FoS ssi and wall displacement magnified 60X.

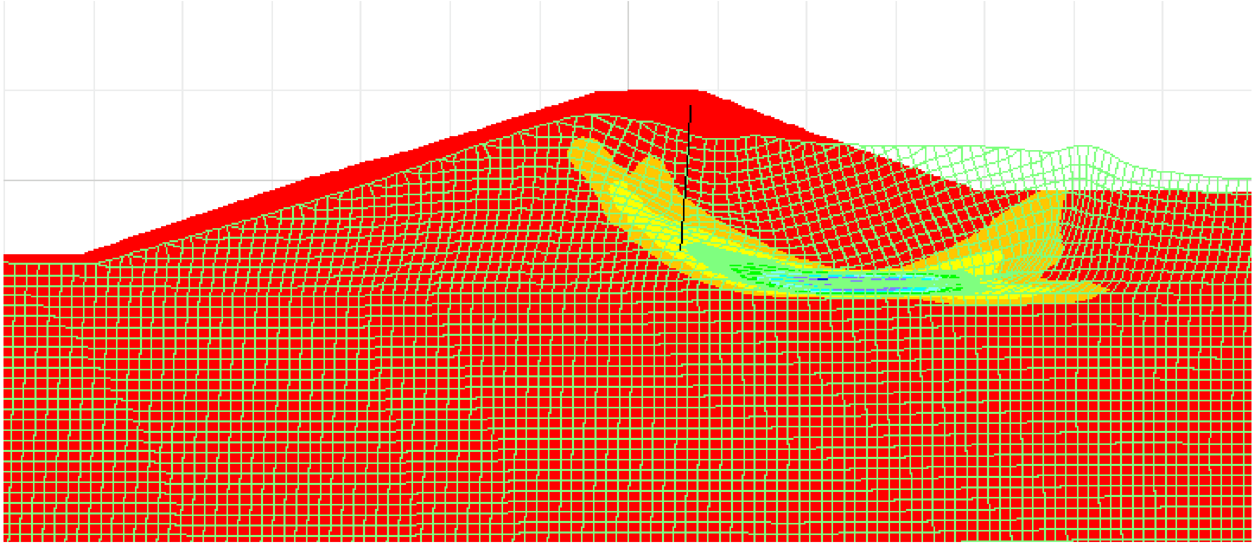


Figure D-15. WL+8 ft, FoS ssi and wall displacement magnified 60X.

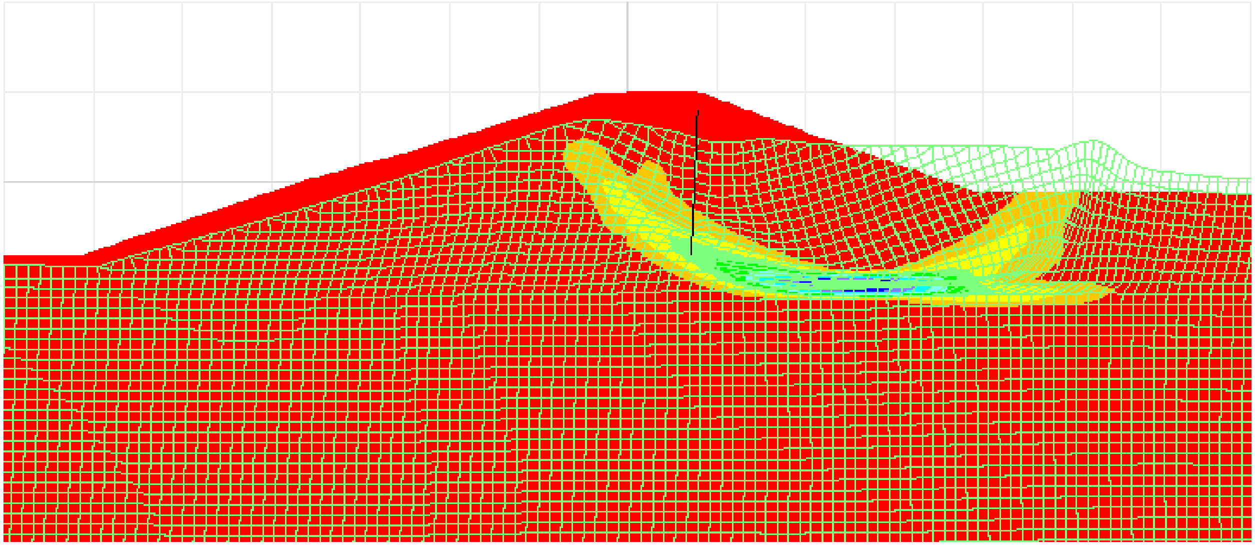


Figure D-16. WL+9 ft, FoS ssi and wall displacement magnified 60X.

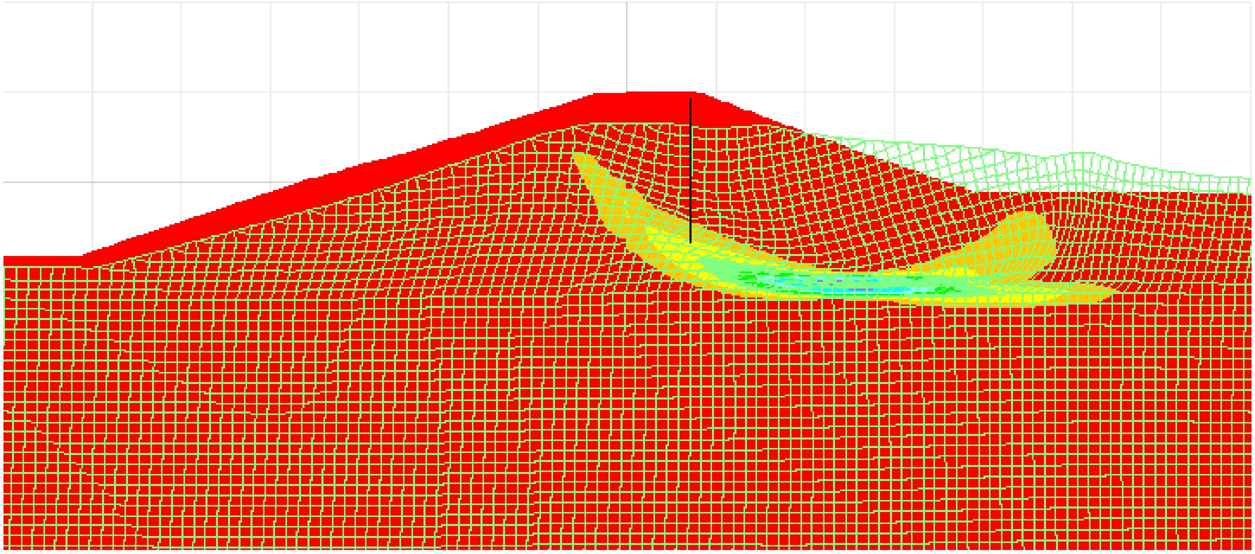


Figure D-17. WL+10 ft, FoS ssi and wall displacement magnified 60X.

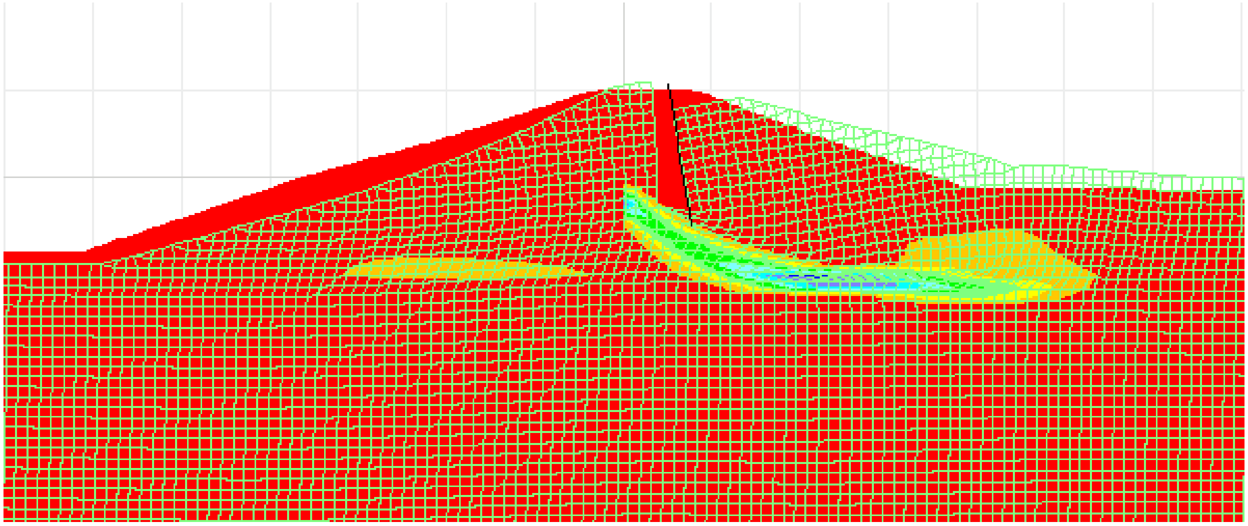


Figure D-18. WL+11 ft, FoS ssi and wall displacement magnified 60X.

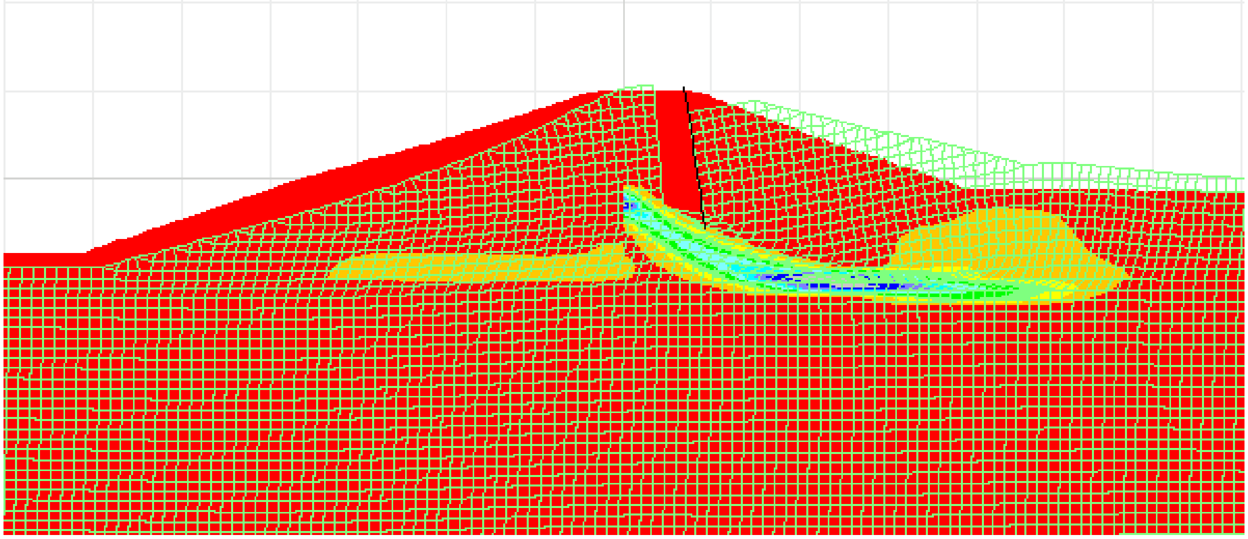


Figure D-19. WL+12 ft, FoS ssi and wall displacement magnified 60X.

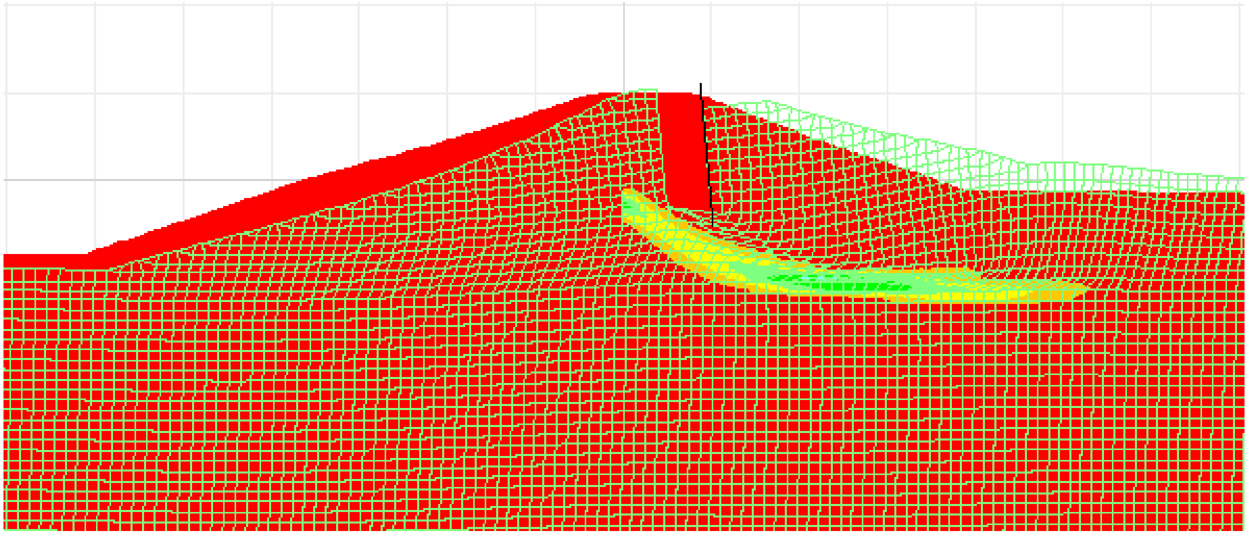


Figure D-20. WL+13 ft, FoS ssi and wall displacement magnified 60X.

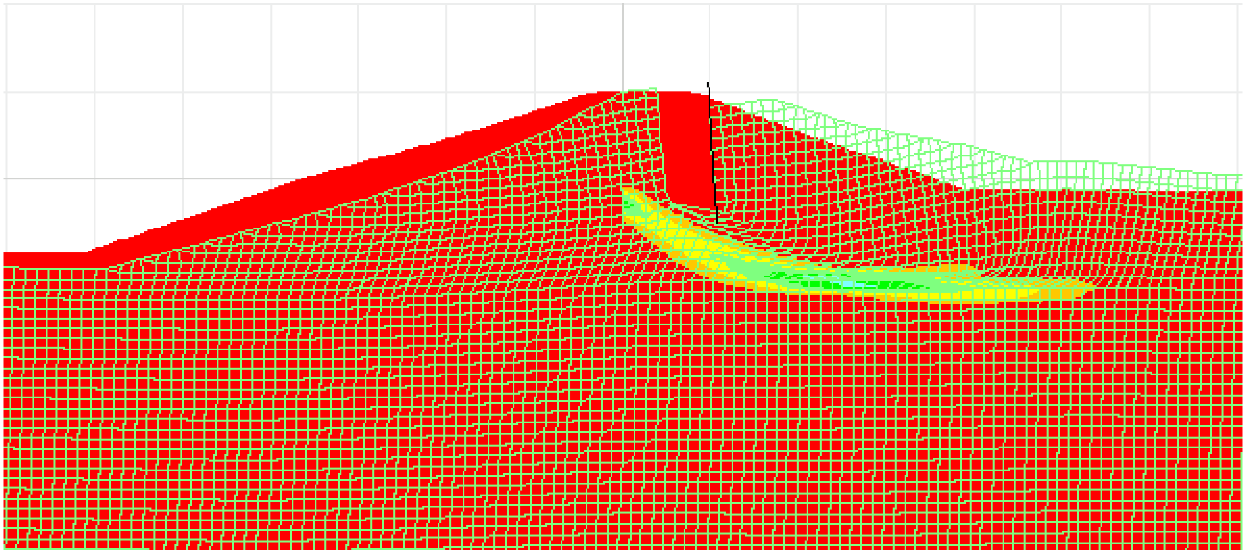
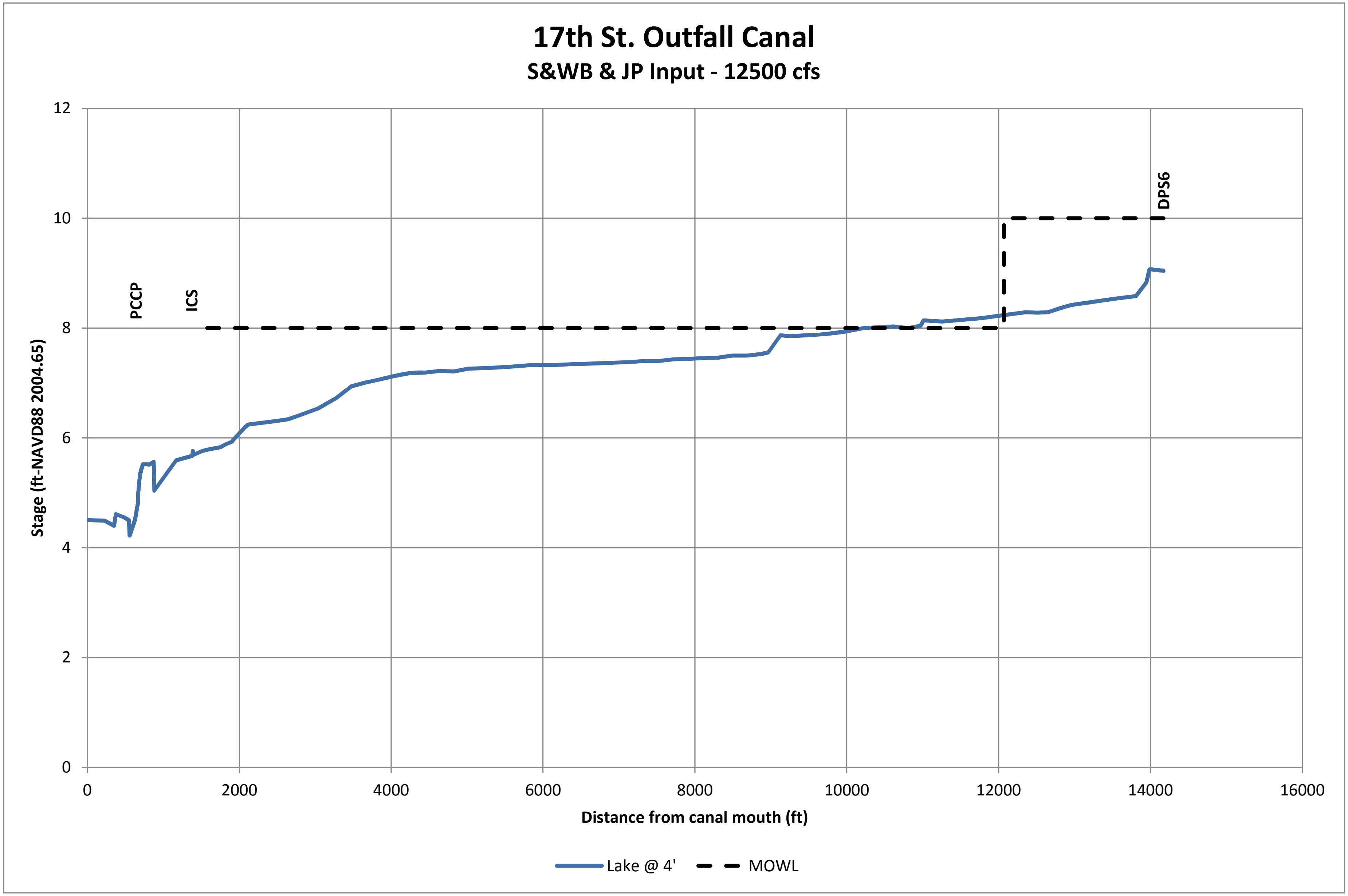


Figure D-21. WL+13.5 ft, FoS ssi and wall displacement magnified 60X.

Appendix G- Maximum Operating Water Level (MOWL) Data


17th St. Outfall Canal
S&WB & JP Input - 12500 cfs
Stage (ft-NAVD88 2004.65)
0
2
4
6
8
10
12
0
2000
4000
6000
8000
10000
12000
14000
16000
Distance from canal mouth (ft)
PCCP
ICS
DPS6
Lake @ 4'
MOWL

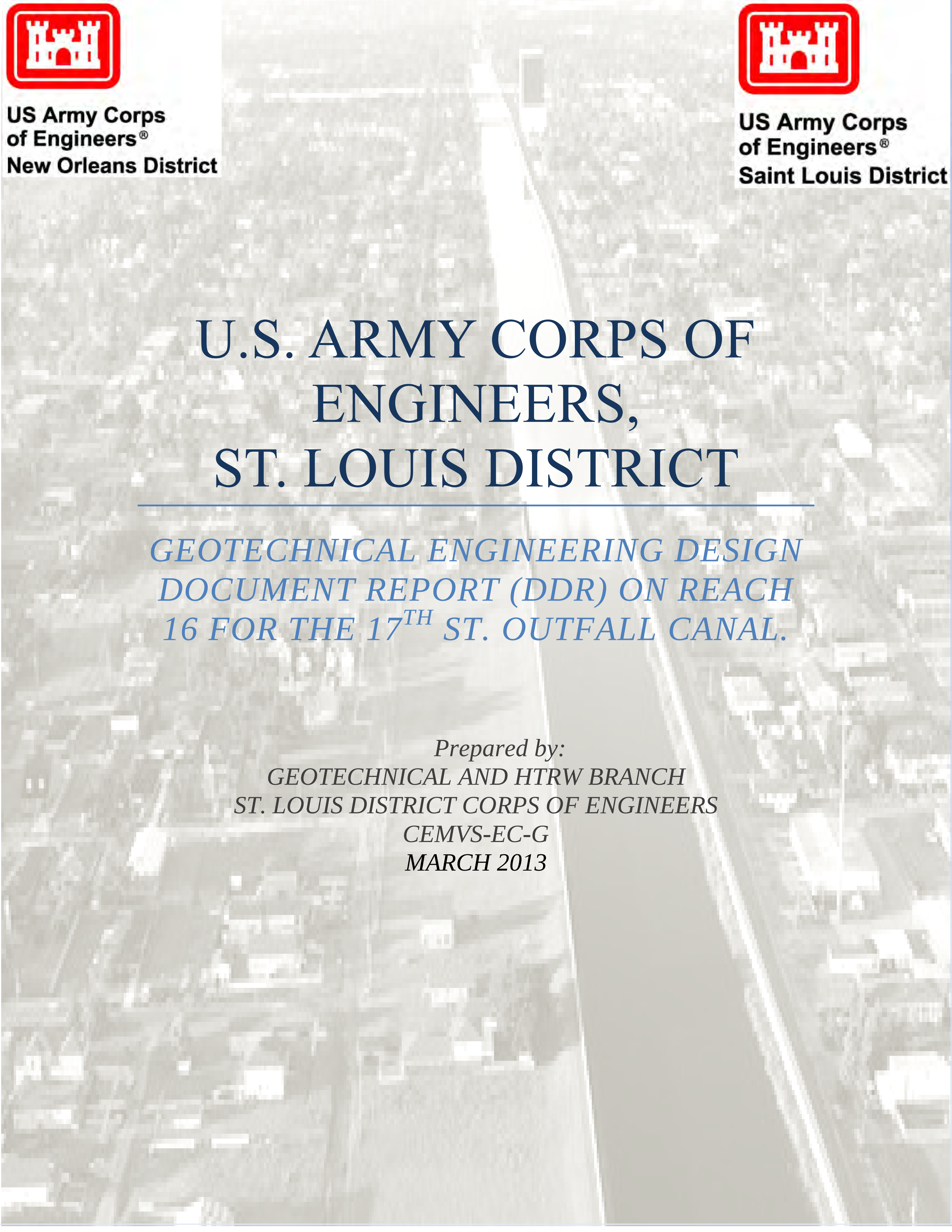
Hydraulic Information (Flowline)			Geotechnical Information		Geotechnical Information	
W.S. Elev. (ft)	W.S. Elev. + Uncertainty (ft)	Distance from DPS 6 (ft)	Distance from DPS 6 (East Side) (ft)	Reach	Distance from DPS 6 (West Side) (ft)	Reach
8.5	9.0	0.0				
8.6	9.1	9.7	237	35	364	18
8.6	9.1	19.5	1013		1000	
8.6	9.1	29.2	1013	34	1000	17
8.6	9.1	39.0	1500		1500	
8.6	9.1	48.7	1500	33	1500	16
8.6	9.1	58.4	2960		3115	
8.6	9.1	68.2	2960	32	3115	15B
8.6	9.1	77.9	3104		3521	
8.6	9.1	87.7	3104	31	3521	15A
8.6	9.1	97.4	3395		4365	
8.6	9.1	107.1	3395	30	4365	14
8.6	9.1	116.9	4131		5165	
8.6	9.1	126.6	4131	29	5165	13
8.6	9.1	136.4	4589		5465	
8.6	9.1	146.1	4589	28	5465	12
8.6	9.1	155.8	5116		5965	
8.6	9.1	165.6	5116	27	5965	11
8.6	9.1	175.3	5327		7260	
8.6	9.1	185.1	5327	26	7260	10
8.3	8.8	225.1	5819		7565	
8.1	8.6	363.1	5819	25	7565	9
8.0	8.5	613.1	6795		7995	
7.9	8.4	1213.1	6795	24	7995	8
7.9	8.4	1363.1	7752		8310	
7.8	8.3	1513.1	7752	23	8310	7
7.8	8.3	1663.1	8469		8605	
7.8	8.3	1813.1	8469	22	8605	6
7.7	8.2	2413.1	10546		9042.5	
7.6	8.1	2913.1	10546	21	9042.5	5
7.6	8.1	3158.1	11019		9320	
7.5	8.0	3199.7	11019	20	9320	4
7.5	8.0	3241.3	11671		9720	
7.5	8.0	3282.9	11671	19	9720	3B
7.5	8.0	3324.5	12098		9865	
7.5	8.0	3366.1			9865	3A
7.5	8.0	3559.1			10365	
7.5	8.0	3947.1			10365	2
7.5	8.0	4140.1			11495	
7.4	7.9	4333.1			11495	1
7.4	7.9	4526.1			11926.5	
7.4	7.9	4719.1				
7.4	7.9	4912.1				
7.4	7.9	5045.1				
7.1	7.6	5203.1				
7.0	7.5	5291.1				
7.0	7.5	5484.1				
7.0	7.5	5677.1				
7.0	7.5	5870.1				
7.0	7.5	6063.1				
6.9	7.4	6256.1				
6.9	7.4	6449.1				
6.9	7.4	6642.1				
6.9	7.4	6835.1				
6.9	7.4	7028.1				
6.9	7.4	7221.1				
6.9	7.4	7414.1				
6.9	7.4	7607.1				
6.8	7.3	7800.1				
6.8	7.3	7993.1				
6.8	7.3	8186.1				
6.8	7.3	8379.1				
6.8	7.3	8572.1				
6.8	7.3	8765.1				
6.8	7.3	8958.1				
6.8	7.3	9151.1				
6.7	7.2	9344.1				
6.7	7.2	9537.1				
6.7	7.2	9730.1				
6.7	7.2	9923.1				
6.6	7.1	10116.1				
6.6	7.1	10309.1				
6.5	7.0	10502.1				
6.4	6.9	10695.1				

Hydraulic Information (Flowline)			Geotechnical Information		Geotechnical Information	
W.S. Elev.	W.S. Elev. + Uncertainty	Distance from DPS 6	Distance from DPS 6 (East Side)	Reach	Distance from DPS 6 (West Side)	Reach
(ft)	(ft)	(ft)	(ft)		(ft)	
6.2	6.7	10898.1				
6.0	6.5	11141.1				
5.9	6.4	11399.1				
5.8	6.3	11527.1				
5.8	6.3	11720.1				
5.8	6.3	12013.1				
5.7	6.2	12056.1				
5.7	6.2	12064.3				
5.7	6.2	12072.6				
5.7	6.2	12080.8				
5.7	6.2	12089.1				
5.5	6.0	12254.1				
5.4	5.9	12264.1				
5.4	5.9	12355.1				
5.3	5.8	12422.1				
5.3	5.8	12537.1				
5.3	5.8	12569.1				
5.3	5.8	12659.1				
5.2	5.7	12779.1				
5.3	5.8	12784.1				
5.2	5.7	12790.1				
5.2	5.7	12796.1				
5.2	5.7	12802.1				
5.1	5.6	13002.1				
4.5	5.0	13291.1				
4.8	5.3	13293.6				
5.0	5.5	13296.1				
5.0	5.5	13298.6				
5.1	5.6	13301.1				
5.0	5.5	13361.1				
5.0	5.5	13381.1				
5.0	5.5	13401.1				
5.0	5.5	13421.1				
5.0	5.5	13441.1				
4.9	5.4	13461.1				
4.8	5.3	13481.1				
4.5	5.0	13501.1				
4.3	4.8	13506.1				
4.0	4.5	13546.1				
3.7	4.2	13616.1				
4.0	4.5	13626.1				
4.1	4.6	13686.1				
4.1	4.6	13796.1				
3.9	4.4	13821.1				
4.0	4.5	13943.1				
4.0	4.5	14121.1				
4.0	4.5	14171.1				

Appendix H – DDR Reach 16

US Army Corps
of Engineers®
New Orleans District

US Army Corps
of Engineers®
Saint Louis District



U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT

GEOTECHNICAL ENGINEERING DESIGN DOCUMENT REPORT (DDR) ON REACH 16 FOR THE 17TH ST. OUTFALL CANAL.

Prepared by:
GEOTECHNICAL AND HTRW BRANCH
ST. LOUIS DISTRICT CORPS OF ENGINEERS
CEMVS-EC-G
MARCH 2013

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Executive Summary

This Design Documentation Report (DDR) presents the geotechnical analyses, conclusions, and recommendations for the seepage remediation of Stations 641+85 to 658+00 (Reach 16) of 17th Street Canal. The seepage addendum June 2012, USACE-MVS showed that there are two isolated areas along Reach 16 with a factor of safety less than the USACE criteria of 1.6. In order to better define the stratigraphy of these two isolated areas, MVS requested additional geotechnical exploration and testing and completed additional seepages analyses. A total of fifteen new borings (17MVS-01PU to 08PU and 17MVS-01CU to 07CU) were drilled close to the existing drainage ditch and in the crown of the levee. The new borings were used to obtain more accurate unit weights, obtain sand gradations and fine content, determine top elevation for the Bay Sound Clay layer, and more accurately identify the soil stratification.

Due to the variation in ground surface elevation (GSE) on the protected side of the I-wall, low spots along the levee toe, and the existence of sandy silt strata within the fine grain blanket, reach 16 was divided in four sub-reaches. These sub-reaches include 16A (655+00 to 658+00), 16B (652+00 to 655+00), 16C (646+41 to 652+00), and 16D (641+85 to 646+41. Detailed seepage analyses were complete on each sub-reach at Stations 657+65, 653+37, 648+89, and 645+10 respectively. A summary of the results are provided on Table 1 and the permeability values used for the fine grain blanket and levee core are shown on Table 2. These values are from the USACE division regulation on soil mechanics design data number 1110-1-400 (DIVR-1110-1-400).

Of the total four I-wall levee sub-reaches analyzed, sub-reaches 16A, 16B, and 16C were recommended for remediation to achieve acceptable factors of safety for the target water level of El. +8.3 feet. (These water elevations are different than the previously used canal water elevations found in the seepage addendum (June 2012, USACE-MVS)) The recommendation would be to install a sheet pile cutoff wall to elevation -55.0 feet in sub-reaches 16A to 16C. This should include a 100 foot extension at each end to account for end effects. The limits of the sheet pile remediation including the 100 foot extension at each end are from Sta. 645+41 to Sta. 659+00 for a total length of 1359 feet.

Table 1 Summary of Factors of Safety for Seepage Analysis in Reach 16

Reach/Station	Factor of Safety without remediation	Factor of Safety with remediation
16A: Sta. 657+65	0.40[1]	n/a [1,3]
16B: Sta. 653+37	1.19[1]	n/a [1,3]
16C: Sta. 648+89	0.42[1]	6.31 [1]
16D: Sta. 645+10	2.55[2]	n/a

Note: 1 Water elevation in canal is EL. + 8.3 ft
2 Water elevation in canal is EL. + 8.2 ft
3 There is no excess head; therefore, the Factor of Safety is not applicable.

Table 2 : Permeability of Fine Grain Materials Used

Soil Type	Blanket Thickness (ft)	Suggested Design Values *kbl* (ft/sec)
Silty Sand	<5	3.28E-05
	5 to 10	2.62E-05
	>10	1.97E-05
Sand and Silty Sand	<5	1.64E-05
	5 to 10	1.31E-05
	10 to 15	9.80E-06
	>15	6.56E-06
Clay and Silty Clay	<5	1.31E-05
	5 to 10	9.80E-06
	10 to 15	4.92E+06
	15 to 20	1.64E-06
	>20	2.62E-07

Objective and Purpose

The purpose of this DDR is to document remediation work along the 17th St. Outfall Canal in Jefferson Parish, Louisiana. Remediation of Reach 16 is necessary to reduce the risk of a seepage failure. This area was identified in the reevaluation report dated March 2013.

Existing Reports

In addition to the B&V and URS reports, other major design reports published on this canal include:

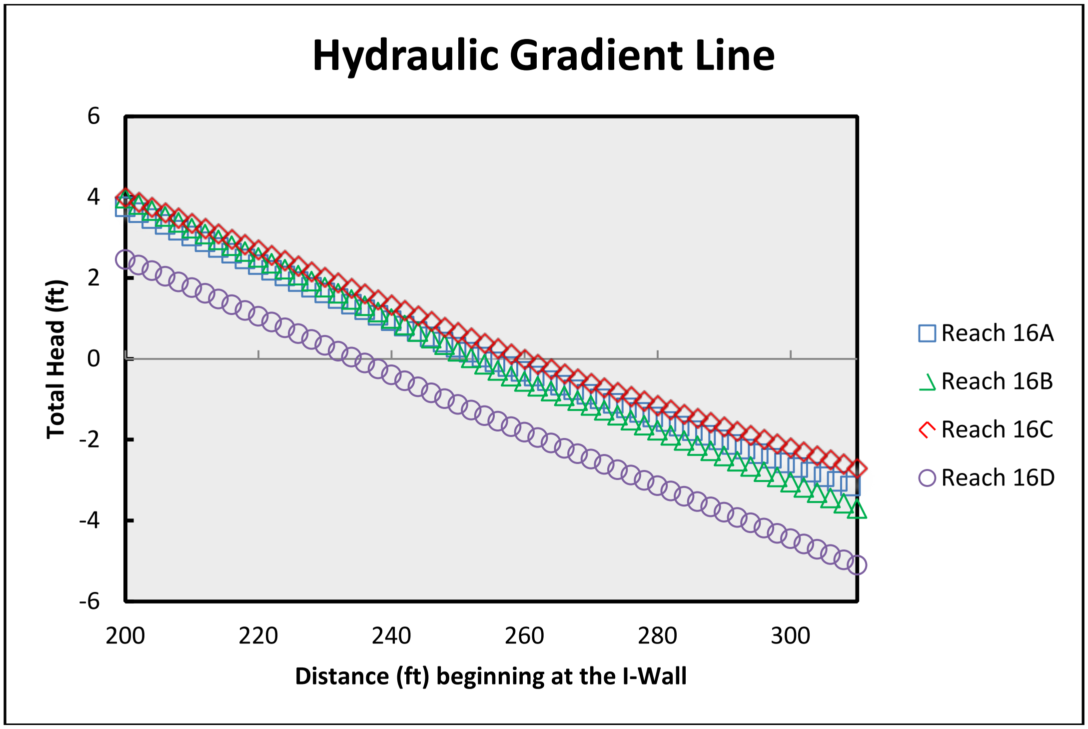
- Remediation of Floodwalls on the 17th Street Canal OFC-05, Design Documentation Report (DDR), dated February 2011.
- Seepage Addendum Geotechnical Engineering Report Remediation to Raise the Maximum Operating Level for the 17th Street Canal OFC-05, dated December 2010.
- Seepage Addendum 2 Geotechnical Engineering Report Remediation to Raise the Maximum Operating Level for the 17th Street Canal OFC-05 (Reach 16), dated September 2011.
- Geotechnical engineering seepage addendum on Reach 16 for the 17th St. Outfall canal, CEMVS-EC-G JUNE 2012

Seepage analysis

A factor of safety of at least 1.6 is required per Corps HSDRRS seepage criteria. The seepage factor of safety was calculated for two water elevations + 8.3 feet (sub-reach 16A, B and C) and + 8.2 feet (sub-reach 16D). These water elevations are different than the previously used canal water elevations found in the seepage addendum (June 2012, USACE-MVS) due to a change in the 17th Street Outfall Canal Maximum Operating Water Level (MOWL) profile in January, 2013.

The seepage analysis was completed using Geostudio's SEEP/W seepage software. The previous SEEP/W models analyzed in the seepage addendum (June 2012, USACE-MVS) were modified to include information obtained from the new exploration drilled at the center line and at the protected side toe of the I-wall. The new exploration confirmed the existence of a sandy layer within the blanket for sub-reaches 16A and 16C. The exploration also confirmed the presence of clean sand material within the core of the levee in sub-reaches 16A, 16B and 16C. In order for SEEP/W to match the newly acquired subsurface data, an average thickness per strata was used to model the blanket in the protected side and the clean sand material in the center line of the levee. The averaging of each sub-reach stratification can be found in appendix D. For the canal side of the levee boring A-17 was used to determine the extension of the clay cap, no averaging was required. The new hydraulic grade line or total head at the top of the aquifer was plotted from the results of each SEEP/W analysis and seen below in Table 2. Seepage gradients were calculated from the levee centerline to the lowest point in the drainage ditch, selected from survey points taken in 2011. The factor of safeties were calculated at the most critical point, which was also the lowest point within the drainage ditch, provided in Table 1 previously. The SEEP/W models are provided in appendix B.

Figure 1: Hydraulic Gradient Line



Conclusion

MVS has developed the following conclusions and remedial measures.

- The existing direct connection at the bottom of the canal along reach 16 increases the velocity vectors that concentrate at the landside ditch, resulting in high pore pressures and exit gradients in the ditch bottom.

- MVS chose to conservatively model the levee core as a SP for sub-reach 16A. The boring logs show the material close to the threshold for a SP which is 10% fine material. The fine content in the sand layer within the levee core has values of 12.2%, 18.1% and 10.4% (17MVS-O6CU, Samples 3C-2, 4A: 17MVS-07CU, Sample 5B-2). MVS feels since the entire sand layer is close to the threshold it can be easily pressurized by the high pore pressures caused by the open connection in the canal. Also, the fine content encountered in protected side sand layer is below 10%. In order to keep geological profile continuity the same sand material that was encountered in the protected side was assumed to exist in the levee core.

- Sub-reach 16B has an existing factor of safety much closer to the required 1.6 and could be repaired by adding material to the protected side slope and ditch. The sheetpile solutions recommended for reaches 16A and 16C would have to be substantially extended into reach 16B to ensure 3-D end effects were accounted for. After considering these required extensions, and in order to maintain continuity with the seepage remediation for sub-reach 16A and 16C, MVS decided to extend the sheet pile wall along the entirety of sub-reach 16B.

- An existing storm drain collector pipe exists along the protected side levee toe in reach 16. Without remediation, high canal water levels will create high piezometric pressures in the foundation of the collector pipe. The condition of the collector pipe is unknown. If a flaw exists in the pipe, (poorly compacted zone along the pipe; or deteriorated metal), the excess piezometric pressures will initiate seepage flow through into the pipe through the deteriorated metal. This in turn can erode the foundation soils, moving them into the pipe’s interior. If uncontrolled, this internal erosion can end up as uncontrolled seepage.

- Therefore, sub-reaches 16A, 16B and 16C are recommended for remediation to achieve acceptable factors of safety for the target water level of El. +8.3. The method of remediation for seepage for these sub-reaches is to install sheet piling five feet off-center of the existing I-wall, towards the protected side, penetrating five feet into the underlying Bay Sound Clay until a tip elevation of -55.0 feet. Sub-reach 16D is not deficient for the seepage stability analyses.

- The sheet pile cutoff wall will included 16A, 16B, and 16C extending from sta. 645+41 to sta. 659+00 to include a 100 foot extension at each end to account for “end-effects” i.e. underseepage being diverted around the ends of the wall.

Appendix A: Boring Data


Legend
● 2013 Borings
● 2012 Borings
● Old Borings
▲ Vane Shear Tests
↔ Reach 16 Subreaches
CANAL ST
CANAL ST
MANDARIN ST
LEMON ST
SIDNEY ST
LAKE AVE
GREENMOUNT DR
LOCUST ST
17MVS-08PU
4-MUG
B7
3-M17C9VS
18-MKG
17-MKG
14-MKG
17MVS-07PU
15-MKG
13-MKG
17MVS-06PU
17MVS-07CU
B9
17MVS-06CU
660+00
17MVS-05PU
17MVS-09PU
17MVS-05CU
11GC-17
Reach 16A
9GC-17
655+00
10GC-17
8GC-17
B11
17MVS-04CU
12-MKG
11-MKG
10-MKG
17MVS-04PU
Reach 16B
17MVS-03CU
9-MKG
8-MKG
17MVS-03PU
7-MKG
6-MKG
5-MKG
4-MKG
B13
17MVS-02CU
650+00
17MVS-01CU
3-M17C8VS
2-MKG
3-MKG
17MVS-02PU
16-MKTU
I-10
Reach 16C
B15
1-MKG
3-MUW
17MVS-01PU
645+00
16-MKCU
B17
Reach 16D
B8
B10
B12
3-M17T15VS
B14
B16
15-MKCU
B18
15-MKTU
4-MUE
BELLAIRE DR
COUNTRY CLUB DR
PONTCHARTRAIN EXPY
I-610
I-610
0
60
120
240
360
Feet

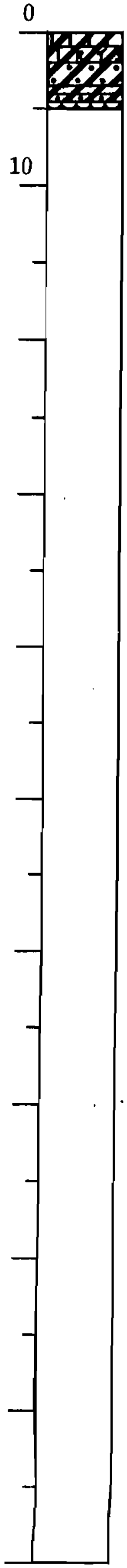
LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Sewerage & Water Board of New Orleans
Metairie Relief Canal, Station 617+50 to Station 663+00
Orleans and Jefferson Parishes, Louisiana
For: Modjeski and Masters, Consulting Engineers, New Orleans, Louisiana

Boring No. A-17 **Soil Technician** Bruce Gerosa **Date** 20 July 1983
Ground Elev. 23.75 (est.) **Datum** C.D. **Gr. Water Depth** 20.75 (est.)

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
1	0.0	1.0	0.0	1.0	Stiff brown & gray silty clay w/clayey		
					silt layers		
2	1.0	2.0	1.0	2.0	Soft brown & gray clay w/silt & decayed		
					roots		
3	2.0	3.0	2.0		Soft gray sandy clay		
4	3.0	3.5		3.5	Soft gray sandy clay w/sand layers		
5	3.5	4.0	3.5	4.0	Medium stiff gray clay		
6	4.0	4.5	4.0	4.5	Soft gray & brown clay w/sand layers		
					& organic matter		
7	4.5	5.0	4.5	5.0	Soft brown humus		



*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

CLAY	SILT	SAND	HUMUS
▨	▥	⠿	≋

Predominant type shown heavy. Modifying type shown light.

Remarks: Boring located on Jefferson Side at Approximately Station 643+00. Approximately 35' from ℄ of Levee on the Canal Side

Enc. 7

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

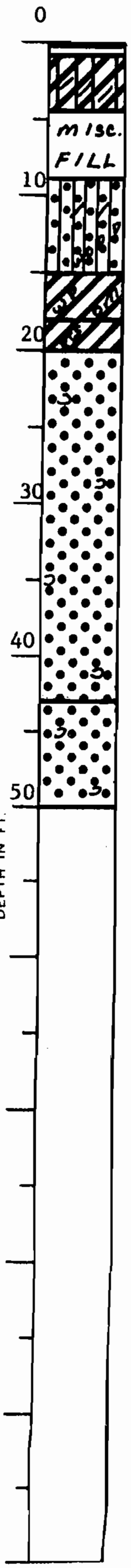
Name of Project: Sewerage & Water Board of New Orleans
Metairie Relief Canal, Station 554+00 to Station 670+00
Orleans and Jefferson Parishes, Louisiana

For: Modjeski and Masters, Inc., Consulting Engineers, New Orleans, Louisiana

Boring No. 11 Soil Technician A. J. Mayeux Date 25 May 1981

Ground Elev. 33 (Est.) Datum Cairo Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
			0.0	0.3	Asphalt		
			0.3	.75	Fill		
1	2.0	2.5	.75	4.5	Stiff gray & tan silty clay w/clay		
					layers		
	5.0	5.5	4.5		Miscellaneous fill (Bricks, glass, sand,		
					clay & etc.)		
2	8.0	8.5		9.0	Ditto		
3	9.0	10.5	9.0		Loose tan silty sand w/some clay	2	4
4	11.5	13.0		15.0	Loose tan silty sand w/some wood	1	4
5	15.0	16.5	15.0	18.0	Soft gray clay w/wood & organic matter	1	4
6	19.0	19.5	18.0	20.0	Medium stiff gray & tan clay w/roots		
7	20.0	21.5	20.0		Very dense gray sand w/shell fragments	10	50=10"
8	23.5	25.0			Ditto	11	50=8"
9	28.5	30.0			Ditto	11	50=8"
10	33.5	35.0			Ditto	12	50=8"
11	38.5	40.0		43.0	Ditto	13	50=8"
12	43.5	45.0	43.0		Dense gray sand w/shell fragments	9	33
13	48.5	50.0		50.0	Ditto	7	32



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CLAY	SILT	SAND	HUMUS
▨	▥	⁘	≋

Predominant type shown heavy. Modifying type shown light.

Remarks: Boring located on Westside of canal @ Sta. No. 652+50 in crown of levee.

Fig. 16

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Sewerage & Water Board of New Orleans
Metairie Relief Canal, Station 554+00 to Station 670+00
Orleans and Jefferson Parishes, Louisiana

For: Modjeski and Masters, Inc., Consulting Engineers, New Orleans, Louisiana

Boring No. 13 Soil Technician R. Courtiade Date 25 May 1981

Ground Elev. 33 (Est.) Datum Cairo Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
			0.0	0.3	Asphalt		
1	2.0	2.5	0.3		Stiff gray & tan clay w/clayey silt		
					layers, brick & shell fragments		
2	5.0	5.5		6.5	Stiff gray & tan clay w/shell & brick		
					fragments & glass		
3	8.0	8.5	6.5	10.0	Stiff gray & tan clay w/clayey silt		
					lenses		
4	10.5	11.0	10.0		Loose tan sand		
5	12.0	13.5			Ditto	2	5
6	14.5	16.0		17.0	Ditto	2	7
7	17.0	18.5	17.0		Wood	3	13
8	19.5	20.0		20.5	Wood w/large roots & sandy clay		
9	21.0	22.5	20.5		Very dense gray sand	5	50=7"
10	23.5	25.0		26.5	Ditto	31	20=2"
11	28.5	30.0	26.5	31.5	Dense gray sand	12	48
12	33.5	35.0	31.5	37.0	Very dense gray sand	52=12"(Seat)	
13	38.5	40.0	37.0		Dense gray sand w/shell fragments	12	32
14	43.5	44.0			Dense gray sand	13	35
15	48.5	50.0		50.0	Dense gray sand w/clay pockets & shell	17	45
					fragments		

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

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CLAY	SILT	SAND	HUMUS
▨	▥	⁙	≋

Remarks: Boring located on Westside of canal @ Sta. No. 649+00 in crown of levee.

Predominant type shown heavy. Modifying type shown light.

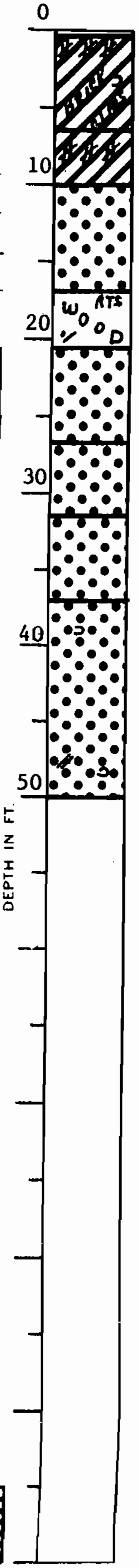


Fig. 18

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

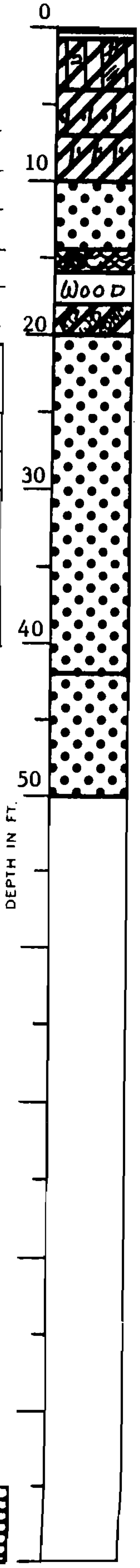
Name of Project: Sewerage & Water Board of New Orleans
Metairie Relief Canal, Station 554+00 to Station 670+00
Orleans and Jefferson Parishes, Louisiana

For: Modjeski and Masters, Inc., Consulting Engineers, New Orleans, Louisiana

Boring No. 15 Soil Technician George Hardee Date 29 May 1981

Ground Elev. 33 (Est.) Datum Cairo Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
			0.0	0.2	Asphalt w/shells		
			0.2	0.6	Loose tan silty sand		
1	1.5	2.5	0.6	4.0	Medium stiff brown silty clay w/shells,		
					clayey silt & clay pockets		
2	4.5	5.5	4.0	7.0	Medium stiff gray & brown clay w/sandy		
					silt layers		
3	7.5	8.5	7.0	10.0	Stiff gray & brown clay w/silty sand		
					lenses		
4	11.0	11.5	10.0		Loose tan & gray sand		
5	11.5	13.0		14.5	Ditto	2	6
6	14.0	15.5	14.5	16.0	Medium stiff dark gray organic clay	2	4
					w/roots & humus pockets		
			16.0	18.0	Wood		
7	19.5	20.0	18.0	20.0	Medium stiff gray clay w/roots, wood &		
					concretions		
8	20.0	21.5	20.0		Very dense gray sand	11	50=10"
9	22.5	24.0			Ditto	14	50=11"
10	25.5	27.0			Ditto	27	50=7"
11	28.5	30.0			Ditto	14	50=11"
12	33.5	35.0			Ditto	20	50=7"
13	38.5	40.0		42.0	Ditto	15	50=10"
14	43.5	45.0	42.0		Dense gray sand	12	35
15	48.5	50.0		50.0	Ditto	12	38



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CLAY	SILT	SAND	HUMUS
▨	▥	⁘	≋

Predominant type shown heavy. Modifying type shown light.

Remarks: Boring located on Westside of canal @ Sta.
No. 645+50 in crown of levee.

Fig. 20

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE LA.

Name of Project: Sewerage & Water Board of New Orleans
Metairie Relief Canal, Station 554+00 to Station 670+00
Orleans and Jefferson Parishes, Louisiana
For: Modjeski and Masters, Inc., Consulting Engineers, New Orleans, Louisiana
Boring No. 17 Soil Technician A. J. Mayeux Date 26 May 1981
Ground Elev. 31 (Est.) Datum Cairo Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
			0.0	0.3	Asphalt		
			0.3	1.0	Fill		
1	2.0	2.5	1.0	4.0	Medium stiff gray & tan clay w/sand		
					lenses, pockets & roots		
2	5.0	5.5	4.0	7.5	Stiff gray & tan silty clay w/shell		
					fragments		
3	8.0	8.5	7.5	10.0	Miscellaneous fill (clay, sandy clay,		
					sand, gravel, bricks & etc.)		
4	11.5	13.0	10.0	15.5	Loose tan silty sand	2	5
5	15.0	16.5	15.5	16.5	Loose tan sand w/clay & wood	2	4
6	17.5	18.0	16.5	18.5	Medium stiff gray clay w/wood, organic		
					matter & roots		
7	18.5	20.0	18.5	21.0	Medium dense gray sand w/wood	3	19
8	21.0	22.5	21.0	23.5	Dense gray sand w/shell fragments	8	37
9	23.5	25.0	23.5	27.0	Very dense gray sand w/shell fragments	10	50=8"
10	28.5	30.0	27.0	33.5	Dense gray sand	5	42
11	33.5	35.0	33.5	38.0	Very dense gray sand	7	50=8"
12	38.5	40.0	38.0		Medium dense gray sand w/shell	5	12
					fragments & clay layers		
13	43.5	45.0			Ditto	6	17
14	48.5	50.0		50.0	Ditto	7	22

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

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Remarks: Boring located on Westside of canal @ Sta.
No. 642+00 in crown of levee.

CLAY	SILT	SAND	HUMUS
▨	▥	⁘	≋

Predominant type shown heavy. Modifying type shown light.

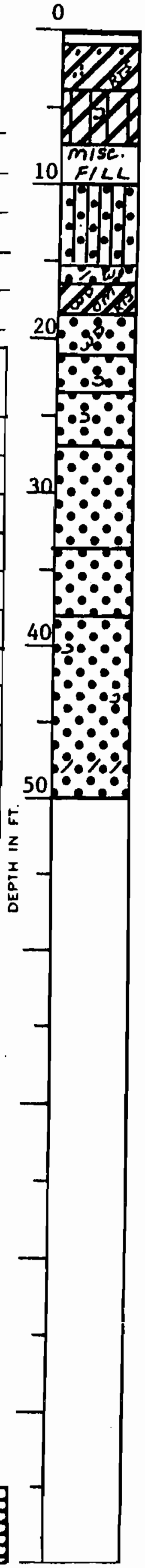


Fig. 22

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Sewerage & Water Board of New Orleans
Metairie Relief Canal, Station 554+00 to Station 670+00
Orleans and Jefferson Parishes, Louisiana

For: Modjeski and Masters, Inc., Consulting Engineers, New Orleans, Louisiana

Boring No. 7 Soil Technician George Hardee Date 28 May 1981

Ground Elev. 33 (Est.) Datum Cairo Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
			0.0	0.2	Asphalt w/shells		
			0.2	0.7	Loose tan silty sand		
1	1.5	2.5	0.7	4.0	Medium compact brown clayey silt with		
					gravel		
2	4.5	5.5	4.0	7.0	Stiff brown silty clay w/shells & clayey		
					silt pockets		
3	7.5	8.5	7.0	10.0	Medium stiff tan & gray clay w/clayey		
					sand layers & pockets		
4	10.5	11.5	10.0	12.0	Medium stiff gray & tan clay with		
					concretions		
5	13.5	14.5	12.0	15.0	Soft tan & gray clay w/sand pockets,		
					shells & gravel		
6	15.0	16.5	15.0	17.0	Medium dense tan & gray sand w/clay	1	14
					pockets		
7	17.5	19.0	17.0		Medium stiff gray & tan clay w/sand	1	5
					pockets & roots		
8	19.5	20.5		20.5	Ditto		
9	20.5	22.0	20.5	23.0	Dense gray sand	4	47
10	23.0	24.5	23.0	25.0	Very dense gray sand	21	50=10"
11	25.5	27.0	25.0		Dense gray sand	13	48
12	28.5	30.0			Ditto	15	49
13	33.5	35.0		38.0	Ditto	12	46
14	38.5	40.0	38.0		Very dense gray sand w/shell fragments	21	50=9"
15	43.5	45.0		47.0	Very dense gray sand	15	53
16	48.5	50.0	47.0	50.0	Medium dense gray sand w/silt	6	23

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located on Westside of canal @ Sta. No. 659+50 in crown of levee.

CLAY	SILT	SAND	HUMUS
▨	▥	⁘	≋

Predominant type shown heavy. Modifying type shown light.

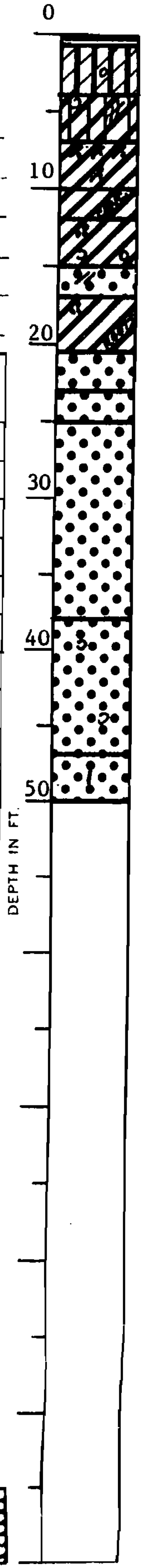


Fig. 12

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Sewerage & Water Board of New Orleans
Metairie Relief Canal, Station 554+00 to Station 670+00
Orleans and Jefferson Parishes, Louisiana

For: Modjeski and Masters, Inc., Consulting Engineers, New Orleans, Louisiana

Boring No. 9 Soil Technician R. Courtiade Date 25 May 1981

Ground Elev. 33 (Est.) Datum Cairo Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
			0.0	0.3	Asphalt		
1	2.0	2.5	0.3	3.5	Compact gray & tan clayey silt w/clay		
					layers		
2	5.0	5.5	3.5	6.0	Medium stiff gray & tan clay w/shell		
					& brick fragments		
3	6.5	8.0	6.0	8.5	Miscellaneous fill (cinders, gravel,	9	28
					lignite, glass, clayey silt & clay		
					layers)		
4	9.0	10.5	8.5	11.0	Loose tan silty sand w/clay layers &	5	8
					some gravel		
5	11.5	13.0	11.0	13.5	Very loose tan silty sand w/few clay	2=	18"(Seat)
					pockets, shells & gravel		
6	14.0	15.5	13.5	17.0	Loose tan silty sand w/organic clay	1	5
					layers		
7	17.5	18.0	17.0	19.0	Wood		
8	19.0	20.5	19.0		Very dense gray sand	7	54
9	23.5	23.5			Ditto	50	=8"(Seat)
10	28.5	30.0			Ditto	22	51
11	33.5	35.0			Ditto	50	=9"(Seat)
12	38.5	40.0			Very dense gray sand w/a layer of shell	50	=9"(Seat)
					fragments		
13	43.5	45.0		46.5	Very dense gray sand	50	=7"(Seat)
14	48.5	50.0	46.5	50.0	Very dense gray silty sand	25	52

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

CLAY	SILT	SAND	HUMUS
▨	▥	⁘	≋

Predominant type shown heavy. Modifying type shown light.

Remarks: Boring located on Westside of canal @ Sta.
No. 656+00 in crown of levee.

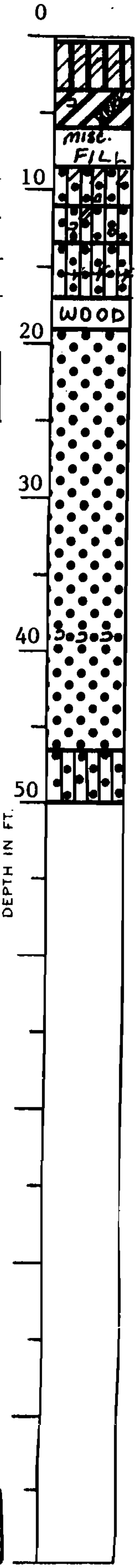


Fig. 14

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING#17 MVS - 01 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA. N 545356.05 E 3663618.73

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.** 9.97

SAMPLE NO 1

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
0.0																					
A			0.0	2.6	28		CH SIS	ST	BR	OX RT SIF											
1.0			677	133.8	29		CH 2	ST	BR	LNS LG E ARS ML OX RT ORG STKS SIF											103.4
B			618	144.9	26																115.2
2.0																					
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 1 OF 10 SHEETS

LMN Form 721 Revised May. 2010

0-3

FOR UNDISTURBED SAMPLES ONLY	17th Street Canal Reevaluation	LABORATORY BORING LOG	(1),(3),(4) **LOCATION:**	SAMPLE NO
	Job No. 13-082B	(2) **BORING#17 MVS - 01 CU**	(1)ZZ	2
		(5) **Water Table**	(3)STA.	
			(6) **DATE TAKEN** 02/17/13 (8) **G.S.E.**	

DEPTH & SUB SAMP. 3.0	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A		1	2.6	3.6	43	3.6	CH SIS	ST	BR	RT OX											
			263	106.5	43		CH 3	ST	BR	LNS LGE ARS ML RT OX ORG STKS											73.7
		2	3.6	4.4	42	4.4	CL SIS	M	BR	OX RT											
4.0			344	128.0	38		CL 36	M	BR	LNS ARS ML OX, RT ORG STKS BRICK GLASS DEBRIS											925
B		1																			
			339	124.1	45																85.67
		2																			
			4.4	5.4	37	5.4	CH SIS	ST	BR	OX RT											
5.0			410	151.1	33		CH 22	ST	BR	LNS ARS ML OX RT ORG STKS BRICK GLASS DEBRIS											113.7
C		1																			
			661	147.7	40																105.3
		2																			
			5.4	7.0	27	7.0	CL SIS	ST	DBR	OX RT WD											
6.0			371	120.4	27		CL 14	M	DBR	LNS ARS ML OX RT RTS ORG STKS GLASS BRICK DEBRIS											950
D																					

CLASSIFIER MJ   RECORDER TSL   CHECKER TSL   DATA ANALYZED 2/19/13   SHEET 2 OF 10 SHEETS

LMN Form 721 Revised May. 2010

3 - 7

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#1 MVS - 01 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.**

SAMPLE NO 3

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
7.0 A			7.0	7.5	31		SM		BR GR												
7.5			560	197.2	31		SM		BR GR	LYSCH											150.1
B	SV		7.5	8.5	20	8.5	SM		LBR	OX						1270				94.6	
			631	166.7	20		SM		LBR	LYSCH OX ORG STKS											138.6
8.5 C		1	8.5	9.2	31	9.2	CH SS	M	GR BR	OX											
		1	404	130.3	31		CH 2	M	GR BR	LYSARSSM OX ORG STKS											99.7
		2	9.2	11.0	24		SM		BR	OX											
9.5		2	70	162.0	24		SM		BR	LYSCH OX ORG STKS											130.9
D																					

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 3 OF 10 SHEETS

LMN Form 721 Revised May. 2010

7' - 11'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING#17 MVS - 01 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.**

SAMPLE NO 4

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
11.0																					
A			407	158.4	26																126.1
11.6																					
B	SV		11.0	13.2	26	13.2	SM		LBR	CS WD										77.8	
			290	144.5	26		SM		LBR	ARS CH DW											115.1
12.6																					
C		1	452	132.2	26																105.3
		2	13.2	13.6	170	13.6	WD														
			117	111.5	170		WD														41.3
13.6																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 4 OF 10 SHEETS

LMN Form 721 Revised May. 2010

11'-15'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 01 CU

(5) Water Table

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.**

SAMPLE NO 5

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
15.0																					
A			13.6	14.0	96		CH SIS	VSO	GR	RT WD											
			29	141.7	96		CH 14	VSO	GR	LNS ARS ML RT RTS DW ORG STKS											72.3
16.0																					
B			16.0	17.0	73		CH SIS	SO	GR	RT WD											
			382	130.4	73		CH 14	SO	GR	LNS ARS ML RT DW											75.2
17.0																					
C			17.0	18.0	58		CH SIS	M	BR	RT WD											
			401	151.6	58		CH 3	M	BR	LNS ARS ML RT RTS DW ORG STKS											96.1
18.0																					
D			18.0	19.0	70		CH SIS	M	GR	RT WD											
			641	164.0	70		CH 4	M	GR	LNS ARS ML RT DW ORG STKS											96.4
19.0																					

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 5 OF 10 SHEETS

LMN Form 721 Revised May. 2010

15'-19'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 **MVS - 01 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.**

SAMPLE NO 6

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	SAMPLE DEPTHS WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
19.0																					
A			19.0	20.0	54	20.0	CH SIS	M	BR	OX RT WD											
			593	153.8	54		CH 3	M	BR	LNSARS ML OX RT RTS ORG STKS											100.0
20.0																					
B			20.0	21.0	26	21.0	SM		BR GR	O WD											
			431	169.81	26		SM		BR GR	Org. MTR. IAN											134.7
21.0		SM																			
C			21.0	23.0	198	22.0	WD	SS	DBR												
			569	071.2	198		WD		DBR	LYSSM											23.9
22.0		SM																			
D																					

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 6 OF 10 SHEETS

LMN Form 721 Revised May. 2010

19'-23'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#17 MVS - 01 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.**

SAMPLE NO 7 to 13

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS		WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT		D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
			PAN NO.	WET WT.										L.L.	P.L.						
		7	23.0	25.5	23		SP F		GR	RT OX	48										
			509	237.7	23		SP		GR	RT OX											193.0
A	SV	8	25.5	28.0	22		SP F		GR	RT OX	77					1190				96.4	
			561	193.9	22		SP		GR	RT OX											159.5
		9	28.0	29.5	22	29.5	SP F		GR	OX SIF	115										
			541	191.4	22		SP		GR	OX SLF(FEW)											157.0
			29.5	33.0		33.0	NS														
B	SV	10	33.0	34.5	22	34.5	SP F		GR	SIF OX	87					1100				95.5	
			209	220.1	22		SP		GR	SLF OX											180.2
			34.5	38.0		38.0	NS														
		11	38.0	39.5	21	39.5	SP F		GR	SIF OY	61										
			612	179.9	21		SP		GR	SIF OX											149.3
C			39.5	43.0		43.0	NS														
	SV	12	43.0	44.5	22	44.5	SM		GR	CS SIF OX	18									88.7	
			110	192.7	22		SM		GR	APSCH SLF OX											157.5
			44.5	48.0		48.0	NS														
D		13	48.0	49.5	22	49.5	SM		GR	OX SIF	73										
			548	243.9	22		SM		GR	OX SLF(FEW)											200.3
			49.5	53.0		53.0	NS														

CLASSIFIER MJ RECORDER TSL CHECKER TL DATA ANALYZED 2/19/13 SHEET 7 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 01 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.**

SAMPLE NO 14 & 15

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A	SV	14	53.0	54.5	28	54.5	SM		GR	CS SIF OX	17									88.5	
			599	228.5	28		SM		GR	ARSCH SLF OX											178.0
			54.5	58.0		58.0	NS														
		15	58.0	59.5	55	59.5	CH SISSO		GNG	OX SIF	3										
			09	121.7	55		CH 2	SO	GNGR	LNS LGE ARS ML OX SLF (FEW)											78.6
B																					
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 8 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#17 MVS - 01 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13 (8) **G.S.E.**

SAMPLE NO 16

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
59.5																					
A			59.5	60.5	53		CH SIS	SO	GNG	OX SIF SI											
			800	116.2	53		CH 22	SO	GNGR	LNS LGE ARS ML OX SLF SI											76.1
60.5																					
B			60.5	63.5	45		CH SIS	M	GNG	OX SIF SI											
			154	110.8	46		CH 22	M	GNGR	LNS LGE ARS ML OX SLF SI											76.1
61.5																					
C			248	107.3	43																75.0
62.5																					
D		1	451	95.8	45																66.3
		2																			
63.5			114	84.3	47		CH 33	M	GNGR	LNS LGE ARS ML OX SLF ORG STKS											57.3

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 9 OF 10 SHEETS

LMN Form 721 Revised May. 2010

59.5'-63.5'

Street Canal Reevaluation

LABORATORY BORING LOG

STURBED SAMPLES ONLY

Job No. 13-082B

(2) BORING#17 MVS - 01 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/17/13

(8) **G.S.E.**

SAMPLE NO 17

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	SAMPLE DEPTHS WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
63.5 A			322	132.9	51																88.3
64.0																					
B			63.5	67.5	51	67.5	CH SIS	M	GR	OX SI SIF											
65.0			350	128.5	51		CH 3	M	GR	LNSLYSML OX SI SLF											85.4
C			356	134.7	46																92.4
66.0																					
D			585	98.7	55																63.6
67.0																					

CLASSIFIER MJ RECORDER TSL CHECKER TSL DATA ANALYZED 2/19/13 SHEET 10 OF 10 SHEETS

LMN Form 721 Revised May. 2010

63.5' - 67.5

Complete Log

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17MVS - 02 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA. N 545206.38 E 3663609.24

(6) **DATE TAKEN** 02/19/13

(8) **G.S.E.** 10.26

SAMPLE NO 1

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	 P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
0.0		1	0.0	0.4	35	0.4	CH SIS	ST	BR	OX RT											
			155	94.8	35		CH2	ST	BR	LNS LGE ARS ML OX RT SPKS DW											70.4
A																					
		2	0.4	1.4	25	1.4	CL SIS	VST	BR	RT WD SIF OX											
1.0			617	82.8	26		CL6	VST	BR	LNS ARS ML RT RTS SIF OX ORG STKS											65.6
		1	48	94.5	23		CL5		BR	LNS LGE ARS ML OX RT ORG STKS											76.9
B																					
		2	1.4	3.0	24		CH SIS	VST	BR	OX											
2.0			395	125.1	24		CH3	VST	BR	LNS LGE ARS ML SPKS DW OX											100.7
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/20/13 SHEET 1 OF 6 SHEETS

LMN Form 721 Revised May. 2010

0'-3'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING#1 MVS - 02 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/19/13

(8) **G.S.E.**

SAMPLE NO 2

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
3.0																					
A			3.0	4.0	47		CH SIS	M	LBRGR	OX WD											
			32	93.5	47		CH3	M	LBRGR	LNS ARS ML OX DW ORG STKS											63.7
3.8																					
B																					
			4.0	7.0	37	7.0	CH SIS	ST	LBRGR	OX WD											
48			118	87.8	41		CH3	ST	LBRGR	LNS ARS ML OX DW ORG STKS BRICK DEBRIS											62.2
C			206	93.6	36																68.8
58																					
D			349	110.0	34																82.0
6.8																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/20/13 SHEET 2 OF 6 SHEETS

LMN Form 721 Revised May. 2010

3'-7'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# MVS - 02 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/19/13 (8) **G.S.E.**

SAMPLE NO 3

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
7.0																					
A	DISTURBED		7.0	7.7	63	7.7	CL SS	VSO	BR	SI SI FRT OX											
			764	191.6	63		CL6	VSO	BR	LNSARSSM: SI SLF RT OX *DEBRIS*											117.3
7.7																					
B	SV		7.7	11.0	20		SM		LBRGR	CS OX										68.8	
			332	147.7	22		SM		LBR GR	LNS LYSARS CH OX ORG STKS											121.3
8.7		CH																			
C			292	175.2	18		[illegible]		LBR [illegible]	LNS [illegible]											149.1
9.7																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/20/13 SHEET 3 OF 6 SHEETS

LMN Form 721 Revised May. 2010

7'-11

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 02 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/19/13

(8) **G.S.E.**

SAMPLE NO 4

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
10																					
115			199	213.6	24					DEBRIS IN SAMPLE (A)											172.0
B	SV		11·0	12·5	25	12·5	SM		T	CS OX										77·8	
			684	165·7	26		SM		T	ARSLNSCH OX ORG STKS											131.4
125																					
C			12·5	15·0		15·0	NS														
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/20/13 SHEET 4 OF 6 SHEETS

LMN Form 721 Revised May. 2010

11'-15'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#17 MVS - 02 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/19/13

(8) **G.S.E.**

SAMPLE NO 5

DEPTH & SUB SAMP. 15.0	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A			489	79.9	64																48.6
16.0																					
B			15.0	19.0	52	19.0	CH SIS	M	GNG	RT WD SS											
			144	128.3	51		CH4	M	GNGR	LNSLGEARSML RT ORGSTKS DW LYR SM											84.9
17.0																					
C			305	131.7	42																92.5
18.0		SM																			
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/20/13 SHEET 5 OF 6 SHEETS

LMN Form 721 Revised May. 2010

15'-19'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#17 MVS - 02 CU**

(5) Water Table

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/19/13

(8) **G.S.E.**

SAMPLE NO PB6 to PB 11

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSIS-TENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A	SV	6	19.0	20.5	23		SP F		GR	RT	33					1400				97.4	
			397	200.5	23		SP		GR	RTS											163.1
		7	20.5	22.0	23		SP F		GR	OX	58										
			198	202.9	23		SP		GR	OX											165.0
	SV	8	22.0	23.5	21		SP F		LBRGR	OX WD O	52					1640				97.2	
			C193	248.6	21		SP		LBRGR	OX RTS ORG MTR											205.1
B	SV	9	23.5	25.0	22		SP F		GR	OX O	71										
			251	229.9	22		SP		GR	OX ORG MTR											188.1
		10	25.0	26.5	23		SP F		GR	OX O SIF	122					1290				97.6	
			699	184.6	23		SP		GR	OX ORG MTR SLF											150.5
		11	26.5	28.0	21	28.0	SP F		GR	OX O SIF	156										
			694	254.3	21		SP		GR	OX ORG MTR SLF											210.8
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/20/13 SHEET 6 OF 6 SHEETS

LMN Form 721 Revised May. 2010

* Complete Log*

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 03 CU**

(5) Water Table

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA. N 545057.27 E 3663599.51

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.** 10.39

SAMPLE NO 1

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSIS-TENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
0.0																					
A			0.0	2.0	31		CH	SIS	ST BR	OX SI SIF RT NP											
			213	201.6	31		CH 2		ST BR	LNS LG CARS ML OX SI SIF RT RTS											153.8
1.0																					
B																					
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/16/13 SHEET 1 OF 11 SHEETS

LMN Form 721 Revised May. 2010

0-2

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 03 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 2

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
2.0		1	2.0	2.5	37	2.5	CH SIS	ST	BR	OX											
			412	133.8	37		CH 2	ST	BR	LNS LGE ARS ML OX SPKS DW											97.7
A																					
		2																			
3.0			647	163.4	39		CL 4	ST	BR												118.0
		1	2.5	3.6	39	3.6	CL SIS	M	BR	OX SIF											
			588	153.0	38		CL K6	M	BR	LNS LGE ARS ML OX SLF SPKS DW											111.3
B																					
		2	3.6	4.0	53	4.0	CH SIS	M	BR	OX SIF SI											
4.0			475	119.4	53		CH 3	M	BR	LNS LGE ARS ML OX SLF SPKS DW SI											78.1
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/16/13 SHEET 2 OF 11 SHEETS

LMN Form 721 Revised May. 2010

2'-4'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#17 MVS - 03 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 3

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	 P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
4.0																					
A			4.0	4.8	32	4.8	CL SIS	M	GR BR	SI SIF OX RT WD											
			133	173.6	32		CL 6	M	GR BR	LNS LGE ARS ML SI SIF OX RT RTS											131.9
4.8																					
B		1	4.8	5.3	43	5.3	CH SIS	ST	GR	OX SIF SI											
			372	[illegible]	43		CH 2	ST	GR	LNS LGE ARS ML OX SPKS DW SIF SI ORG STKS											89.9
		2	5.3	7.0	27	7.0	CL SIS	ST	BR GR	OX SIF SI											
5.8			158	196.4	27		CL 6	ST	BR GR	LNS LGE ARS ML OX SPKS DW SIF SI ORG STKS											154.2
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/16/13 SHEET 3 OF 11 SHEETS

LMN Form 721 Revised May. 2010

4'-7'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 03 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 4

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS		WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT		D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
			PAN NO.	WET WT.										L.L.	P.L.						
7.0																					
A			7.0	8.4	41	8.4	CL SS	VSO	BR	SIF RT											
			215	193.2	43		CL 4	VSO	BR	LJS LYS SM SLF RT ORG STKS											138.2
8.0																					
B		1	624	214.8	38																155.4
	OC SV	2	8.4	9.0	20	9.0	SM		BR	CS SI SIF									1.2	87.0	
9.0			28	216.4	20		SM		BR	AZS CH SI SLF											179.9
C			9.0	9.6	21	9.6	CL SS	SO	BR	OX SIF											
			581	220.2	21		CL 4	SO	BR	LNS LGE ARS SM OX SLF											182.8
D			9.6	10.5	7	10.5	SM		BR	SIF											
			443	204.5	7		SM		BR	SLF											191.6

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/19/13 SHEET 4 OF 11 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING#[redacted] **MVS - 03 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 5

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
11.0																					
A																					
			10.5	11.6	29	11.6	SI			CS											
11.6			700	261.3	29		SI			ARSCL											202.2
B	SV		11.6	13.0	24		SP	F	T							1280				95.4	
			750	205.0	26		SP		T												1624
12.6																					
C		GRAB SAMPLE	13.0	15.0	21	15.0	SP	F	BR	WD											
			323	265.3	21		SP		BR	RTS											219.5
D																					

CLASSIFIER MJ RECORDER TSL CHECKER DATA ANALYZED 2/16/13 SHEET 5 OF 11 SHEETS

LMN Form 721 Revised May. 2010

11'-15'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 03 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 6

DRY WEIGHT

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
15.0 A			15.0	15.6	54	15.6	CH SS	SO	GNG	OX WD RT											
15.6			578	139.0	54		CH 2	SO	GNGR	LNS LGE ARS SM OX ORG STKS RTS RT											90.2
B		1	15.6	16.1	39	16.1	CL SS	M	GNG	OX											
			84	164.0	39		CL H	SM	GNGR	LNS LGE ARS SM OX ORG STKS SPKS DW											110.9
							C	ST	GNG												
		2	16.1	16.6	51	16.6	CH SS	M	GNG	OX											
16.6			201	138.3	51		CH 2	M	GNGR	LNS LG EARS SM OX SPKS DW ORG STKS DW											91.5
C	5V		16.6	18.0	27		SP F		GR							1370				99.0	
17.6			900	194.9	27		SP		GR												1540
D																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/16/13 SHEET 6 OF 11 SHEETS

LMN Form 721 Revised May. 2010

15' - 18'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 03 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 7

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A	SL		18.0	19.0	35		SP	F	GR	ND SIF						1170				95.6	
			531	243.9	35		SP		GR	RTS SIF											181.3
B																					
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/16/13 SHEET 7 OF 11 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

LABORATORY BORING LOG

Job No. 13-082B

(2) BORING# 17 MVS - 03 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 8 to 15

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
	SV	8	19.0	21.5	22		SP F		GR	OX	36					.1250				97.2	
			425	264.5	22		SP		GR	OX											217.3
A		9	21.5	24.0	22		SP F		LGR	OX	86										
			107	292.9	22		SP		LGR	OX											239.5
		10	24.0	26.5	24		SP F		GR		68										
			678	228.8	24		SP		GR												184.2
	SV	11	26.5	28.0	23		SP F		GR	SIF	88					.1300				96.6	
			404	218.8	23		SP		GR	SLF											177.8
B		12	28.0	29.5	18	29.5	SP F		GR	SIF	122										
			040	237.7	18		SP		GR	SLF											200.8
			29.5	33.0		33.0	NS														
			S-1																		
		13	33.0	34.5	20	34.5	SP F		GR	SIF	98										
			54	245.2	20		SP		GR	SLF											204.6
C			34.5	38.0		38.0	NS														
	SV	14	38.0	39.5	24	39.5	SM		GR	SIF OX	75					.0802				91.7	
			214	231.5	24		SM		GR	SLF OX											186.2
			39.5	43.0		43.0	NS														
D		15	43.0	44.5	28	44.5	SM		GR	SIF OX	33										
			159	232.2	28		SM		GR	SLF OX											182.1
			44.5	48.0		48.0	NS														

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/19/13 SHEET 8 OF 11 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY	17th Street Canal Reevaluation Job No. 13-082B	**LABORATORY BORING LOG** **(2) BORING# 17 MVS - 03 CU** (5) **Water Table**	(1),(3),(4) **LOCATION:** (1)ZZ (3)STA.	SAMPLE NO 16, 17, 18
			(6) **DATE TAKEN** 02/16/13 (8) **G.S.E.**	

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSIS-TENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	 P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
	SV	16	48.0	49.5	21	49.5	SM		GR	SIF OX	66					.0759				90.5	
			C189	225.8	21		SM		GR	SLF OX											187.2
A			49.5	53.0		53.0	NS														
	SV	17	53.0	54.5	21	54.5	SM		GR	SIF OX	47					.1030				94.3	
			[illegible]	275.0	21		SM		GR	SLF OX											227.2
			54.5	58.0		58.0	NS														
B		18	58.0	59.5	45	59.5	CH SS	M	GR	SIF	8										
			[illegible]	[illegible]	45		CH 22	SM	GR	LNS LGE ARS SH SLF (FEW)											102.8
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/19/13 SHEET 9 OF 11 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# MVS - 03 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13

(8) **G.S.E.**

SAMPLE NO 19

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
59.5 A																					
			59.5	60.0	48		CH SIS	VSO	GNG	OX SIF											
60.0			559	133.7	48		CH 2	VSO	GNGR	LNS LYS ML OX SLF											90.5
B			293	153.1	50																102.1
61.0																					
C			60.0	63.0	47		CH SIS	M	GNG	OX SIF											
			249	117.3	49		CH 3	M	GNGR	LNS LYS ML OX SLF											78.7
62.0																					
D			412	113.5	43																79.3
63.0																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/19/13 SHEET 10 OF 11 SHEETS

LMN Form 721 Revised May. 2010

59.5'-63'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 03 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ________

(3)STA.________

(6) **DATE TAKEN** 02/16/13 (8) **G.S.E.**________

SAMPLE NO 20

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	SAMPLE DEPTHS WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
63.0																					
A			63.0	64.0	54		CH SIS	M	GR	OX SI SIF											
			685	122.1	54		CH 4	M	GR 1	LNSARSML OX SI SLF											79.4
64.0																					
B			64.0	67.0	46	67.0	CH SIS	ST	GR	OX SI SIF											
			640	132.3	46		CH 4	ST	GR	LNSARSML OX SI SLF											90.6
65.0																					
C			479	99.4	44																69.0
66.0																					
D			329	99.7	49																66.9
67.0																					

CLASSIFIER MJ RECORDER TSL CHECKER DD DATA ANALYZED 2/19/13 SHEET 11 OF 11 SHEETS

LMN Form 721 Revised May. 2010

63'-67

Complete Log

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 04 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA. N 544907.06 E 3663588.86

(6) **DATE TAKEN** 02/14/13

(8) **G.S.E.** 10.38

SAMPLE NO 1

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
0.0																					
A			0.0	1.0	26	1.0	CH SIS	ST	BR	CC SI SIF RT											
			235	61.4	26		CH 2	ST	BR	LNS LGE ARS ML CC SI SIF RT											48.7
1.0																					
B			1.0	3.0		3.0	NS														
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/14/13 SHEET 1 OF 11 SHEETS

LMN Form 721 Revised May. 2010

0.0'-3.0'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 04 CU**

(5) Water Table

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/16/13 (8) **G.S.E.**

SAMPLE NO RD 1

DEPTH & SUB SAMP. 0.0	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A			0.0	1.0	35		CH SIS	ST	BR	RT SIF OX											
			211	180.1	35		CH 2	ST	BR	ARSLNSHL RT SLF OX											1338
1.0																					
B			1.0	3.0		3.0	NS														
C																					
D																					

REDRILL

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/16/13 SHEET 2 OF 11 SHEETS

LMN Form 721 Revised May. 2010

0'-3'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 04 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/14/13

(8) **G.S.E.**

SAMPLE NO 2

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
3.0																					
A			139	107.9	35		CH [illegible]														81.1
4.0			129	103.7	38					[illegible] DW											75.1
B		1	3.0	4.5	36	4.5	CH SIS	ST	BR	WD SI SIF OX											
			354	[illegible]	35		CH 2	ST	BR	LNS ARSML DW SI ORG STKS SLF OX crumbly											80.6
		2	4.5	5.0	29	5.0	CL	ST	BR	SI SIF WD											
5.0			023	91.1	29		CL 6	ST	BR	SI SLF DW ORG STKS											70.9
C		1	5.0	5.4	31	5.4	CH SIS	ST	BR	OX											
			112	110.5	34		CH 2	ST	GR	LNS LGE ARSML OX ORG STKS SPKS DW											84.4
		2	5.4	7.0	29	7.0	CL	ST	BR	SI SIF CC RT											
6.0			271	102.4	29		CL 4	ST	BR	SI SIF CC RT CRUMBLY											79.4
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/14/13 SHEET 3 OF 11 SHEETS

LMN Form 721 Revised May. 2010

3.0'-7.0'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 04 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/14/13

(8) **G.S.E.**

SAMPLE NO 3

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
7.0	B																				
A	SV		7.0	8.0	20		SM		BR T	CS						.0795				90.1	125.8
7.7			641	151.2	20		SM		BZ T	LNSARSCH											
B				156.1	13		SM		BR T	LNSARSCH											137.8
8.7																					
C	SV		8.0	11.0	12	11.0	SM		BR T	CS						.1170				92.6	159.4
			652	174.5	10		SM		BR T	LNSARSCH											
9.7																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/14/13 SHEET 4 OF 11 SHEETS

LMN Form 721 Revised May. 2010

7.0'- 11.0'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 04 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/14/13

(8) **G.S.E.**

SAMPLE NO 4

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
11.0																					
A			433	157.9	24																127.1
12.0																					
B	SV		11.0	13.0	24	13.0	SP F		T							1240				95.3	
			507	198.0	23		SP		T												160.6
13.0																					
C	C		13.0	15.0	82	15.0	CH 4 O	M	DGR	SS WD									16.1		
			789	98.6	82		CH 4 ON	M	DGR	LNSARSSH RTS LSE ORG ARS											54.3
14.0																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/14/13 SHEET 5 OF 11 SHEETS

LMN Form 721 Revised May. 2010

11.0' - 15.0'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 04 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/14/13 (8) **G.S.E.**

SAMPLE NO 5

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
15.0																					
A																					
15.6			514	97.7	56																62.7
B			15.0	17.4	50	17.4	CH SS	M	GNG	RT ND											
			64	103.9	54		CH 2	M	GNGR	LNS ARSOM RT ORG STKS RTS											69.0
16.6																					
			288	130.3	42																92.1
C																					
			17.4	18.0	20	18.0	SP F		GR							1400				98.9	
17.6	6V	SP	188	171.4	20		SP		GR												142.7
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/14/13 SHEET 6 OF 11 SHEETS

LMN Form 721 Revised May. 2010

15.0'-18.0'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 04 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/14/13

(8) **G.S.E.**

SAMPLE NO 6

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A	SV	BAG SAMPLE	18.0	19.0	29	19.0	SM		T GR	CS SIFSI						1200				94.1	
			122	251.9	29		SM		T GR	LYS ARSCH SLF SI											194.9
B																					
C																					
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/14/13 SHEET 7 OF 11 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 04 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ________

(3)STA.________

(6) **DATE TAKEN** 02/15/13

(8) **G.S.E.**________

SAMPLE NO 7- 16

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS		WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
			PAN NO.	WET WT.																	
	SV	7	19.0	21.5	21		SP F		LGR		78					.1240				97.8	
			176	159.1	21		SP		LGR												131.8
A		8	21.5	24.0	22		SP F		LGR		154										
			453	158.9	22		SP		LGR												130.0
		9	24.0	26.5	24		SP F		GR		79										
			301	164.1	24		SP		GR												132.4.
		10	26.5	29.0	23		SP F		GR		111										
			667	169.1	23		SP		GR												137.9
B	SV	11	29.0	31.5	19		SP F		GR	SI SIF	97					.1280				96.6	
			447	249.9	19		SP		GR	SI SIF											210.0
		12	31.5	34.0	23		SP F		GR	SI SIF	96										
			689	279.8	23		SP		GR	SI SIF											227,1
		13	34.0	36.5	22		SP F		GR	SIF OX	134										
			586	209.6	22		SP		GR	SIF OX											171.4
C	SV	14	36.5	39.0	24		SP F		GR	SIF OX	114					.1170				96.5	
			359	215.8	24		SP		GR	SIF OX											174.2
	SV	15	39.0	41.5	24	41.5	SP F		GR	SIF OX	107					.1110				96.2	
			234	237.9	24		SP		GR	SIF OX											191.8
			41.5	44.5		44.5	NS														
D		16	44.5	46.0	26	46.0	SM		GR	CS OX SIF	68										
			69	250.0	26		SM		GR	LNSABG CH OX SLF<FEW>											198.5

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/15/13 SHEET 8 OF 11 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 04 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/15/13

(8) **G.S.E.**

SAMPLE NO PB 17,18,19

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A			46.0	49.5		49.5	NS														
	SV	17	49.5	51.0	28	51.0	SM		GR	CS SIF	29									89.5	
			278	235.6	28		SM		GR	ARS LNS CH SLF <FEN>											184.0
			51.0	54.5		54.5	NS														
B	SV	18	54.5	56.0	28	56.0	SM		GNG	CS	18									88.0	
			582	224.5	28		SM		GNGR	ARS CH											175.6
			56.0	59.5		59.5	NS														
		19	59.5	61.0	47	61.0	CH SS	SO	GNG	SI SIF	6										
			178	146.9	47		CH [illegible]Z	SO	GNGR	LNS SM SI SLF											99.7
C			61.0	63.0		63.0	NS														
D																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/15/13 SHEET 9 OF 11 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 04 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/15/13

(8) **G.S.E.**

SAMPLE NO 20

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
63.0																					
A			621	115.8	51																76.7
63.8																					
B			63.0	67.0	48		CH SIS	M	GNG	SIF SI											
64.8			285	93.6	50		CH 33	SM	GNGR	LYSML SIF SI											62.5
C			318	133.5	43																93.1
65.8																					
D			469	100.2	45																69.0
66.8																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/15/13 SHEET 10 OF 11 SHEETS

LMN Form 721 Revised May. 2010

63.0'-67.0'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 04 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ__________

(3)STA.__________

(6) **DATE TAKEN** 02/15/13

(8) **G.S.E.**__________

SAMPLE NO 21

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
67.0																					
A			67.0	69.0	54		CH SIS	ST	GNG	CC SIF											
68.0			135	98.2	52		CH 4	ST	GNGR	ARSML CC SIF											64.8
B			236	129.2	55																83.5
69.0																					
C							CH														
			69.0	71.0	51	71.0	CH SIS	ST	GNG	CC											
70.0			347	111.7	51		CH 4	ST	GNGR	ARSML CL											74.0
D			243	101.4	51																67.0
71.0																					

CLASSIFIER MJ RECORDER TSL CHECKER ECS DATA ANALYZED 2/15/13 SHEET 11 OF 11 SHEETS

LMN Form 721 Revised May. 2010

67.0' - 71.0' *COMPLETE LOG*

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 05 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA. N 544707.95 E 3663575.13

(6) **DATE TAKEN** 02/20/13 (8) **G.S.E.** 10.18

SAMPLE NO 1

DRY WEIGHT

DEPTH & SUB SAMP.	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	DRY WEIGHT
0.0									
A	0.0	3.0	22	3.0	CL SIS	VST	BR	WD SIFOX	
1.0	676	99.4	20		CL [illegible]	VST	BR	LNSARSHL WD SLF OX	82.8
B	112	94.3	23						76.4
2.0									
C									
D									

Other columns: TESTS ASSIGNED, LOG, PENTRN. RES., U.C.T., BULK DENSITY, ATTERBERG LIMIT L.L. P.L., D-10 SIZE, TEST WATER CONTENT, UCT DEPTH, Organic Content %, Coarse Material %

CLASSIFIER DD RECORDER TSL CHECKER TSL DATA ANALYZED 2/21/13 SHEET 1 OF 6 SHEETS

LMN Form 721 Revised May. 2010

0'-3'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#17 MVS - 05 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/20/13

(8) **G.S.E.**

SAMPLE NO 2

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
3.0																					
A			3.0	4.2	35	4.2	CH SIS	ST	GR BR	OX											
3.6			688	90.0	35		CH [illegible]	ST	GR BR	LNS ARS ML OX SPKS DN				67							66.7
B		1	402	72.3	35																53.9
4.6		2	456	77.3	24		CL 4	ST	[illegible]	SIF OX BRICK											62.5
C			4.2	7.0	25	7.0	CL SIS	ST	BR GR	SIF OX											
			98	57.5	26		CL 6	ST	BR GR	LYSML SIF OX BRICK											45.8
5.6																					
D																					

CLASSIFIER DD RECORDER TSL CHECKER TSL DATA ANALYZED 2/21/13 SHEET 2 OF 6 SHEETS

LMN Form 721 Revised May. 2010

3'-7'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 05 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/20/13

(8) **G.S.E.**

SAMPLE NO 3

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
7.0																					
A			7.0	8.0	39		SM		RBR BK	CS SIF 0											84.3
			424	117.3	39		SM		RBR BK	ARSCH SIF ORG MTRS GLASS											
8.0																					
B	0C		8.0	9.0	76		SM		BK	CS SIF 0									40.2		57.1
			161	200.5	76		SM		BK	ARSCH SIF ORG MTRS GLASS											
9.0																					
C	SV		9.0	11.0	13	11.0	SM		LBR	CS OX						1300				92.7	136.8
			233	154.1	13		SM		LBR	LYSARSCH OX; SPKS DW											
10.0		CH																			
D																					

CLASSIFIER DD RECORDER TSL CHECKER TSL DATA ANALYZED 2/21/13 SHEET 3 OF 6 SHEETS

LMN Form 721 Revised May. 2010

7'-11'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 05 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/20/13

(8) **G.S.E.**

SAMPLE NO 4

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
11.0																					
A			576	139.5	23		F		LBR T	OX DW											113.7
									LBR T	OX DW											
12.0																					
B	SL		11.0	13.0	23	13.0	SP F		LBR T	OX WD						1300				95.5	
			613	201.3	23		SP		L82 T	OX WD											164.2
13.0																					
C			13.0	15.0	90	15.0	CH 0	VSO	DG R BR	WD RT											
			685	117.7	90		CH OH CH	VSO	DG R BR	WD RT ARS SP											61.9
14.0																					
D																					

CLASSIFIER DD RECORDER TSL CHECKER TSL DATA ANALYZED 2/21/13 SHEET 4 OF 6 SHEETS

LMN Form 721 Revised May. 2010

11' - 15'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# MVS - 05 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/20/13

(8) **G.S.E.**

SAMPLE NO 5

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
15.0 A																					
15.6			277	104.3	61		CH-3	S	GR	ARS SP RT WD OX											64.7
B			15.0	19.0	54	19.0	CH	M	GR	RT WD OX											
			22	100.2	53		CH-3	M	GR	ARS SP RT WD OX											65.5
16.6 C																					
			393	95.2	49																63.8
17.6 D																					

CLASSIFIER DD RECORDER TSL CHECKER TSL DATA ANALYZED 2/21/13 SHEET 5 OF 6 SHEETS

LMN Form 721 Revised May. 2010

15'-19'

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING#17 MVS - 05 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/20/13

(8) **G.S.E.**

SAMPLE NO 6 to 12

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A	SV	6	19.0	19.5	50	19.5	CH SS	SO	GR	RT											
			306	129.5	50		CH 2	SO	GR	ARS LYS SP RT											86.4
		7	19.5	20.5	24		SP F		BR GR	CS RT	101					1490				97.2	
			266	227.2	26		SP		BR GR	ARS LYS CH RT											181.0
		8	20.5	22.0	23		SP F		GR		138										
			326	194.3	23		SP		GR												158.3
B	SV	9	22.0	23.5	22		SP F		GR		92										
			534	209.9	22		SP		GR												171.9
		10	23.5	25.0	23		SP F		GR	SIF	111					1280				97.0	
			220	156.5	23		SP		GR	SLF											127.3
		11	25.0	26.5	22		SP F		GR	SIF	100										
			336	193.1	22		SP		GR	SLF											158.3
C	SV	12	26.5	28.0	22	28.0	SP F		GR	SIF WD	119					1570				96.6	
			311	189.9	22		SP		GR	SLF WD											156.1
D																					

CLASSIFIER DD RECORDER TSL CHECKER TSL DATA ANALYZED 2/21/13 SHEET 6 OF 6 SHEETS

LMN Form 721 Revised May. 2010

Complete Logs

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 06 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA. N 544556.98 E 3663563.95

(6) **DATE TAKEN** 02/21/13 (8) **G.S.E.** 10.10

SAMPLE NO 1

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
00																					
A			0.0	1.2	24		CL SIS	ST	BR	WD RT SIF											
			438	95.0	24		CL 6	ST	BR	LNSLYSML LYS CH RTS RT SLF *DEBRIS*											76.7
10		1																			
B			1.2	3.0	21	3.0	CL SIS	ST	BR	RT WD SIF											
			66	129.5	21		CL 4	ST	BR	LNSLYSML RT RTS SLF											106.8
20		2																			
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 1 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 06 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 2

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.		WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSIS-TENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	 P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
				WET WT.																	
A 3.0																					
			3.0	4.4	44	4.4	CH SIS	ST	BR	OX SIFND											
3.4			149	86.4	43		CH 3	ST	BR	LNSARSWL OX ORG STKS SLF DW											56.2
B			38	75.8	44																52.8
4.4																					
		1	4.4	4.8	33	4.8	CL SIS	ST.	BR	OX WD RT SI SIF											
			C-349	120.5	33		CL 6	ST	BR	LNSLGEARSWL OX DW RT ORG STKS SI SLF											90.8
C		2																			
5.6			496	95.3	41																67.4
D			4.8	7.0	40	7.0	CH SIS	ST	BR	OX WD RT SI SIF											
			658	106.8	38		CH 2	ST	BR	LNSLGEARSWL OX DW RT ORG STKS SI SLF											77.2
6.4																					

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 2 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 06 CU

(5) Water Table

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 3

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
7.0 A			7.0	7.5	59	7.5	CH	SO	BR	OX											
			294	100.5	59		CH 2	SO	BR	OX ORG STKS *SLUSH PKTS*											63.1
7.5																					
B			7.5	9.0	31	9.0	CL	SO	DBR RBR	OX SIF											
			83	97.4	36		CL 4	SO	DBRRBR	OX SLF ORG ARS *DEBRIS*											71.8
8.5																					
		1	172	169.3	25																135.1
C		2	9.0	11.0	25		SM		BR	CS OX										81.9	
9.5	SV		44	169.4	25		SM		BR	ARSCLHSCH OX											135.8
D																					

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 3 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#** 17 MVS - 06 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 4

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	 P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
11.0																					
A	SV		11.0	12.0	21		SM		LBR	CS OX 0										89.6	
			82	182.3	21		SM		LBR	ARSCH OX ORG MTR W/DEBRIS											151.1
12.0																					
B																					
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 4 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 06 CU

(5) Water Table

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) DATE TAKEN 02/21/13

(8) G.S.E.

SAMPLE NO 5

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A		GRAB SAMPLE	12.0	15.0	23	15.0	SM		BR	CS											151.7
			216	186.4	23		SM		BR	ARSCH											
B																					
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 5 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 06 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 6

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
15.0																					
A			656	82.0	43																57.5
15.7																					
			15.0	16.5	41	16.5	CH SIS	ST	GR	OX RT											
B		1	212	99.9	39		CH 3	ST	GR	LNS ARS ML OX RT SPKS DW											71.9
16.7		2																			
			16.5	17.2	24	17.2	CL SIS	ST	GNG	OX											
C		1	346	104.9	24		CL 6	ST	GNGR	LNS ARS ML OX ORG STKS SPKS DW											84.8
	SV	2	17.2	19.0	22		SP F		GR LGR	CS						1370				97.0	
17.7			327	147.9	22		SP		GR LGR	ARS CH											120.8
D																					

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 6 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

LABORATORY BORING LOG

Job No. 13-082B

(2) BORING# 17 MVS - 06 CU

(5) Water Table

(1),(3),(4) LOCATION:

(1)ZZ

(3)STA.

(6) DATE TAKEN 02/21/13

(8) G.S.E.

SAMPLE NO 7 - 14

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A			19.0	21.5	21		SP F		LBR GR	0X	106					1290				96.2	
	SV	7	298	256.0	21		SP		LBR GR	0X											211.8
			21.5	24.0	21		SP F		LBR GR	0X	154										
		8	596	206.2	21		SP		LBR GR	0X											170.3
			24.0	26.5	21		SP F		LBR GR	0X	133					1300				97.4	
	SV	9	440	156.7	21		SP		LBR GR	0X											129.6
B			26.5	28.0	20	28.0	SP F		LBR GR	0X SIF	158										
		10	601	195.2	20		SP		LBR GR	0X SLF											162.8
			28.0	30.0		30.0	NS														
							NS														
			30.0	31.5	21	31.5	SP F		LBR GR	0X SIF	136					1180				97.2	
	SV	11	19	182.6	21		SP		LBR GR	0X SLF											151.4
C			31.5	35.0		35.0	NS														
							NS														
			35.0	36.5	18	36.5	SP F		GR	0X SIF 0	132										
		12	558	200.9			SP		GR	0X SLF ORG MTR											170.3
			36.5	40.0	18	40.0	NS														
							NS														
D			40.0	41.5	20	41.5	SM		GR	0X SIF 0	58					1040				92.5	
	SV	13	12	209.2	20		SM		GR	0X SLF ORG MTR											173.8
			41.5	45.0		45.0	NS														
							NS														
			45.0	46.5	28	46.5	SM		GR	0X SIF	69					0881				93.3	
	SV	14	620	200.5	28		SM		GR	0X SLF											156.2

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 7 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 06 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 15-17

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSIS-TENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A			46.5	50.0		50.0	NS														
							NS														
			50.0	51.5	31	51.5	SM		GR	CS SI SIF O	20									80.3	
	SV	15	95	181.0	31		SM		GR	ARS LNS CH SI SLF ORG MTR											138.3
			51.5	55.0		55.0	NS														
							NS														
B			55.0	56.5	22	56.5	SM		GR	CS OX SIF	43					.0826				91.2	
	SV	16	24	180.1	22		SM		GR	ARS CH OX SLF											140.0
			56.5	60.0		60.0	NS														
							NS														
			60.0	61.5	57	61.5	CH	M	GR	SIF	8										
		17	672	140.5	57		CH 3	M	GR	SLF											89.7
C			61.5	63.0		63.0	NS														
							NS														
D																					

CLASSIFIER MJ RECORDER DD CHECKER DATA ANALYZED 2/22/13 SHEET 8 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 06 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 18

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	SAMPLE DEPTHS WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A 63.0																					
63.4			52	92.4	50																61.8
B			63.0	67.0	50		CH SIS	ST	GNG	OX SIF SI											
			411	105.1	51		CH 3	ST	GNGR	LNS LYSML OX SLF SI											69.8
64.4																					
C			338	102.7	48																69.3
65.4																					
D			238	110.3	49																73.9
66.4																					

CLASSIFIER MJ RECORDER DD CHECKER

DATA ANALYZED 2/22/13

SHEET 9 OF 10 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 06 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 19

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
67.0																					
A			207	87.6	51																58.2
67.7																					
B			67.0	71.0	52	71.0	CH S1	ST	GNG	S1 S1FOX											
			120	86.1	51		CH 3	ST	SNGR	LNSARSML S1 SLF OX											57.2
68.7																					
C			478	123.8	55																80.1
69.7																					
D			30	81.0	49																53.7
70.7																					

CLASSIFIER MJ RECORDER DD CHECKER DD DATA ANALYZED 2/22/13 SHEET 10 OF 10 SHEETS

LMN Form 721 Revised May. 2010

* COMPLETE LOG *

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 07 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA. N 544408.57 E 3663554.20

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.** 10.13

SAMPLE NO 1

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	SAMPLE DEPTHS WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
0.0																					
A			153	97.8	20																81.2
0.6																					
B			0.0	3.0	21	3.0	CL	H	BR	RT SIF											
			282	84.1	21		CL 4	H	BR	RT SLFORG STKS *DEBRIS*											69.7
1.6																					
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13 SHEET 1 OF 6 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 07 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13 (8) **G.S.E.**

SAMPLE NO 2

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS		WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT		D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
			PAN NO.	WET WT.										L.L.	P.L.						
3.0																					
A			3.0	5.0	38	5.0	CH SIS	ST	BR	OX											
			5	108.3	34		CH 2	ST	BR	LNS LYS NL OX SPKS DW											80.9
4.0																					
B			2	130.1	42																91.5
5.0																					
C			5.0	7.0	30	7.0	CH	ST	DBR	SI SIFCC OX											
			79	83.1	30		CH 2	ST	DBR	SI SLF SPKS DW CC OX LYS CL											63.9
6.0		CL																			
D																					

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13 SHEET 2 OF 8 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 07 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13 (8) **G.S.E.**

SAMPLE NO 3

DEPTH & SUB SAMP. 7.0	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	SAMPLE DEPTHS / WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A			7.0	9.0	21	9.0	CL SIS	ST	BR	OX SI SIF											
			151	140.8	24		CL H	ST	BR	LNS LYS ML OX ORG STKS SI SLF W/DEBRIS											1136
8.0																					
B			279	134.2	17																114.9
9.0																					
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13 SHEET 3 OF 8 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY	17th Street Canal Reevaluation Job No. 13-082B	LABORATORY BORING LOG (2) BORING# 17 MVS - 07 CU (5) Water Table	(1),(3),(4) LOCATION: (1)ZZ (3)STA. (6) DATE TAKEN 02/21/13 (8) G.S.E.	SAMPLE NO 4

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	 WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	 P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A		GRAB SAMPLE	9.0	11.0	27	11.0	CH SIS	M	GR	OX											
			483	112.1	27		CH 2	M	GR	LNS LYS ML OX ORG STKS *GRAB SAMPLE*											88.3
B																					
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13 SHEET 4 OF 8 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING# 17 MVS - 07 CU**

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 5

DEPTH & SUB SAMP. 11.0	TESTS ASSIGNED	LOG	SAMPLE DEPTHS PAN NO.	SAMPLE DEPTHS WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
A			11.0	11.5	36	11.5	CL SIS	SO	BR	ND RT											
		1	C-180	169.2	36		CL 4	SO	BR	LNS LGE ARS HL RTS RT ORG STKS *DEBRIS*											124.1
		2	11.5	12.3	32	12.3	CH SS	ST	BR	OX											
12.0			692	159.0	38		CH 2	ST	BR	LNS LYS BH OX ORG STKS SPKS DW											71.7
B																					
		1	1208	181.9	26																80.8
		2	12.3	13.2	27	13.2	SM		BR	CS OX O										87.8	
13.0	8V		606	295.9	27		SM		BR	ARS LYS CH OX ORG MTR											154.4
C		1																			
			13.2	15.0	48	15.0	CH SS	M	GR BR	WD											
		2	72	123.7	48		CH 2	M	GR BR	LNS LYS BH DW ORG STKS											83.2
14.0																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13 SHEET 5 OF 8 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

Job No. 13-082B

LABORATORY BORING LOG

(2) BORING# 17 MVS - 07 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 6

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS / PAN NO.	WET WT.	WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
15.0																					
A			15.0	16.0	58	16.0	CH	SO	GR LBR	RT WD											529
			690	83.6	58		CH 3	SO	GR LBR	RT ORG STKS WD											
16.0		WD																			
B																					
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13

SHEET 6 OF 8 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation **LABORATORY BORING LOG**

Job No. 13-082B **(2) BORING#** 17 MVS - 07 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 7

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS		WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT		D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
			PAN NO.	WET WT.										L.L.	P.L.						
			1 2 3 4 5	6 7 8 9 10	11 12 13	14 15 16 17 18	19 20 21 22 23 24 25	26 27 28	29 30 31 32 33 34 35 36 37	38 39 40 41 42 43 44 45 46 47 48 49 50 51	52 53 54 55	56 57 58 59	60 61 62	63 64 65	66 67 68	69 70 71 72 73	74 75 76	77 78 79 80	81 82 83 84 85	86 87 88 89 90	
A		GRAB SAMPLE	16.0	17.5	56	17.5	CH SIS	SO	GR	SIF											
			225	219.4	56		CH 2	SO	GR	LNSLGEARSNL SLF	GRAB SAMPLE										140.0
B																					
C																					
D																					

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13 SHEET 7 OF 8 SHEETS

LMN Form 721 Revised May. 2010

FOR UNDISTURBED SAMPLES ONLY

17th Street Canal Reevaluation

LABORATORY BORING LOG

Job No. 13-082B

(2) BORING# 17 MVS - 07 CU

(5) **Water Table**

(1),(3),(4) **LOCATION:**

(1)ZZ

(3)STA.

(6) **DATE TAKEN** 02/21/13

(8) **G.S.E.**

SAMPLE NO 8-14

DEPTH & SUB SAMP.	TESTS ASSIGNED	LOG	SAMPLE DEPTHS		WATER CONTENT	STRATUM CHANGE	BORING LOG	CONSISTENCY	COLOR	MODIFICATION SYMBOLS	PENTRN. RES.	U.C.T.	BULK DENSITY	ATTERBERG LIMIT L.L.	ATTERBERG LIMIT P.L.	D-10 SIZE	TEST WATER CONTENT	UCT DEPTH	Organic Content %	Coarse Material %	DRY WEIGHT
			PAN NO.	WET WT.																	
	SV	8	17.5	19.0	22	19.0	SM		LBRGR	OX	53					1230		.	.	94.1	
			232	230.0	22		SM		LBRGR	OX											189.1
A		9	19.0	20.5	22	.	SP	F	LBRGR	OX	130							.	.	.	
			296	206.7	22		SP		LBRGR	OX											169.1
			20.5	22.0	22	.	SP	F	LBRGR	OX	109					1540		.	.	96.7	
	SV	10	143	217.0	22		SP		LBRGR	OX											177.9
		11	22.0	23.5	21	.	SP	F	LBRGR	OX	134							.	.	.	
			501	217.5	21		SP		LBRGR	OX											180.4
			23.5	25.0	22	.	SP	F	LBRGR	OX	121					1400		.	.	97.4	
B	SV	12	160	161.0	22		SP		LBRGR	OX											132.4
			25.0	26.5	21	.	SP	F	LBRGR	OX	103							.	.	.	
		13	125	240.7	21		SP		LBRGR	OX											198.8
			26.5	28.0	23	28.0	SP	F	LBRGR	OX	56					1350		.	.	97.7	
	SV	14	687	212.2	23		SP		LBRGR	OX											173.0
			.	.		.												.	.	.	
C																					
			.	.		.												.	.	.	
			.	.		.												.	.	.	
			.	.		.												.	.	.	
D																					
			.	.		.												.	.	.	

CLASSIFIER MJ RECORDER DD CHECKER ECS DATA ANALYZED 2/22/13 SHEET 8 OF 8 SHEETS

LMN Form 721 Revised May. 2010

* Complete Log *

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 10-017136 **Current Date:** 1/17/2013
Boring: 17MVS-01PU - Final

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	VST BR CH3 W/ LYS ML, LYS SM, G	CH3	8	23	99	122	87	UC	-	2341	4683	70	20	50		
1B	1.0	LGR & BK SM W/ O, RT, G	SM		8												SV
1C	2.0	LGR SM W/ O, G	SM		6												
2	4.0	M LGR CH4 W/ ARS SP, WD	CH4		60												
3A1	6.5	M LGR CH4 W/ ARS O	CH4	10	52	70	107	100	UC	-	514	1028	91	23	68	0.47	
3A2	7.2	M LGR CH4 W/ ARS SM, CC	CH4		51												
3B	7.5	M LGR CH4 W/ ARS SM, CC	CH4		50	72	108	100	UU	0	500		98	36	62	0.50	
3C1	8.5	VSO LGR CL4	CL4	14	28	92	119	94	UC	-	220	439	32	15	17	0.19	
3C2	9.2	SO LGR CL4 W/ S, ARS CH, RT	CL4		27												
4	10.5	LGR SM W/ ARS CH, RT	SM		24												SV
5	13.0	LGR SP W/ O, ARS CH	SP		28												SV
6	15.5	LGR SM W/ O, ARS CH	SM		22												

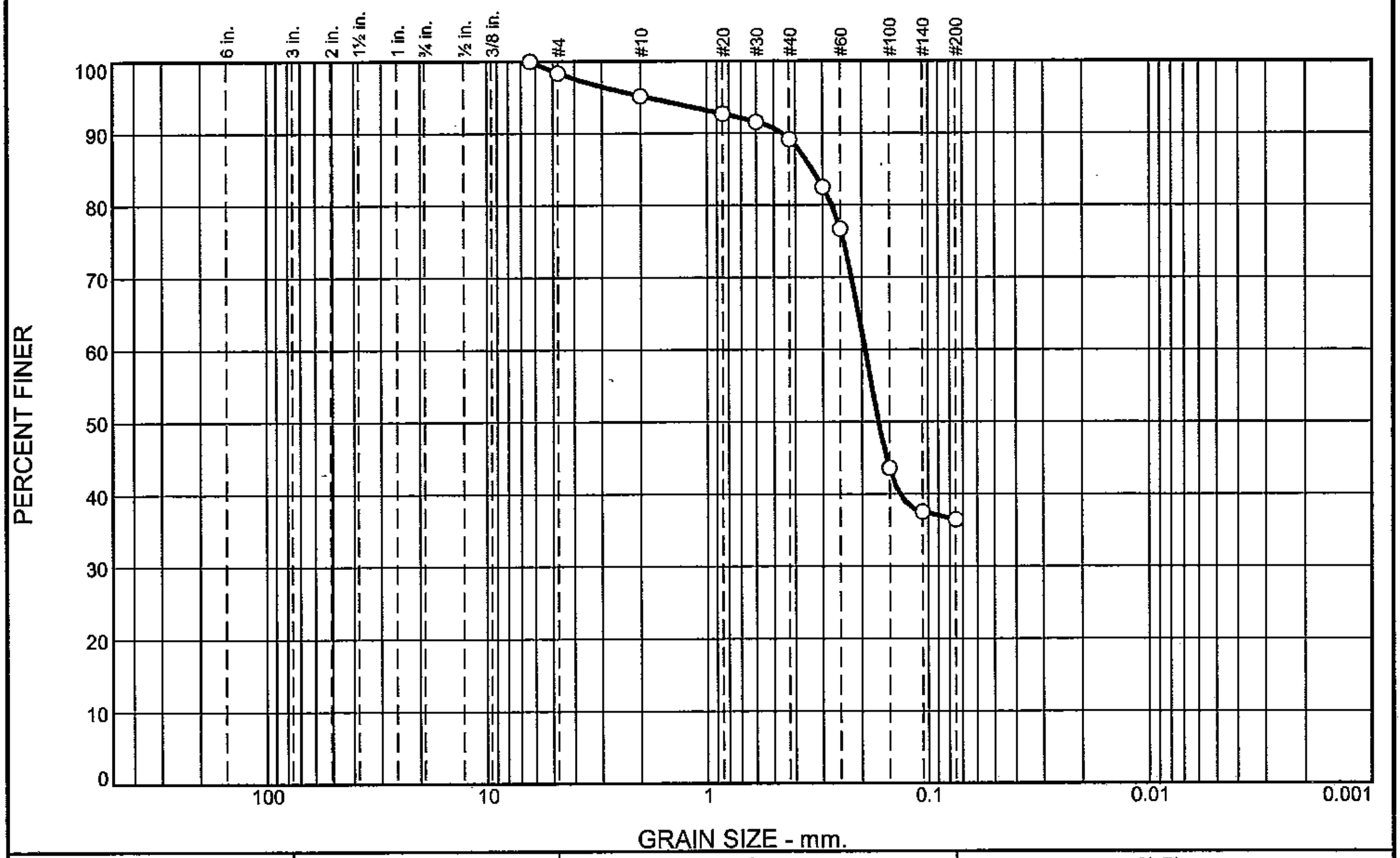
Remarks: ________________________

Checked By: ________

Stantec Consulting Services Inc.

File Name: 17MVS-01PU_be_boring_log_v10_0.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.6	3.2	6.1	52.6	36.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	98.4		
#10	95.2		
#20	92.7		
#30	91.6		
#40	89.1		
#50	82.5		
#60	76.7		
#100	43.6		
#140	37.6		
#200	36.5		

* (no specification provided)

Soil Description

LGR & BK SM W/ O, RT, G

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4598 D_{85}= 0.3348 D_{60}= 0.1935

D_{50}= 0.1682 D_{30}= D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-01PU **Depth:** 1.0

Sample Number: 1B

Date: 12/7/12

Stantec

Saint Rose, Louisiana

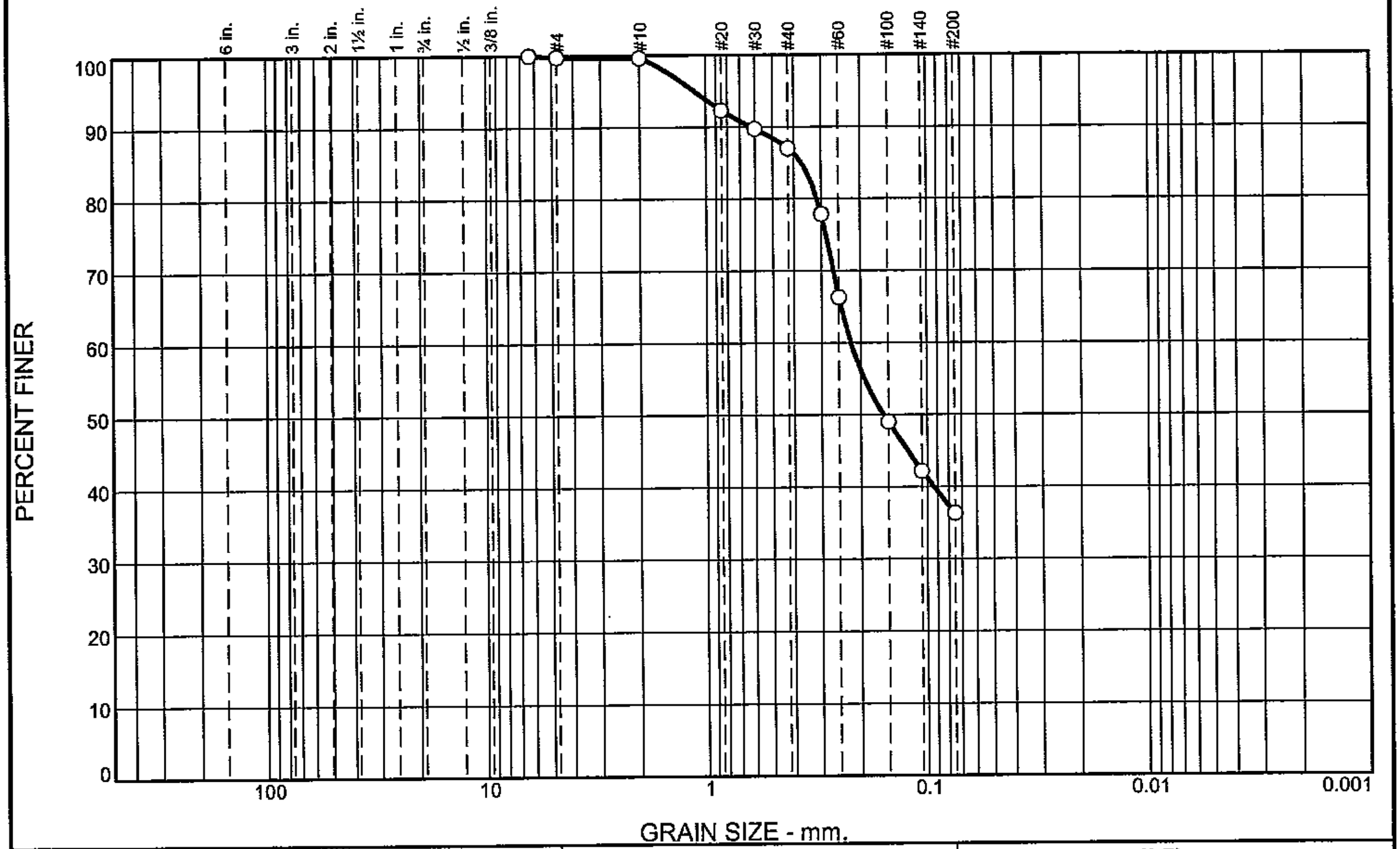
Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana

Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.2	12.6	50.7	36.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	99.8		
#10	99.6		
#20	92.3		
#30	89.7		
#40	87.0		
#50	77.9		
#60	66.3		
#100	49.0		
#140	42.2		
#200	36.3		

* (no specification provided)

Soil Description

LGR SM W/ ARS CH, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6244 D_{85}= 0.3679 D_{60}= 0.2214
D_{50}= 0.1573 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-01PU **Depth:** 10.5
Sample Number: 4

Date: 12/7/12

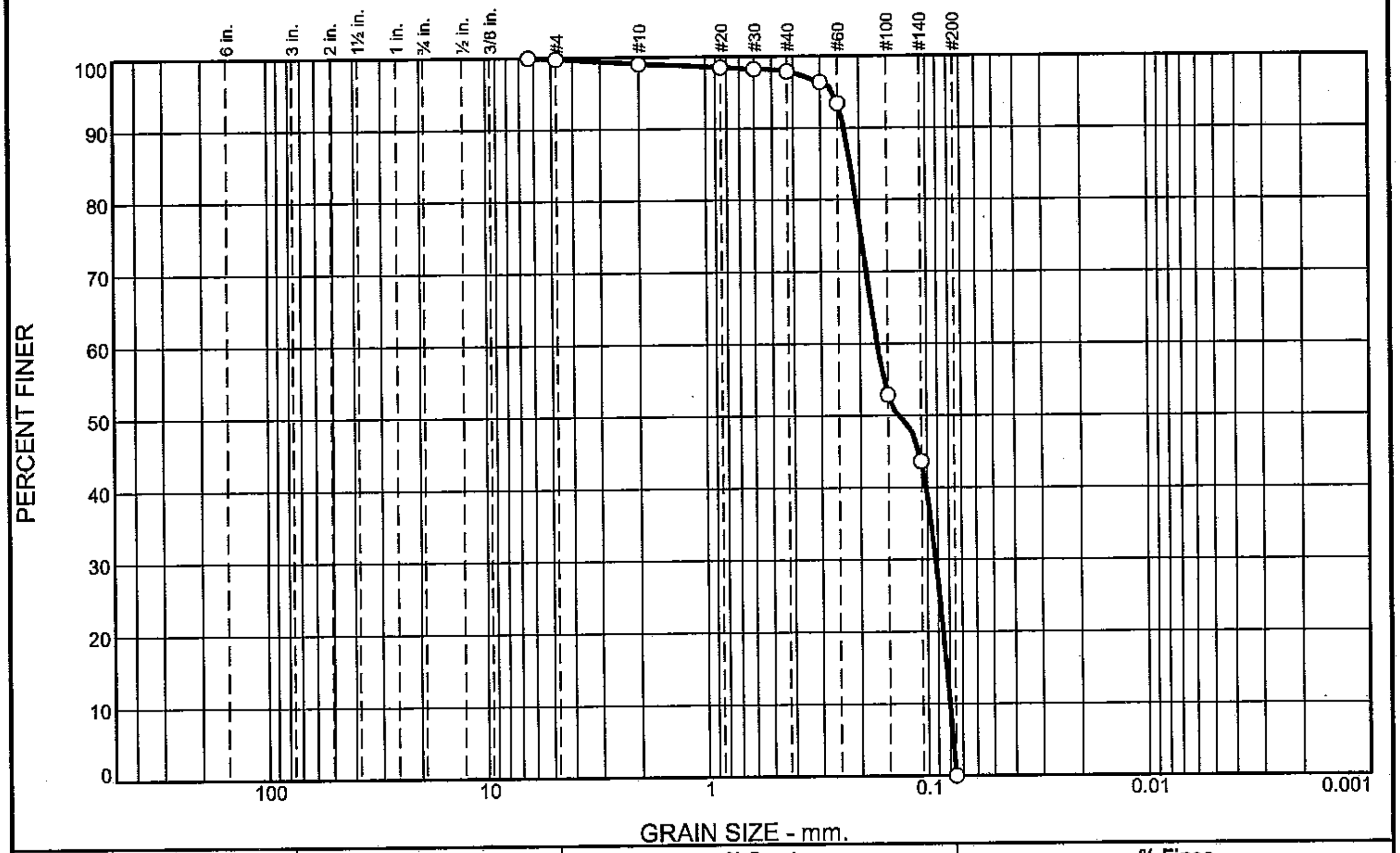
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.7	1.2	97.9	0.0	0.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	99.8		
#10	99.1		
#20	98.5		
#30	98.3		
#40	97.9		
#50	96.4		
#60	93.4		
#100	52.9		
#140	43.7		
#200	0.0		

* (no specification provided)

Soil Description

LGR SP W/ O, ARS CH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2347 D_{85}= 0.2196 D_{60}= 0.1675
D_{50}= 0.1348 D_{30}= 0.0921 D_{15}= 0.0826
D_{10}= 0.0800 C_u= 2.10 C_c= 0.63

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-01PU **Depth:** 13.0
Sample Number: 5

Date: 12/7/12

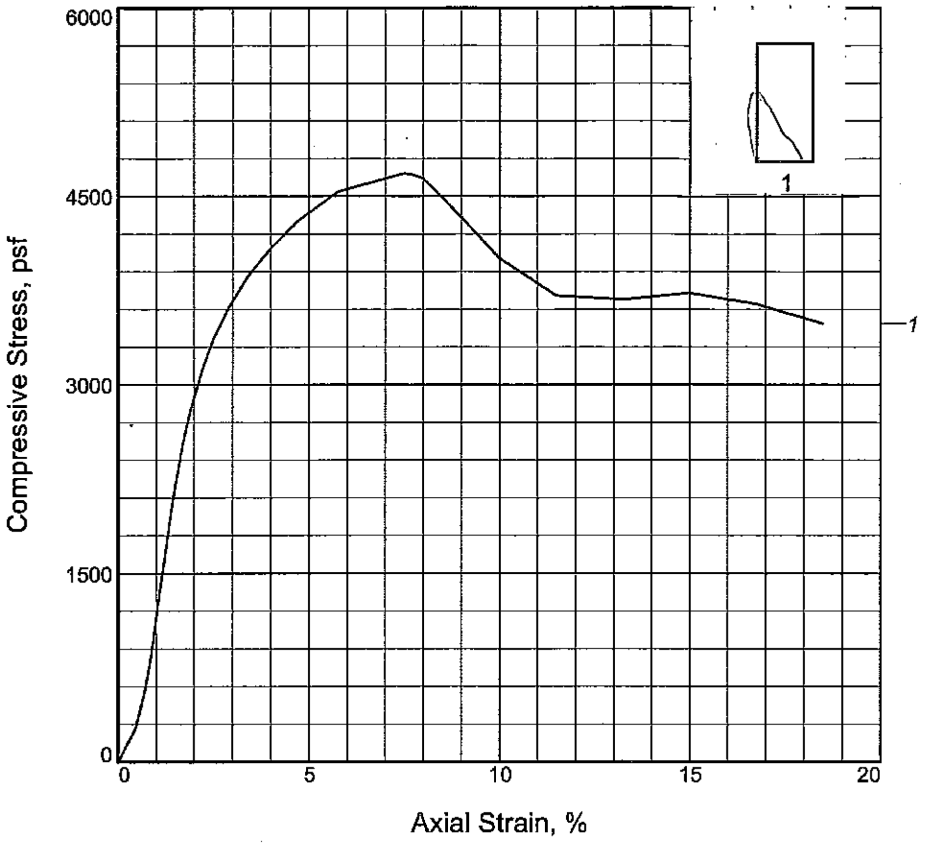
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	4683			
Undrained shear strength, psf	2341			
Failure strain, %	7.5			
Strain rate, in./min.	1.000			
Water content, %	22.9			
Wet density, pcf	122.0			
Dry density, pcf	99.3			
Saturation, %	86.7			
Void ratio	0.7222			
Specimen diameter, in.	1.393			
Specimen height, in.	3.001			
Height/diameter ratio	2.15			

Description: VST BR CH3 W/ LYS ML, LYS SM, G

LL = 70	**PL =** 20	**PI =** 50	**Assumed GS=** 2.74	**Type:** UNDISTURBED

Project No.: 10-017136
Date Sampled: 12/7/12
Remarks:

Figure ________

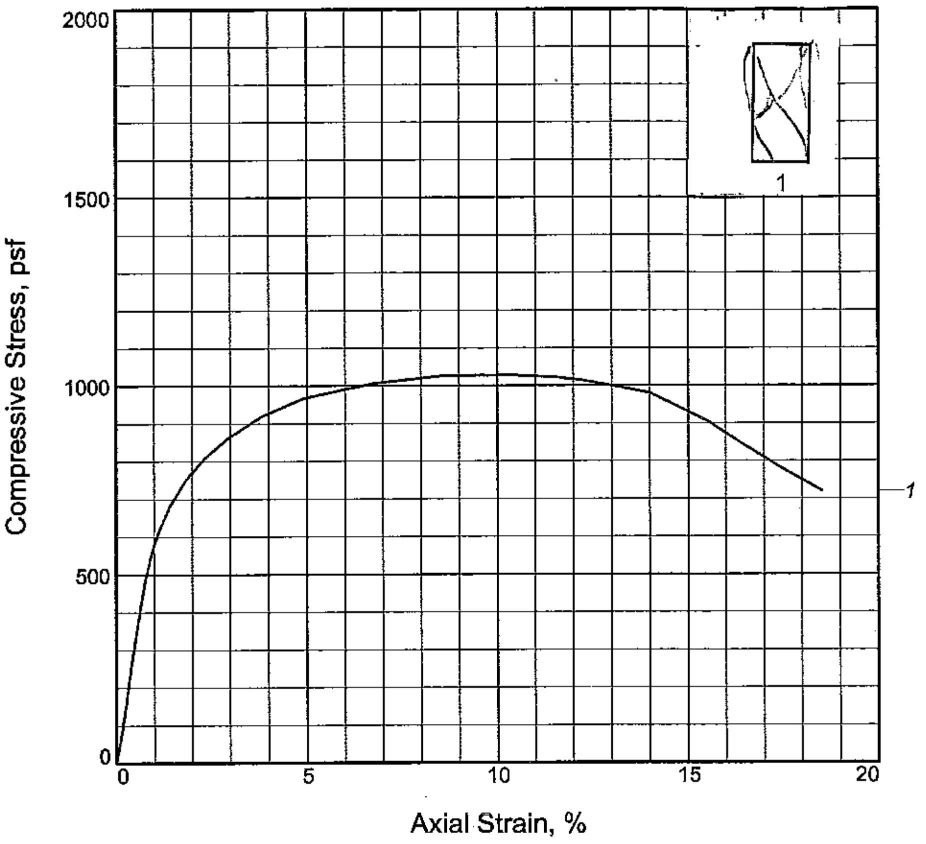
Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Source of Sample: 17MVS-01PU **Depth:** 0.0
Sample Number: 1A

UNCONFINED COMPRESSION TEST
Stantec
Saint Rose, Louisiana

Tested By: VF **Checked By:** MJB/JS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1028			
Undrained shear strength, psf	514			
Failure strain, %	10.3			
Strain rate, in./min.	1.000			
Water content, %	52.5			
Wet density, pcf	106.8			
Dry density, pcf	70.0			
Saturation, %	99.7			
Void ratio	1.4437			
Specimen diameter, in.	1.391			
Specimen height, in.	3.009			
Height/diameter ratio	2.16			

Description: M LGR CH4 W/ ARS O

LL = 91 **PL =** 23 **PI =** 68 **Assumed GS=** 2.74 **Type:** UNDISTURBED

Project No.: 10-017136
Date Sampled: 12/7/12
Remarks:

Figure ______

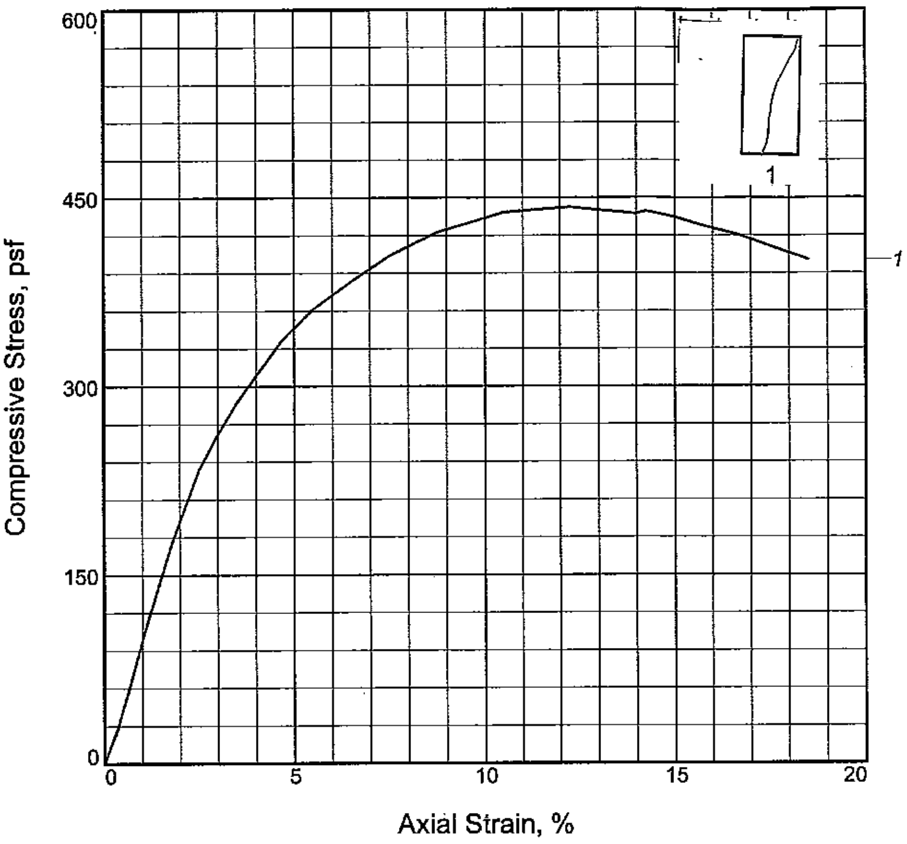
Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Source of Sample: 17MVS-01PU **Depth:** 6.5
Sample Number: 3A1

UNCONFINED COMPRESSION TEST
Stantec
Saint Rose, Louisiana

Tested By: VF **Checked By:** MJB/JS

UNCONFINED COMPRESSION TEST



Sample No.	**1**			
Unconfined strength, psf	439			
Undrained shear strength, psf	220			
Failure strain, %	14.2			
Strain rate, in./min.	1.000			
Water content, %	28.5			
Wet density, pcf	118.9			
Dry density, pcf	92.5			
Saturation, %	93.6			
Void ratio	0.8217			
Specimen diameter, in.	1.378			
Specimen height, in.	3.005			
Height/diameter ratio	2.18			

Description: VSO LGR CL4

LL = 32	**PL =** 15	**PI =** 17	**Assumed GS=** 2.70	**Type:** UNDISTURBED

Project No.: 10-017136
Date Sampled: 12/7/12
Remarks:

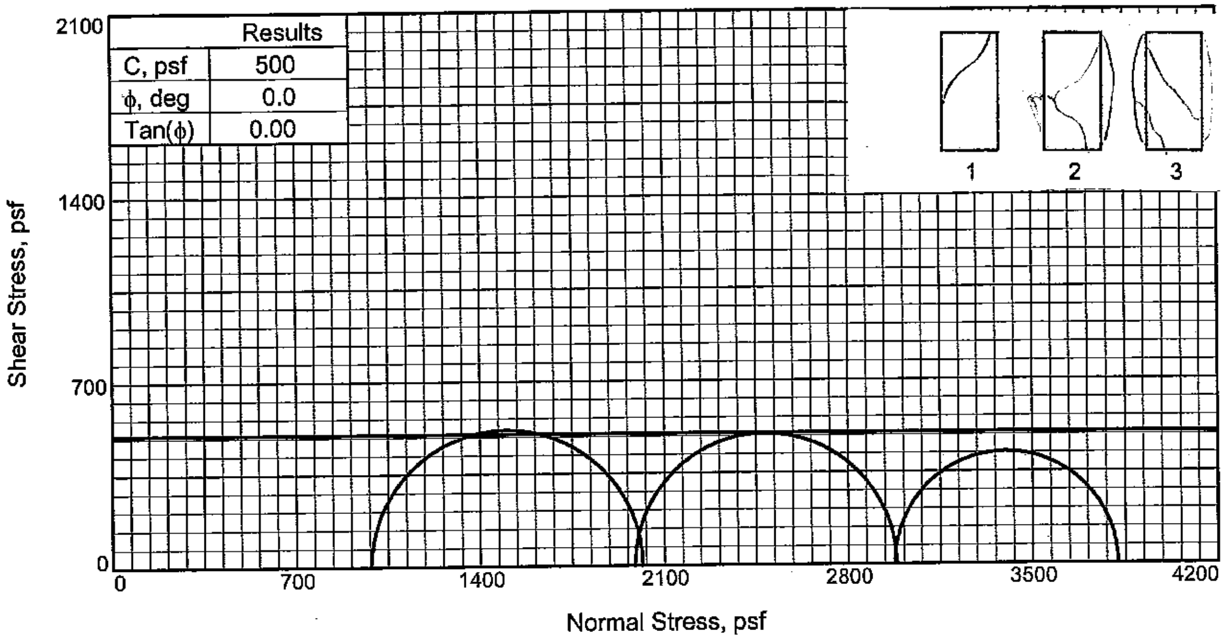
Figure ______

Client: USACE

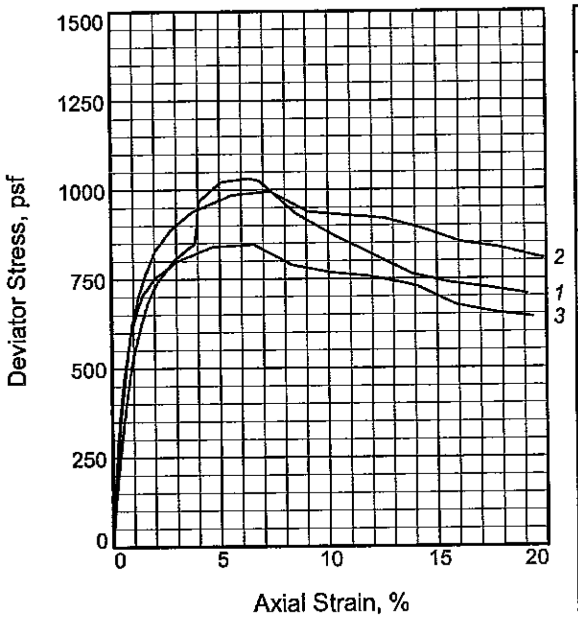
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Source of Sample: 17MVS-01PU **Depth:** 8.5
Sample Number: 3C1

UNCONFINED COMPRESSION TEST
Stantec
Saint Rose, Louisiana

Tested By: VF **Checked By:** MJB/JS



	Results
C, psf	500
ϕ, deg	0.0
Tan(ϕ)	0.00



	Sample No.	1	2	3
Initial	Water Content, %	50.4	51.5	57.0
	Dry Density, pcf	71.8	70.9	66.6
	Saturation, %	99.8	99.9	99.5
	Void Ratio	1.3833	1.4139	1.5693
	Diameter, in.	1.392	1.388	1.400
	Height, in.	3.006	3.007	3.008
At Test	Water Content, %	50.4	51.5	57.0
	Dry Density, pcf	71.8	70.9	66.6
	Saturation, %	99.8	99.9	99.5
	Void Ratio	1.3833	1.4139	1.5693
	Diameter, in.	1.392	1.388	1.400
	Height, in.	3.006	3.007	3.008
	Strain rate, in./min.	1.000	1.000	1.000
	Back Pressure, psi	0.00	0.00	0.00
	Cell Pressure, psi	6.84	13.80	20.66
	Fail. Stress, psf	1032	996	847
	Strain, %	6.3	7.3	6.6
	Ult. Stress, psf	763	890	728
	Strain, %	13.8	14.3	14.1
	σ_1 Failure, psf	2017	2983	3822
	σ_3 Failure, psf	985	1987	2975

Type of Test:
Unconsolidated Undrained

Sample Type: UNDISTURBED

Description: M LGR CH4 W/ ARS SM, CC

LL= 98 **PL=** 36 **PI=** 62

Assumed Specific Gravity= 2.74

Remarks:

Figure ______

Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project
17th Street Canal Reevalution, Jefferson Parish, Louisiana

Source of Sample: 17MVS-01PU **Depth:** 7.5

Sample Number: 3B

Proj. No.: 10-017136 **Date Sampled:** 12/7/12

TRIAXIAL SHEAR TEST REPORT
Stantec
Saint Rose, Louisiana

Tested By: VF **Checked By:** MJB/JS

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

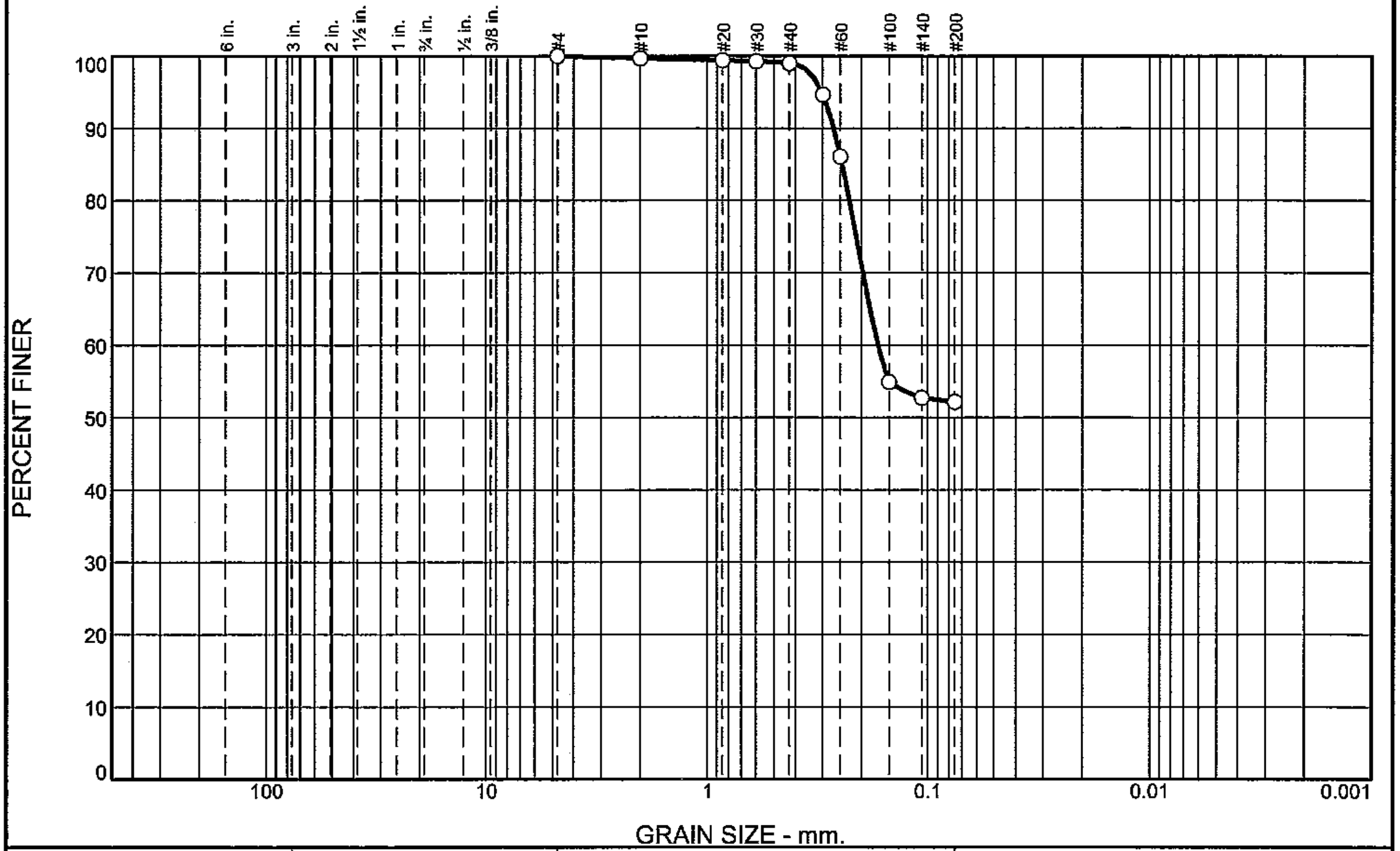
Project Number: 10-017136 **Current Date:** 12/13/2012
Boring: 17MVS-02PU - Final

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	VST BR CL6 W/ ARS CH	CL6		16								46	21	25		
1B	1.0	BR ML W/ ARS CH, G	ML		11												
1C1	2.0	BR ML W/ ARS CH, G	ML		14												
1C2	2.7	M BR CHOA W/ ARS ML, G	CHOA	2	56	97	62	89	UC	-	974	1947	121	29	92	0.90	
2A1	4.0	ST BR CH2 W/ LYS SM, O, G, RT	CH2		29												
2A2	4.5	BR ML W/ RT	ML		19												SV
3	6.0	BR SP	SP		19												
4	8.5	BR SP	SP		18												SV
5	11.0	BR SP	SP		21												
6	13.5	BR SP	SP		21												SV
7	16.0	BR SP W/ O, G	SP		20												

Remarks: ________ Checked By:

Stantec Consulting Services Inc. File Name: Final 17MVS-02PU_be_boring_log_

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	0.7	46.9	52.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	99.4		
#30	99.3		
#40	99.0		
#50	94.6		
#60	86.1		
#100	54.9		
#140	52.7		
#200	52.1		

* (no specification provided)

Soil Description

BR ML W/ RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2684 D_{85}= 0.2456 D_{60}= 0.1685
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Source of Sample: 17MVS-02PU **Depth:** 4.5
Sample Number: 2A2

Date: 12/7/12

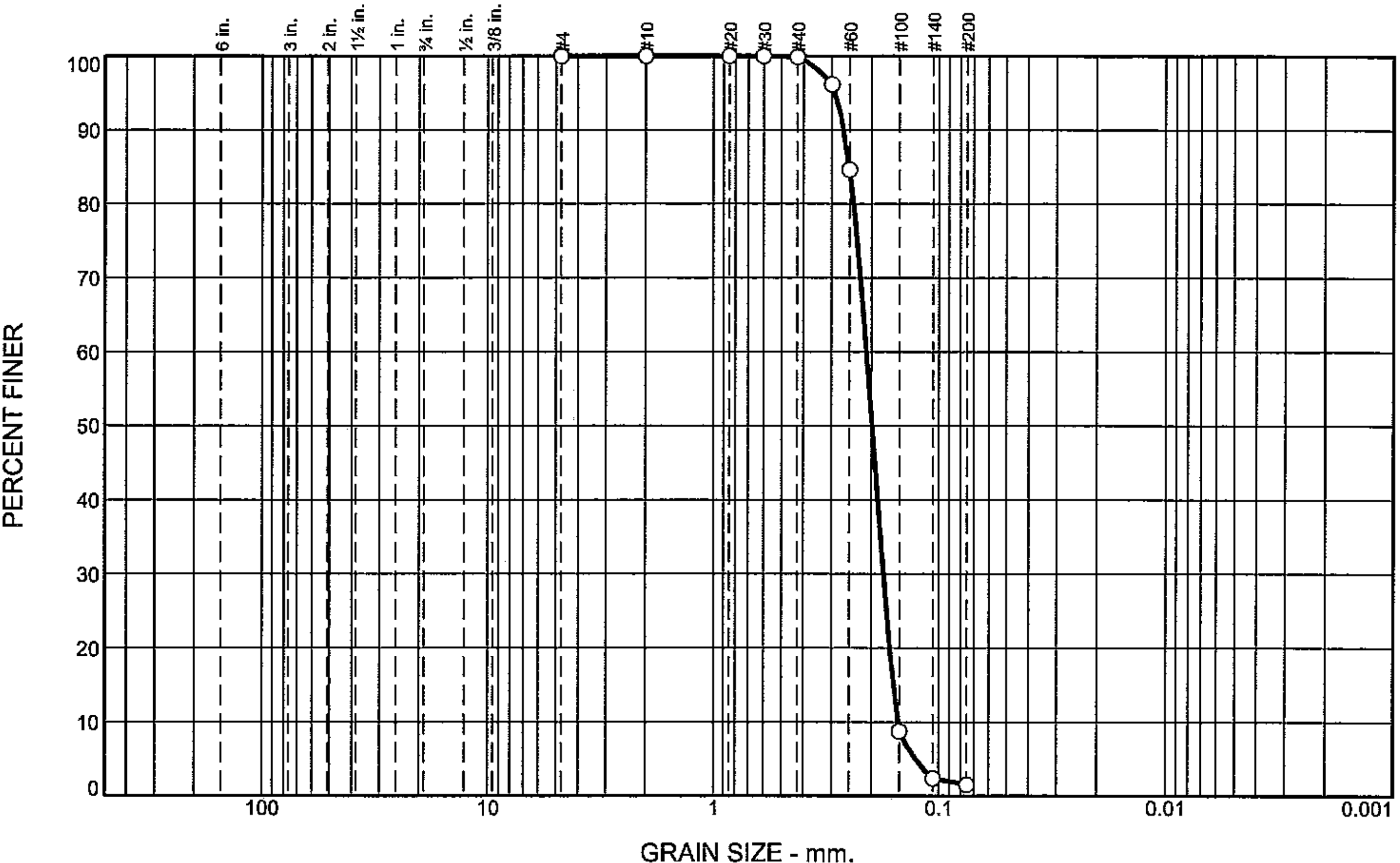
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	98.4	1.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#30	100.0		
#40	99.9		
#50	96.2		
#60	84.6		
#100	8.7		
#140	2.4		
#200	1.5		

* (no specification provided)

Soil Description

BR SP

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2657 D_{85}= 0.2509 D_{60}= 0.2105
D_{50}= 0.1986 D_{30}= 0.1767 D_{15}= 0.1592
D_{10}= 0.1521 C_u= 1.38 C_c= 0.98

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-02PU **Depth:** 8.5
Sample Number: 4
Date: 12/7/12

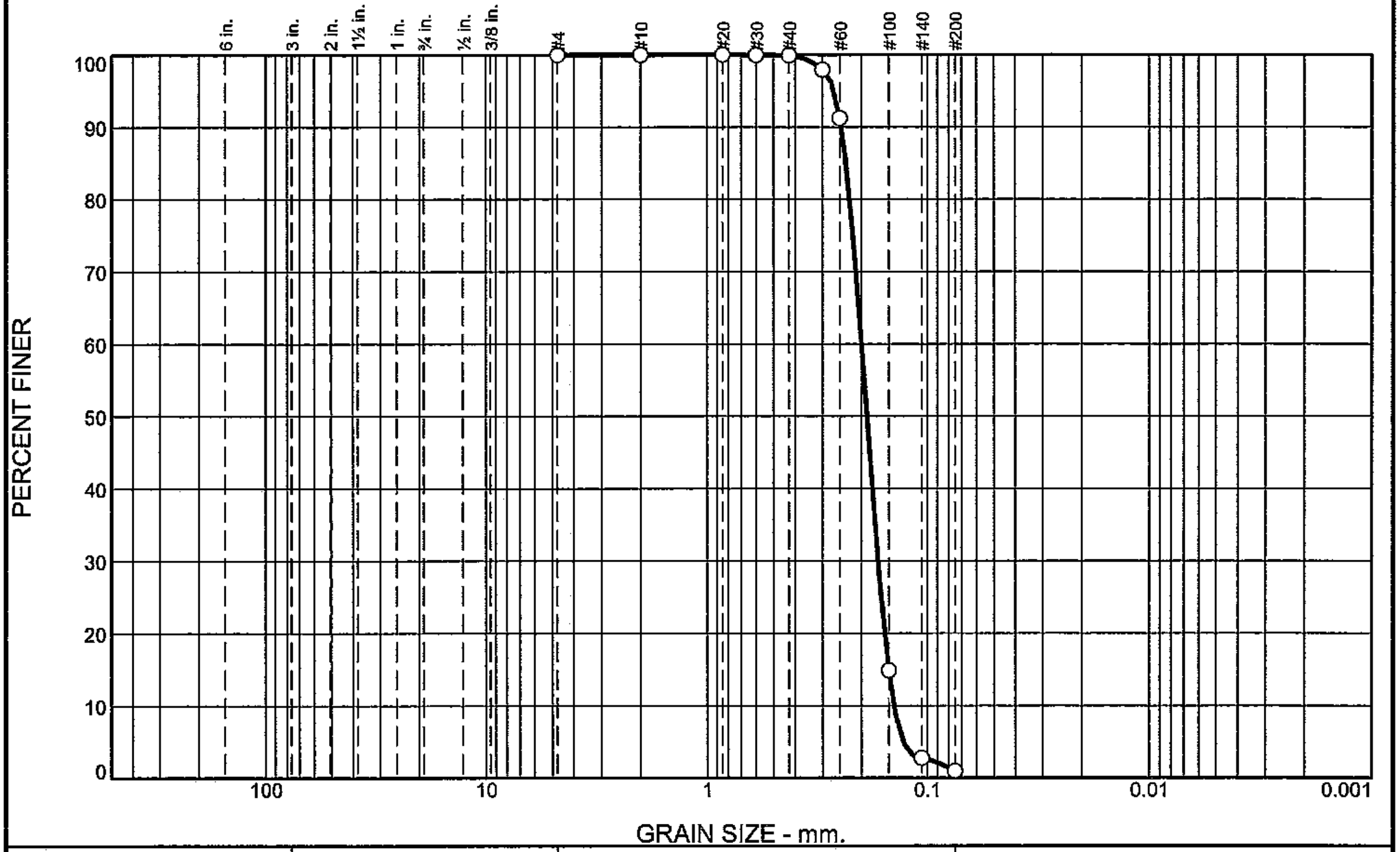
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	99.0	0.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#30	100.0		
#40	99.9		
#50	97.9		
#60	91.2		
#100	14.9		
#140	2.8		
#200	0.9		

* (no specification provided)

Soil Description

BR SP

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2465 D_{85}= 0.2351 D_{60}= 0.1997
D_{50}= 0.1888 D_{30}= 0.1679 D_{15}= 0.1502
D_{10}= 0.1420 C_u= 1.41 C_c= 0.99

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-02PU **Depth:** 13.5
Sample Number: 6

Date: 12/7/12

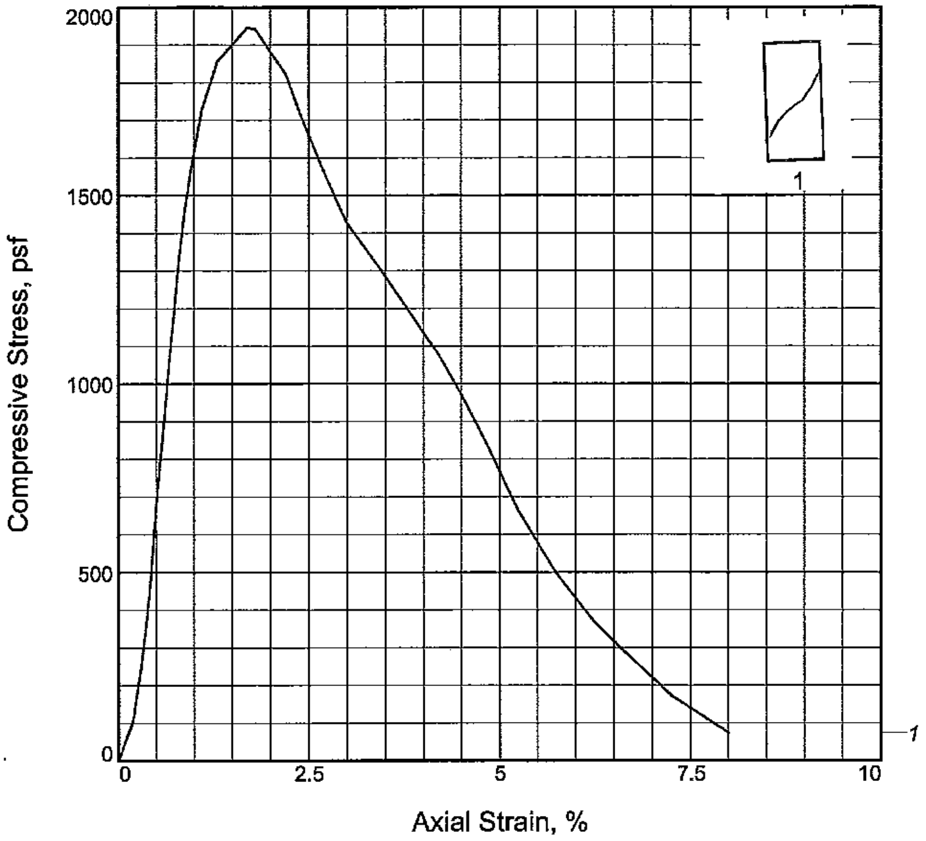
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1947			
Undrained shear strength, psf	973			
Failure strain, %	1.7			
Strain rate, in./min.	1.000			
Water content, %	56.2			
Wet density, pcf	97.5			
Dry density, pcf	62.4			
Saturation, %	89.5			
Void ratio	1.6892			
Specimen diameter, in.	1.392			
Specimen height, in.	3.011			
Height/diameter ratio	2.16			

Description: M BR CHOA W/ ARS ML, G

LL = 121 **PL =** 29 **PI =** 92 **Assumed GS=** 2.69 **Type:** UNDISTURBED

Project No.: 10-017136
Date Sampled: 12/17/12
Remarks:

Figure ________

Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Source of Sample: 17MVS-02PU **Depth:** 2.7
Sample Number: 1C2

UNCONFINED COMPRESSION TEST
Stantec
Saint Rose, Louisiana

Tested By: VF

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Assigned By: ______

Project Number: 10-017136

Current Date: 1/17/2013

Boring: 17MVS-03PU - Final

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR SM W/ ARS CH, G, RT	SM		9												SV
1B	1.0	BR SM W/ ARS CH, G, RT	SM		8												
1C	2.0	BR SP W/ LYS CH, RT, G	SP		3												SV
1D	3.0	BR SP W/ ARS CH, RT	SP		7												
2	4.0	LGR SM W/ ARS CH, G	SM		19												SV
3	6.5	LGR SM W/ ARS CH, G	SM		18												SV
4	9.0	LGR SP W/ ARS CH, G	SP		23												
5	11.5	LGR SP W/ G, WD	SP		31												
6	14.0	LGR SP W/ ARS CH, RT, O	SP		30												SV

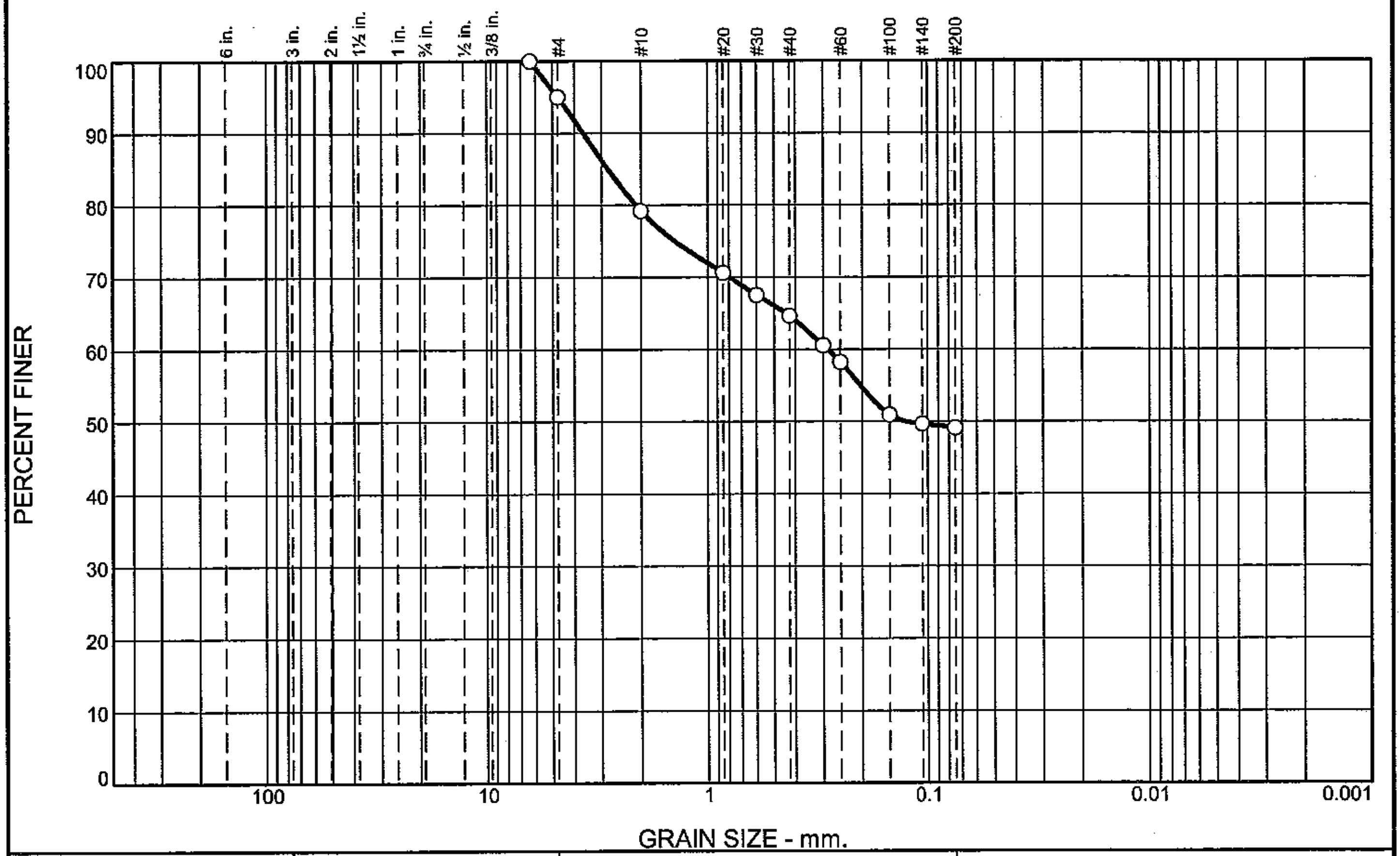
Remarks: ______

Checked By: ______

Stantec Consulting Services Inc.

File Name: 17MVS-03PU_be_boring_log_v10_0.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.0	15.8	14.6	15.5	49.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	95.0		
#10	79.2		
#20	70.6		
#30	67.5		
#40	64.6		
#50	60.5		
#60	58.2		
#100	50.9		
#140	49.7		
#200	49.1		

* (no specification provided)

Soil Description

BR SM W/ ARS CH, G, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.6417 D_{85}= 2.8126 D_{60}= 0.2871
D_{50}= 0.1272 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-03PU **Depth:** 0.0
Sample Number: 1A

Date: 12/7/12

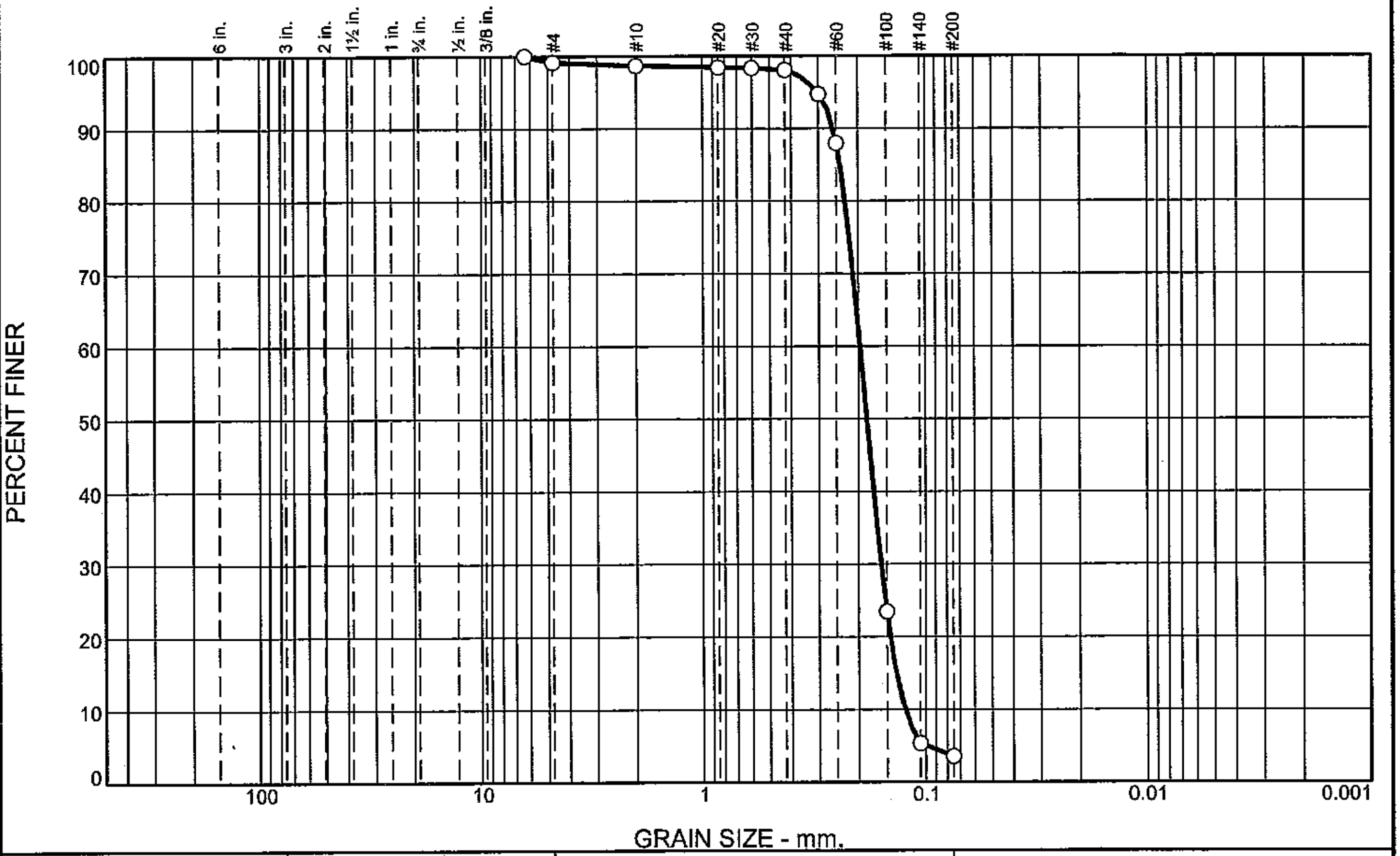
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS
MJB

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	0.5	0.6	94.6	3.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	99.2		
#10	98.7		
#20	98.4		
#30	98.3		
#40	98.1		
#50	94.7		
#60	88.0		
#100	23.5		
#140	5.4		
#200	3.5		

* (no specification provided)

Soil Description

BR SP W/ LYS CH, RT, G

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2582 D_{85}= 0.2408 D_{60}= 0.1965
D_{50}= 0.1836 D_{30}= 0.1588 D_{15}= 0.1359
D_{10}= 0.1243 C_u= 1.58 C_c= 1.03

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-03PU **Depth:** 2.0
Sample Number: 1C

Date: 12/7/12

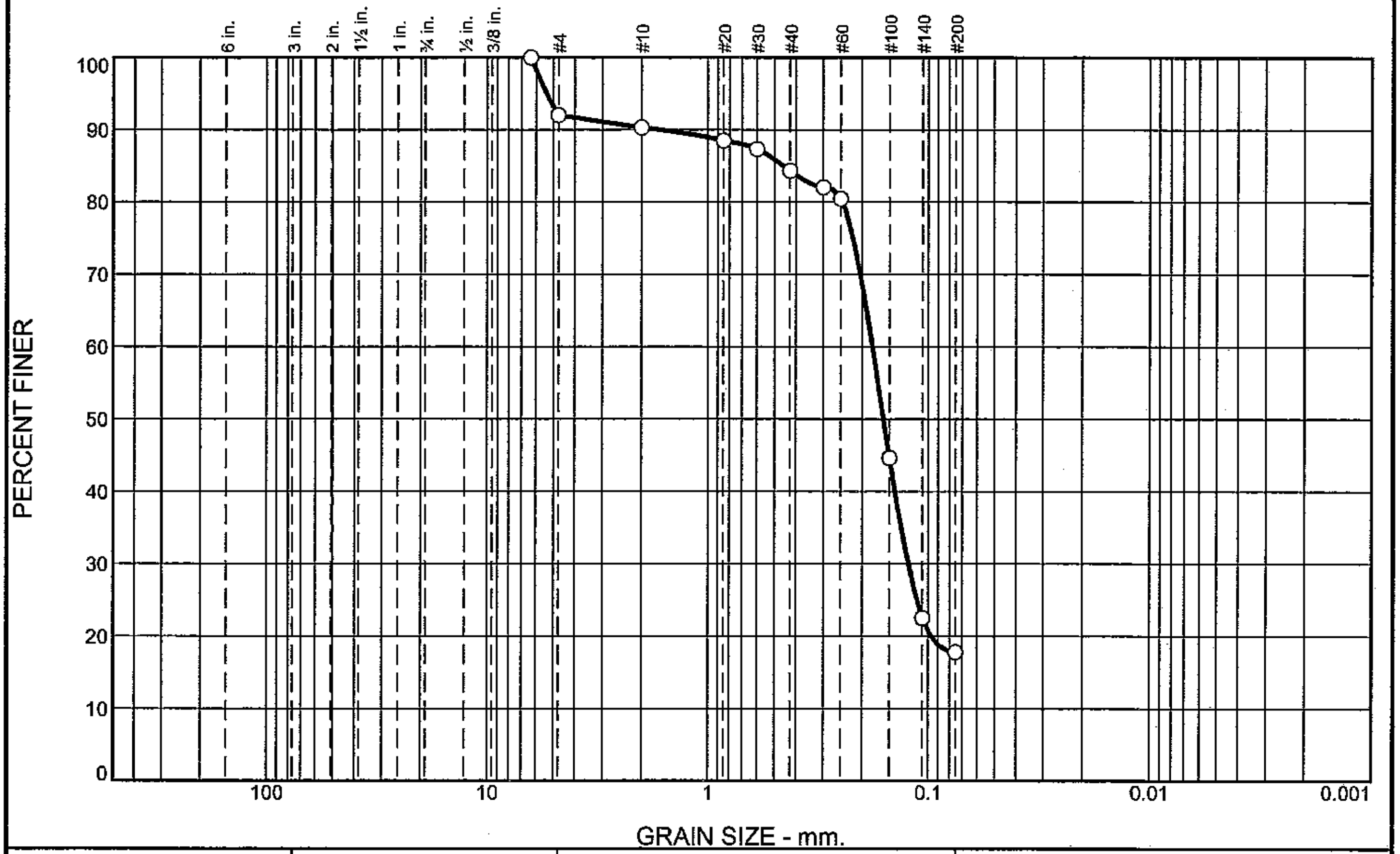
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.0	1.7	6.0	66.5	17.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	92.0		
#10	90.3		
#20	88.5		
#30	87.3		
#40	84.3		
#50	82.0		
#60	80.5		
#100	44.6		
#140	22.5		
#200	17.8		

* (no specification provided)

Soil Description

LGR SM W/ ARS CH, G

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.6493 D_{85}= 0.4563 D_{60}= 0.1794
D_{50}= 0.1597 D_{30}= 0.1230 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-03PU **Depth:** 4.0
Sample Number: 2

Date: 12/7/12

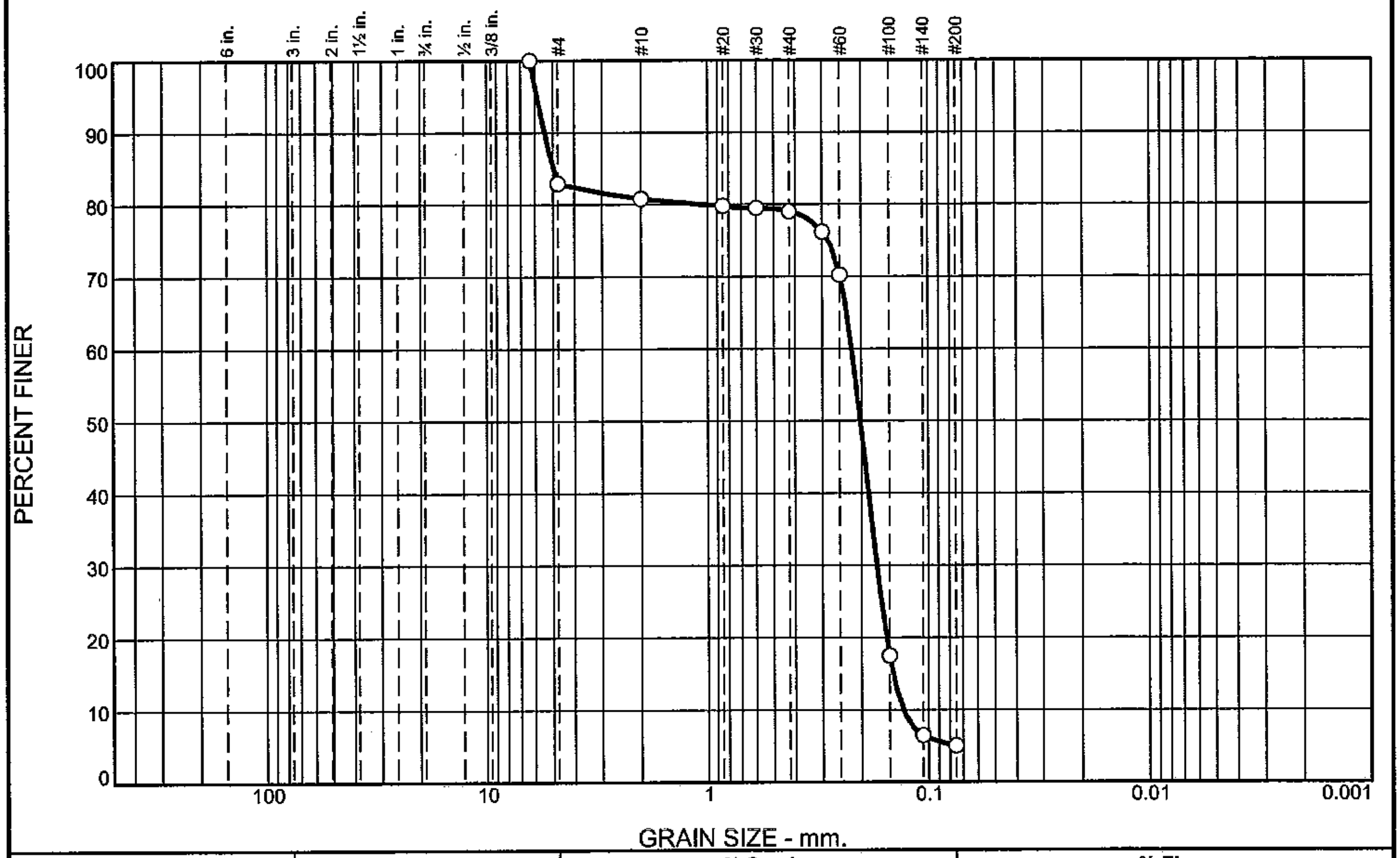
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	17.1	2.1	1.7	74.1	5.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	82.9		
#10	80.8		
#20	79.8		
#30	79.5		
#40	79.1		
#50	76.2		
#60	70.2		
#100	17.5		
#140	6.5		
#200	5.0		

* (no specification provided)

Soil Description

LGR SM W/ ARS CH, G

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.4359 D_{85}= 4.9647 D_{60}= 0.2212

D_{50}= 0.2022 D_{30}= 0.1708 D_{15}= 0.1447

D_{10}= 0.1304 C_u= 1.70 C_c= 1.01

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-03PU **Depth:** 6.5
Sample Number: 3

Date: 12/7/12

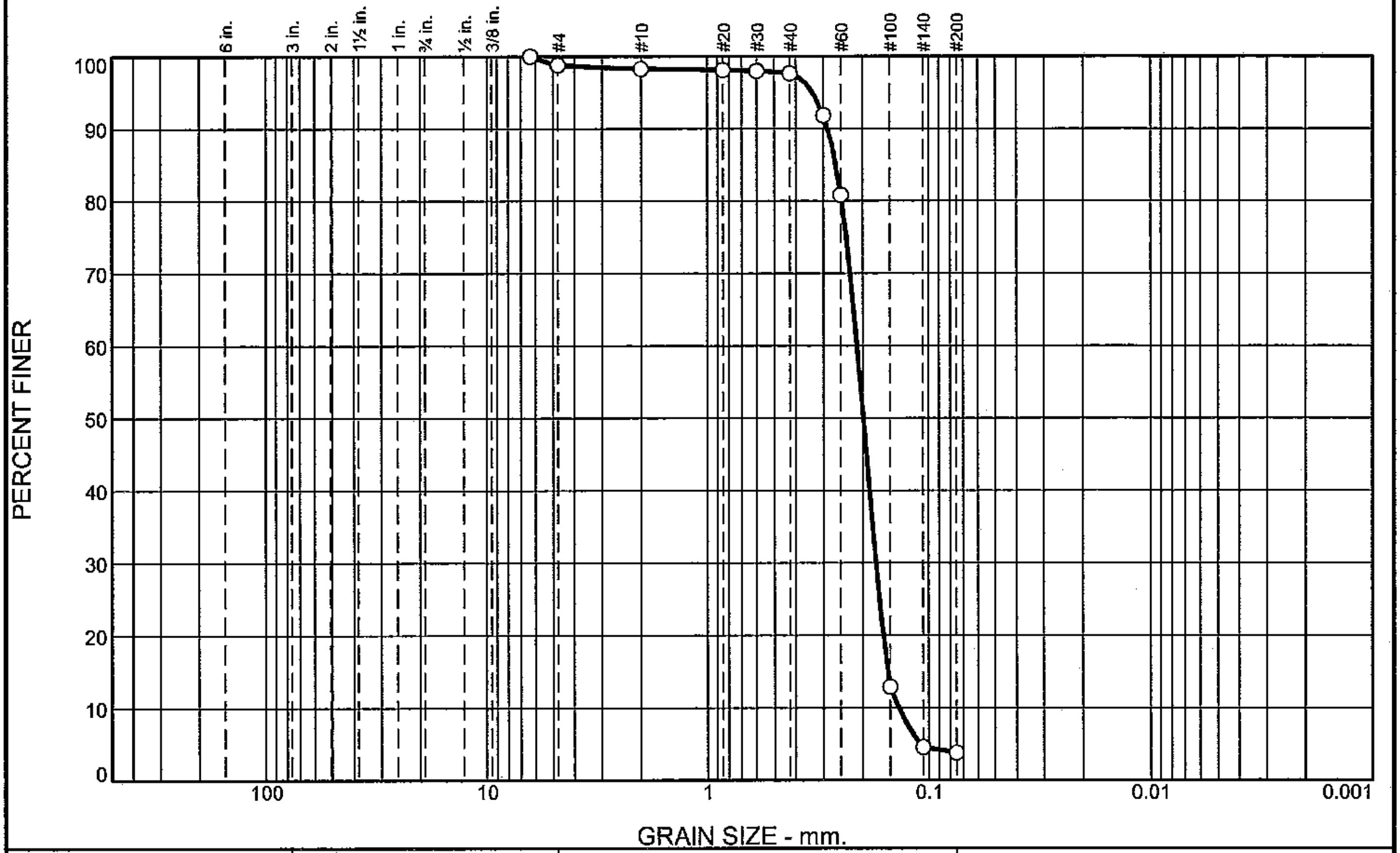
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.2	0.5	0.6	93.9	3.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	98.8		
#10	98.3		
#20	98.1		
#30	98.0		
#40	97.7		
#50	91.8		
#60	80.8		
#100	12.9		
#140	4.6		
#200	3.8		

* (no specification provided)

Soil Description

LGR SP W/ ARS CH, RT, O

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2866 D_{85}= 0.2628 D_{60}= 0.2120
D_{50}= 0.1985 D_{30}= 0.1739 D_{15}= 0.1536
D_{10}= 0.1371 C_u= 1.55 C_c= 1.04

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-03PU **Depth:** 14.0
Sample Number: 6

Date: 12/7/12

Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 10-017136
Boring: 17MVS-04PU - Final

Current Date: 1/17/2013

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR ML W/ ARS & LYS CH, G	ML		16												SV
1B	1.0	LGR SM W/ LYS CH, G	SM		4												SV
1C	2.0	LGR SM W/ G, RT	SM		1												
1D	3.0	LGR SP W/ O, RT	SP		2												
2	4.0	T SM W/ ARS CH, WD, RT	SM		18												SV
3	6.5	T SP W/ O, RT	SP		23												SV
4	9.0	T SM W/ O	SM		20												SV
5	11.5	T SM W/ G, O, RT	SM		21												
6	14.0	T SM W/ RT	SM		26												

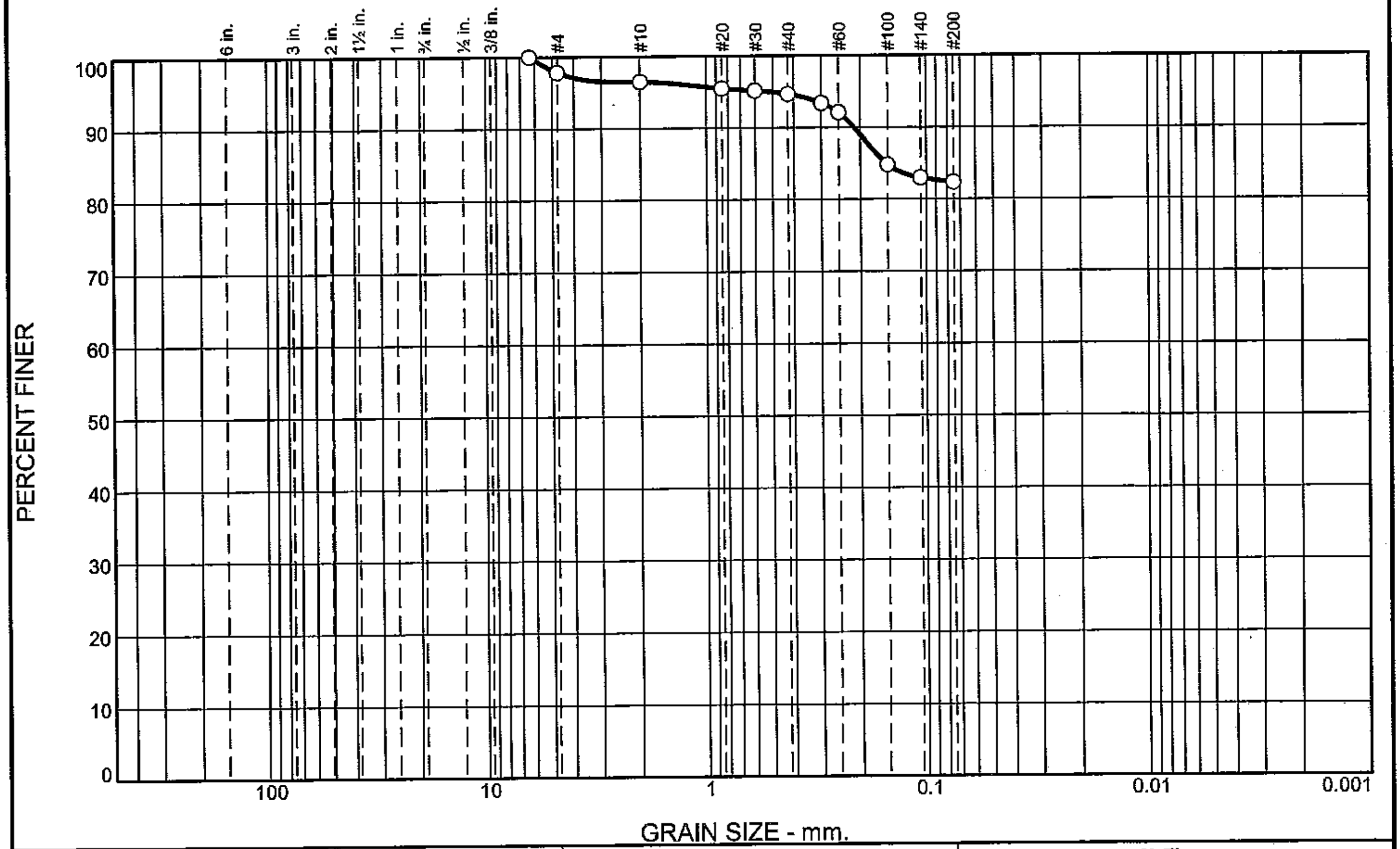
Remarks: ____________________

Stantec Consulting Services Inc.

Checked By: ________

File Name: Final_17MVS-04PU_be_boring_log_

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.1	1.4	1.8	12.4	82.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	97.9		
#10	96.5		
#20	95.5		
#30	95.2		
#40	94.7		
#50	93.4		
#60	92.1		
#100	84.8		
#140	83.0		
#200	82.3		

* (no specification provided)

Soil Description

BR ML W/ ARS & LYS CH, G

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2134 D_{85}= 0.1526 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Source of Sample: 17MVS-04PU **Depth:** 0.0
Sample Number: 1A

Date: 12/7/12

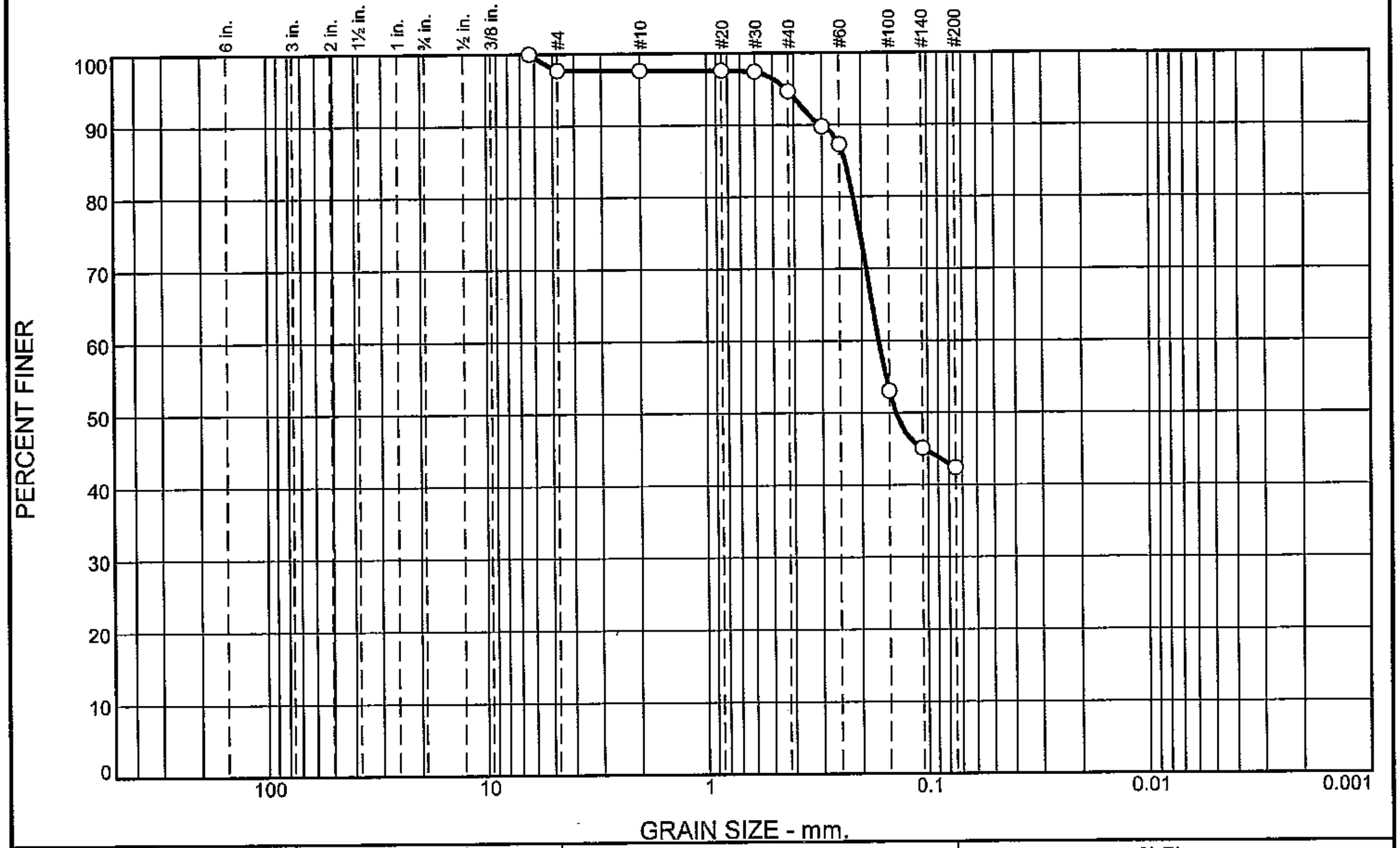
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.3	0.1	2.9	52.3	42.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	97.7		
#10	97.6		
#20	97.6		
#30	97.4		
#40	94.7		
#50	89.8		
#60	87.3		
#100	53.0		
#140	45.1		
#200	42.4		

* (no specification provided)

Soil Description

LGR SM W/ LYS CH, G

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3074 D_{85}= 0.2364 D_{60}= 0.1673

D_{50}= 0.1400 D_{30}= D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-04PU **Depth:** 1.0

Sample Number: 1B

Date: 12/7/12

Stantec

Saint Rose, Louisiana

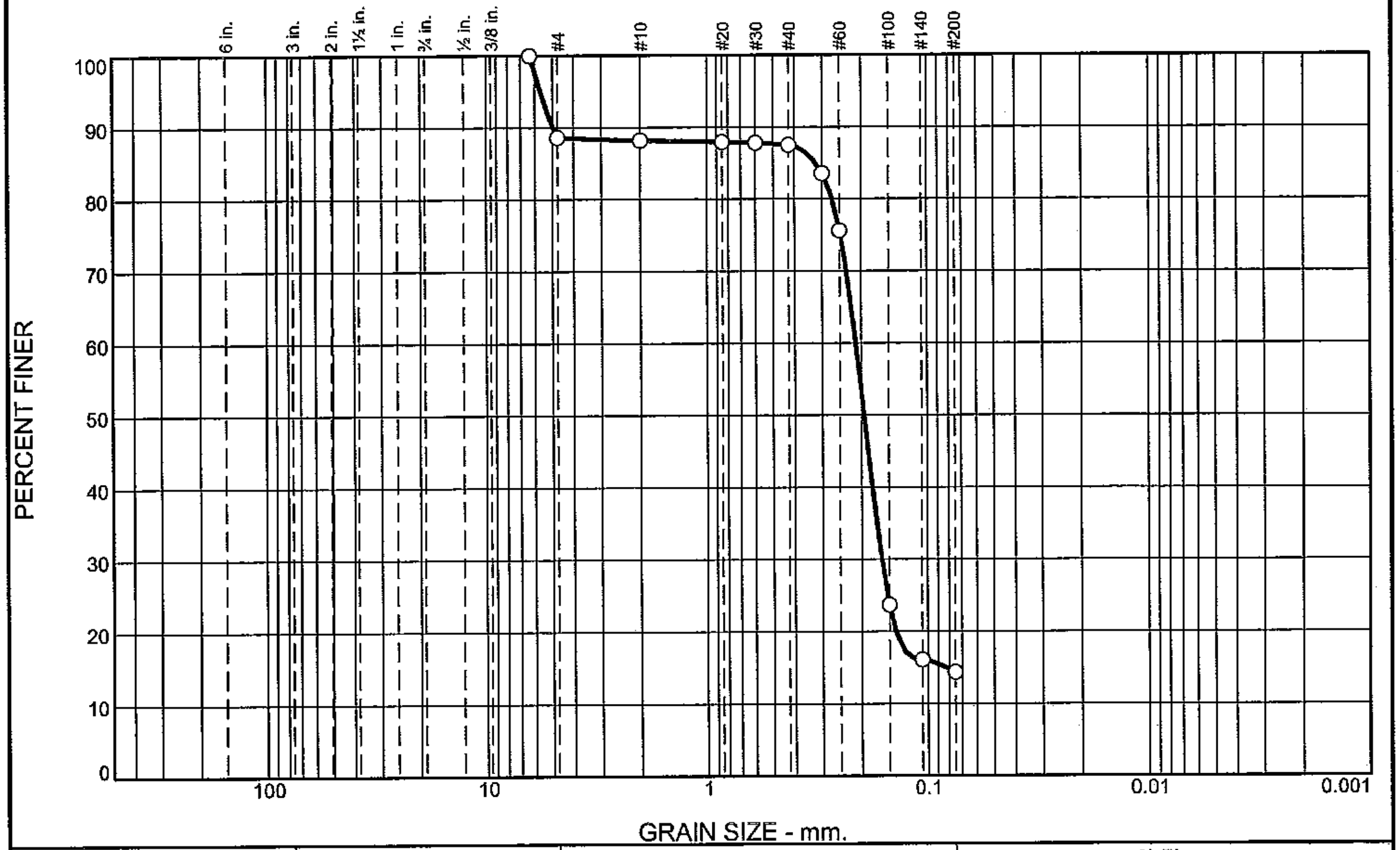
Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana

Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	11.4	0.4	0.7	73.1	14.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	88.6		
#10	88.2		
#20	87.9		
#30	87.8		
#40	87.5		
#50	83.5		
#60	75.6		
#100	23.7		
#140	16.1		
#200	14.4		

* (no specification provided)

Soil Description

T SM W/ ARS CH, WD, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.9701 D_{85}= 0.3208 D_{60}= 0.2121
D_{50}= 0.1946 D_{30}= 0.1622 D_{15}= 0.0826
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-04PU **Depth:** 4.0
Sample Number: 2

Date: 12/7/12

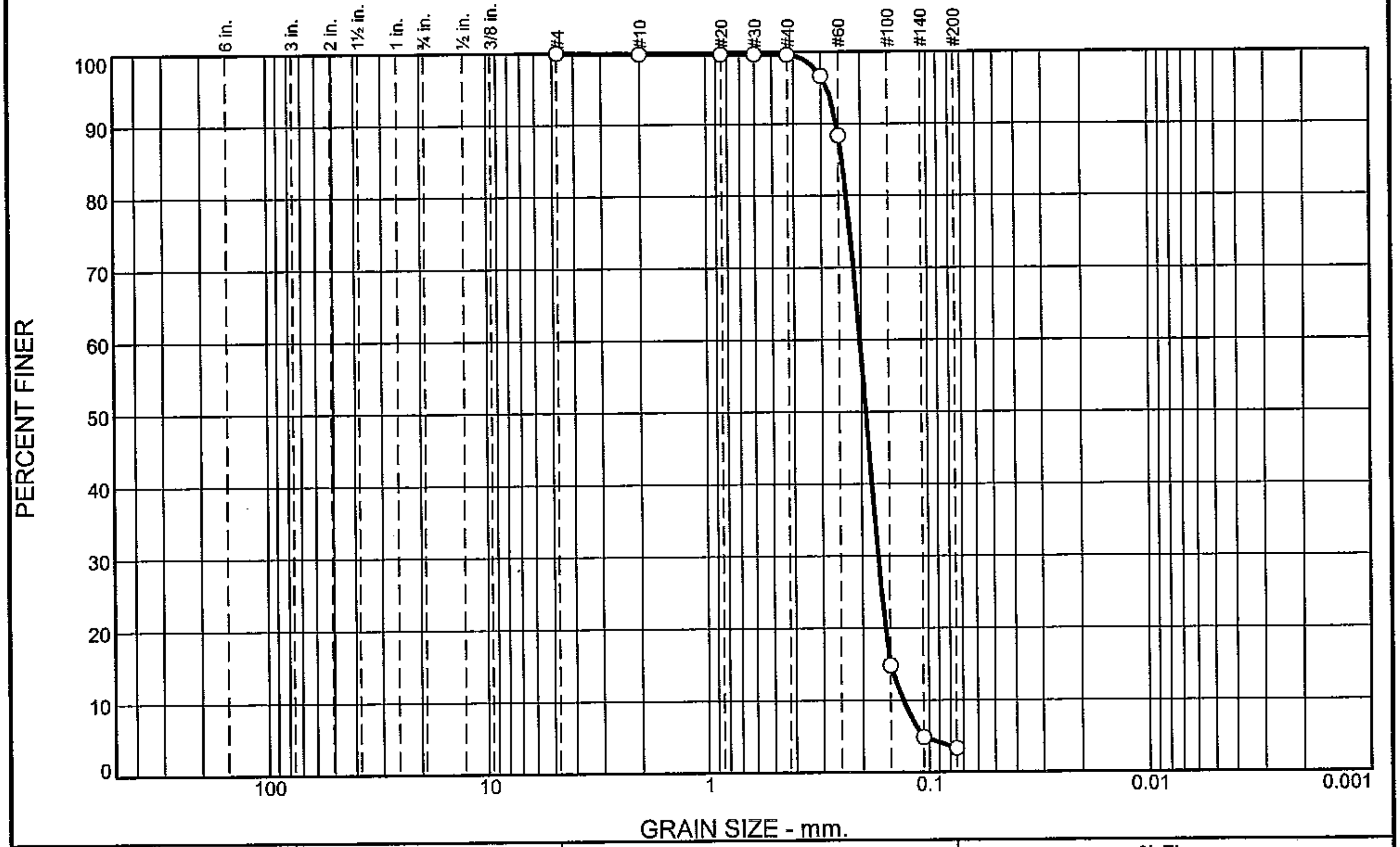
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.2	96.3	3.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.7		
#30	99.7		
#40	99.6		
#50	96.7		
#60	88.3		
#100	14.8		
#140	4.9		
#200	3.3		

* (no specification provided)

Soil Description

T SP W/ O, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2552 D_{85}= 0.2416 D_{60}= 0.2029

D_{50}= 0.1913 D_{30}= 0.1692 D_{15}= 0.1503

D_{10}= 0.1313 C_u= 1.55 C_c= 1.07

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-04PU **Depth:** 6.5

Sample Number: 3

Date: 12/7/12

Stantec

Saint Rose, Louisiana

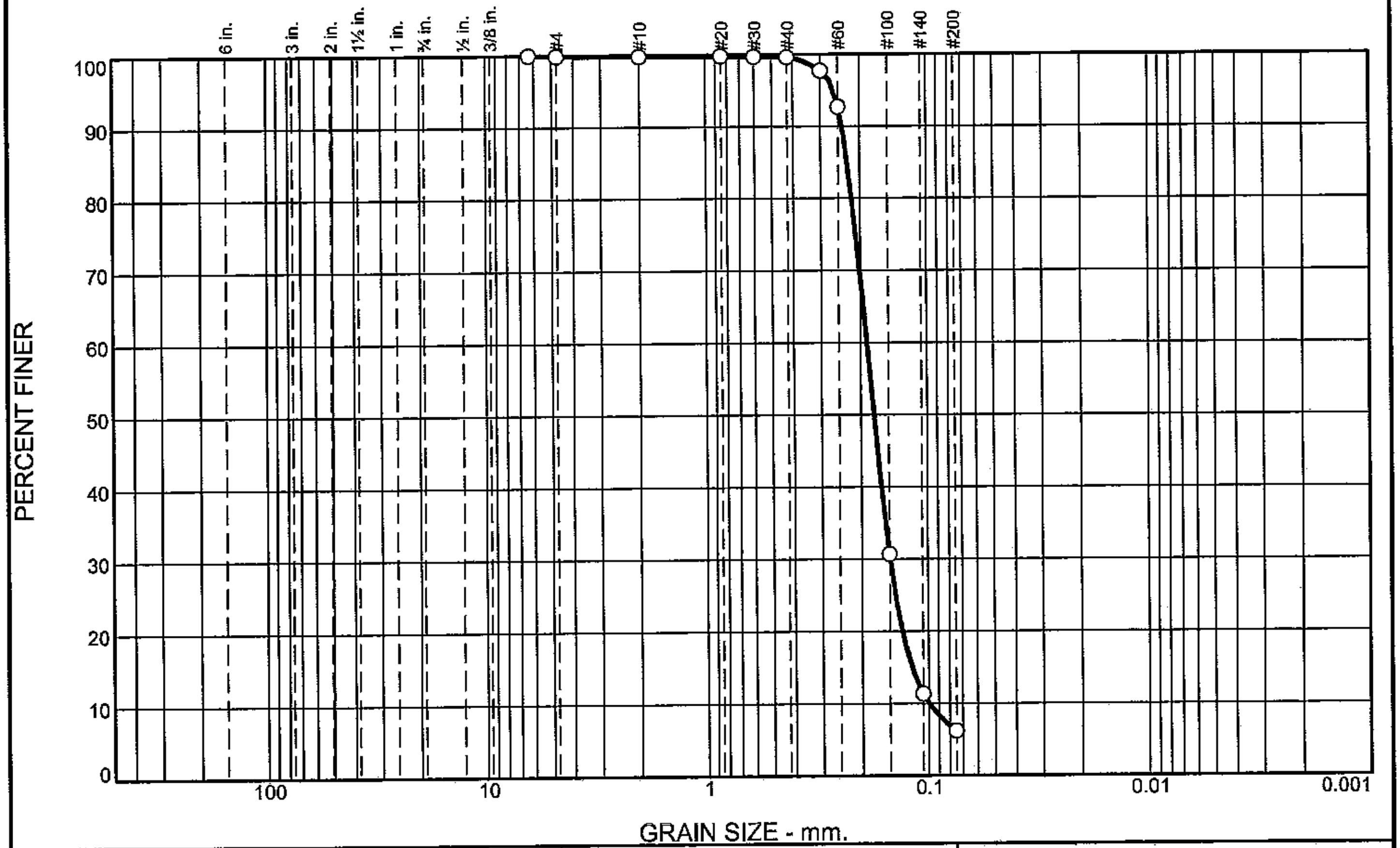
Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana

Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.1	0.2	93.4	6.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	99.9		
#10	99.8		
#20	99.8		
#30	99.7		
#40	99.6		
#50	97.7		
#60	92.7		
#100	30.7		
#140	11.4		
#200	6.2		

* (no specification provided)

Soil Description

T SM W/ O

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2407 D_{85}= 0.2280 D_{60}= 0.1877

D_{50}= 0.1750 D_{30}= 0.1490 D_{15}= 0.1191

D_{10}= 0.0997 C_u= 1.88 C_c= 1.19

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-04PU **Depth:** 9.0
Sample Number: 4

Date: 12/7/12

Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 10-017136 **Current Date:** 1/17/2013

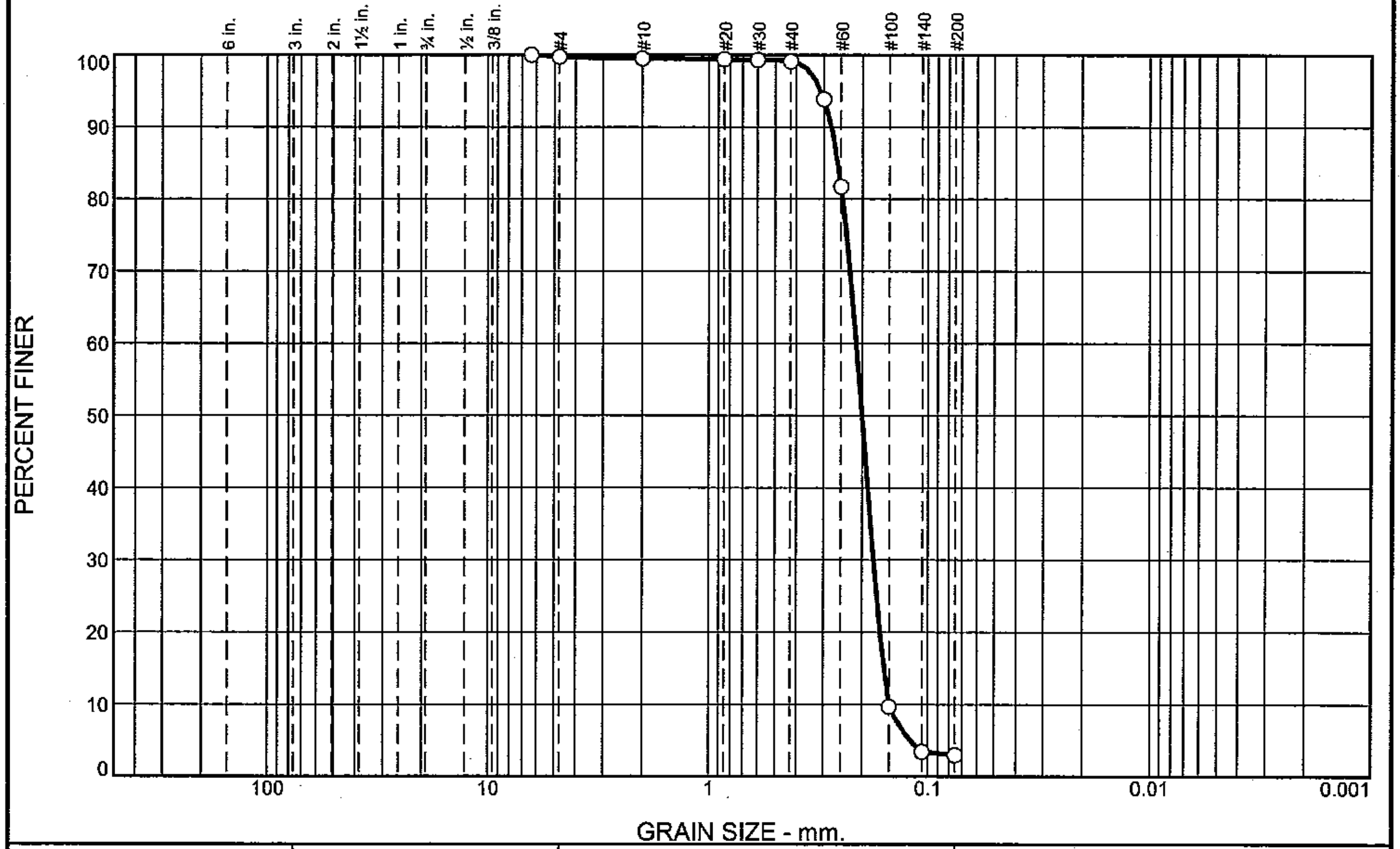
Boring: 17MVS-05PU - Final

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	M BR CL4 W/ ARS & LYS SM, O	CL4		28								39	24	15		
1B	1.0	BR MH W/ ARS SP, ARS CH, G	MH		39								54	45	9		
2A	2.0	M BR CH4 W/ ARS SP, ARS ML, O	CH4	10	47	73	107	96	UC	-	582	1164	87	18	69	0.45	
2B	3.0	M BR & T CH3 W/ ARS SP, O	CH3		39	81	113	97	UU	0	529		63	20	43	0.55	
3A	4.0	BR & T SP W/ LYS CH, G, RT	SP		15												SV
3B	5.0	T SM W/ ARS CH	SM		9												SV
4A	8.0	T SM W/ RT	SM		12												
4B	9.0	T SP	SP		9												
4C	10.0	T SP	SP		20												SV
5	12.0	LGR SM	SM		23												SV
6	14.5	LGR SM	SM		23												SV
7	17.0	LGR SP	SP		27												
8	19.5	LGR SM W/ SIF, G	SM		26												SV
9	22.0	LGR SP W/ SIF	SP		23												
10	24.5	LGR SP W/ SIF	SP		36												
11	27.0	LGR SP W/ SIF, RT	SP		35												
12	29.5	LGR SP W/ SIF	SP		31												SV
13	32.0	LGR SP W/ SIF	SP		28												
14	34.5	LGR SP W/ SIF	SP		29												
15	37.0	LGR SP W/ SIF	SP		28												
16	39.5	LGR SP	SP		27												SV
17	42.0	LGR SP W/ SIF	SP		28												
18	44.5	LGR SP W/ SIF	SP		29												
19	47.0	LGR SP W/ SIF	SP		28												
20	49.5	LGR SP W/ SIF	SP		25												SV
21	52.0	LGR SP W/ SIF	SP		34												
22	54.5	LGR SP W/ SIF	SP		31												
23	57.0	LGR SP W/ SIF	SP		25												
24	59.5	LGR SP W/ SIF	SP		30												SV

Remarks: ________________________________ Checked By: ________

Stantec Consulting Services Inc. File Name: 17MVS-05PU_be_boring_log_v10_0.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.3	0.4	96.1	3.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	99.8		
#10	99.5		
#20	99.4		
#30	99.3		
#40	99.1		
#50	93.9		
#60	81.7		
#100	9.7		
#140	3.5		
#200	3.0		

* (no specification provided)

Soil Description

BR & T SP W/ LYS CH, G, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2771 D_{85}= 0.2587 D_{60}= 0.2131
D_{50}= 0.2004 D_{30}= 0.1770 D_{15}= 0.1583
D_{10}= 0.1506 C_u= 1.42 C_c= 0.98

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 4.0
Sample Number: 3A

Date: 12/7/12

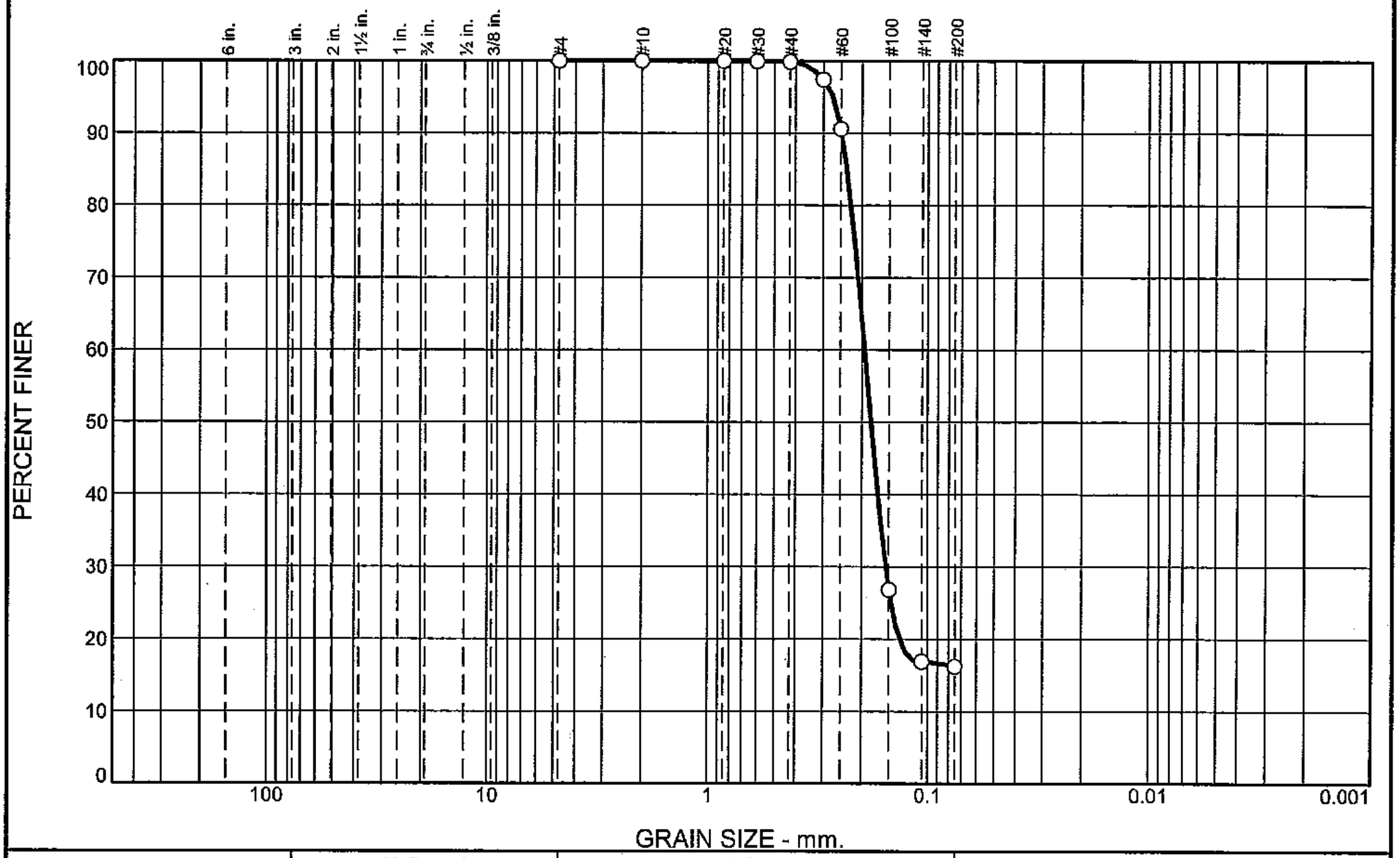
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	83.7	16.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#30	100.0		
#40	99.9		
#50	97.4		
#60	90.6		
#100	26.8		
#140	16.9		
#200	16.2		

* (no specification provided)

Soil Description

T SM W/ ARS CH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2481 D_{85}= 0.2348 D_{60}= 0.1943
D_{50}= 0.1815 D_{30}= 0.1551 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 5.0
Sample Number: 3B

Date: 12/7/12

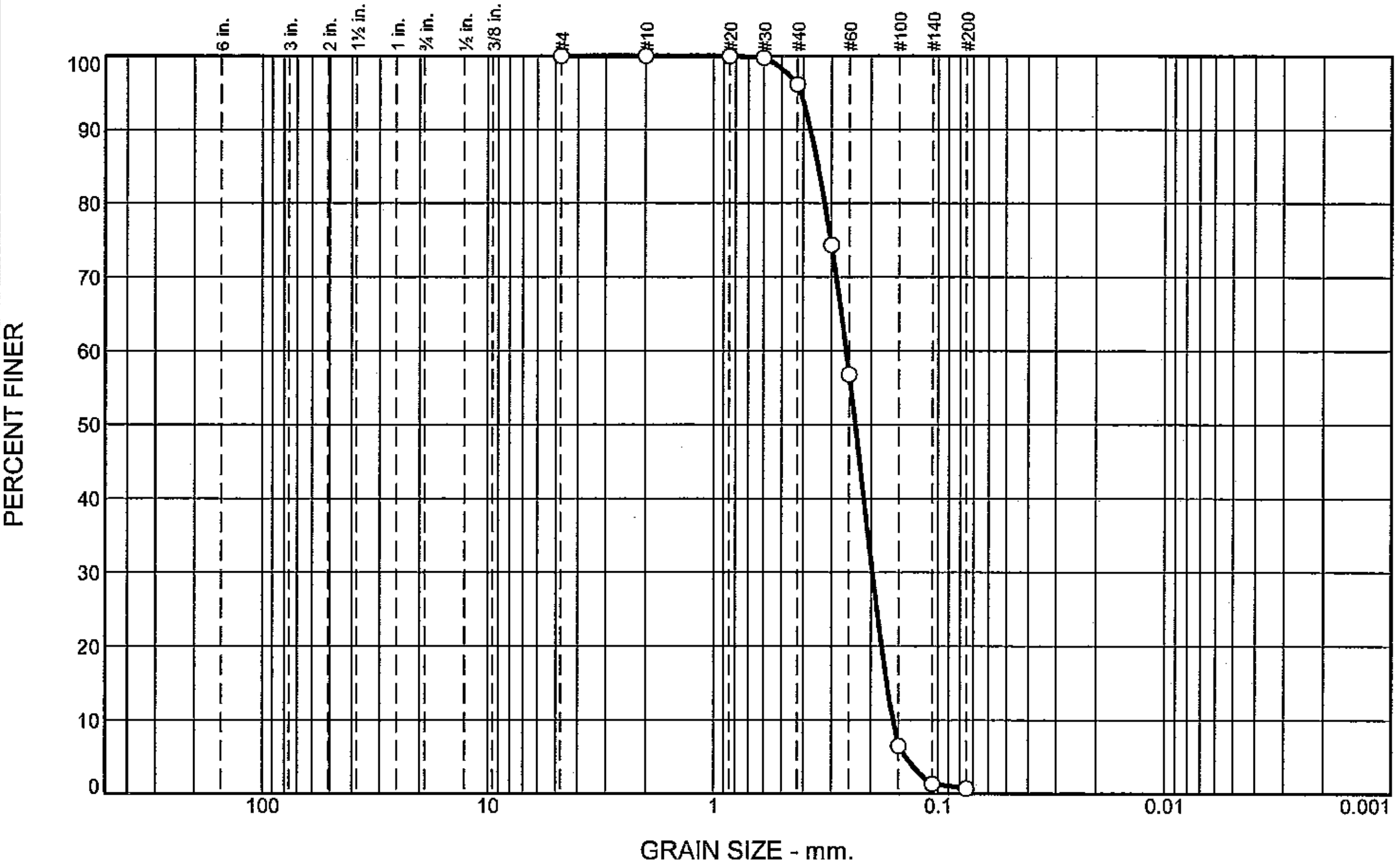
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.9	95.3	0.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#30	99.8		
#40	96.1		
#50	74.4		
#60	56.8		
#100	6.5		
#140	1.3		
#200	0.8		

* (no specification provided)

Soil Description

T SP

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3717 D_{85}= 0.3436 D_{60}= 0.2577
D_{50}= 0.2350 D_{30}= 0.1970 D_{15}= 0.1694
D_{10}= 0.1589 C_u= 1.62 C_c= 0.95

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 10.0
Sample Number: 4C
Date: 12/7/12

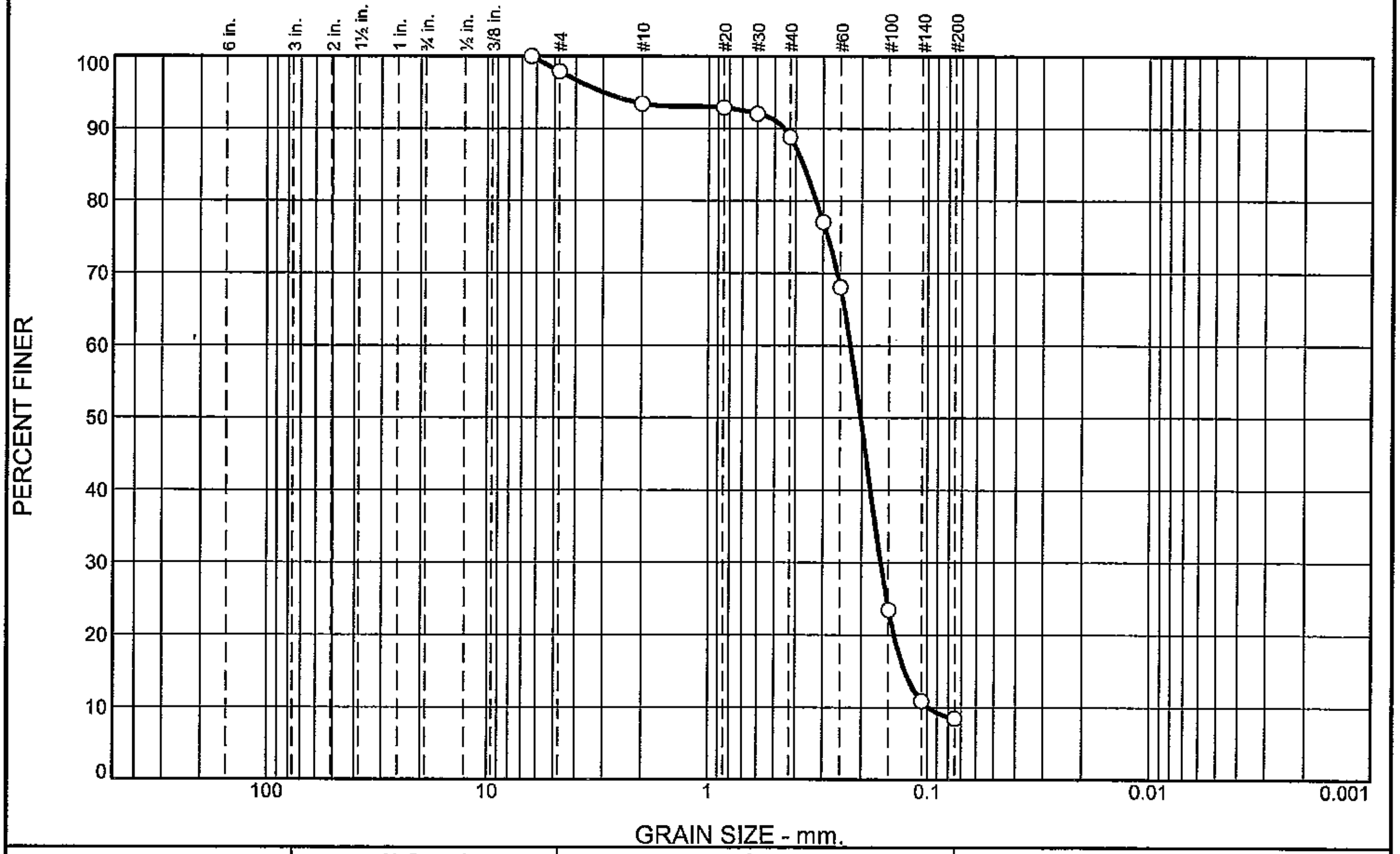
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.1	4.5	4.6	80.3	8.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	97.9		
#10	93.4		
#20	92.9		
#30	92.1		
#40	88.8		
#50	77.0		
#60	68.1		
#100	23.5		
#140	10.9		
#200	8.5		

* (no specification provided)

Soil Description

LGR SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4527 D_{85}= 0.3698 D_{60}= 0.2249
D_{50}= 0.2018 D_{30}= 0.1633 D_{15}= 0.1265
D_{10}= 0.0987 C_u= 2.28 C_c= 1.20

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 12.0
Sample Number: 5

Date: 12/7/12

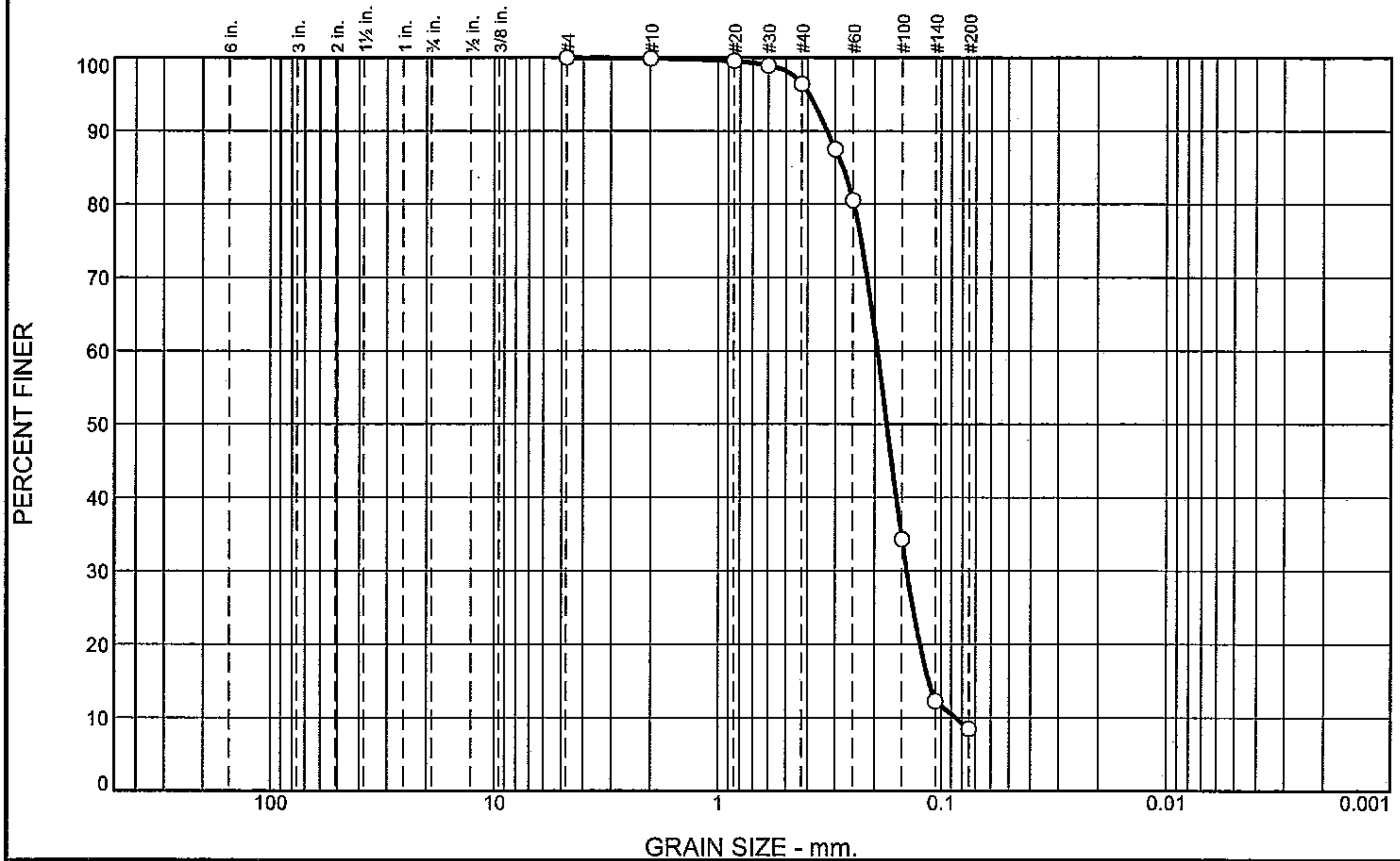
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	3.5	87.9	8.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.6		
#30	98.9		
#40	96.4		
#50	87.5		
#60	80.5		
#100	34.3		
#140	12.3		
#200	8.5		

* (no specification provided)

Soil Description

LGR SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3265 D_{85}= 0.2772 D_{60}= 0.1943
D_{50}= 0.1760 D_{30}= 0.1428 D_{15}= 0.1136
D_{10}= 0.0862 C_u= 2.25 C_c= 1.22

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 14.5
Sample Number: 6

Date: 12/7/12

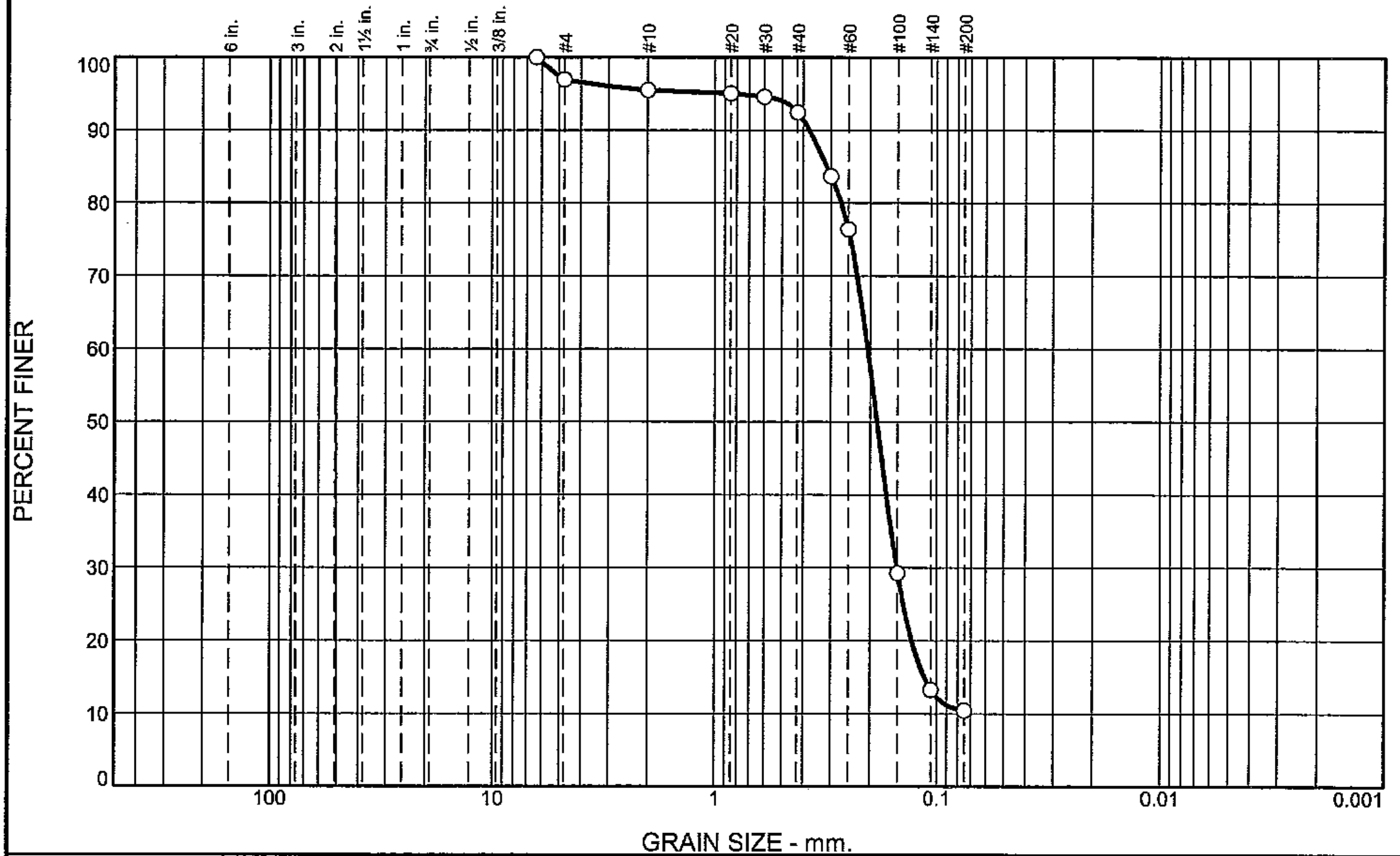
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.1	1.4	3.1	81.9	10.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	96.9		
#10	95.5		
#20	95.1		
#30	94.6		
#40	92.4		
#50	83.7		
#60	76.4		
#100	29.3		
#140	13.3		
#200	10.5		

* (no specification provided)

Soil Description

LGR SM W/ SIF, G

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3760 D_{85}= 0.3134 D_{60}= 0.2051
D_{50}= 0.1861 D_{30}= 0.1513 D_{15}= 0.1137
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 19.5
Sample Number: 8

Date: 12/7/12

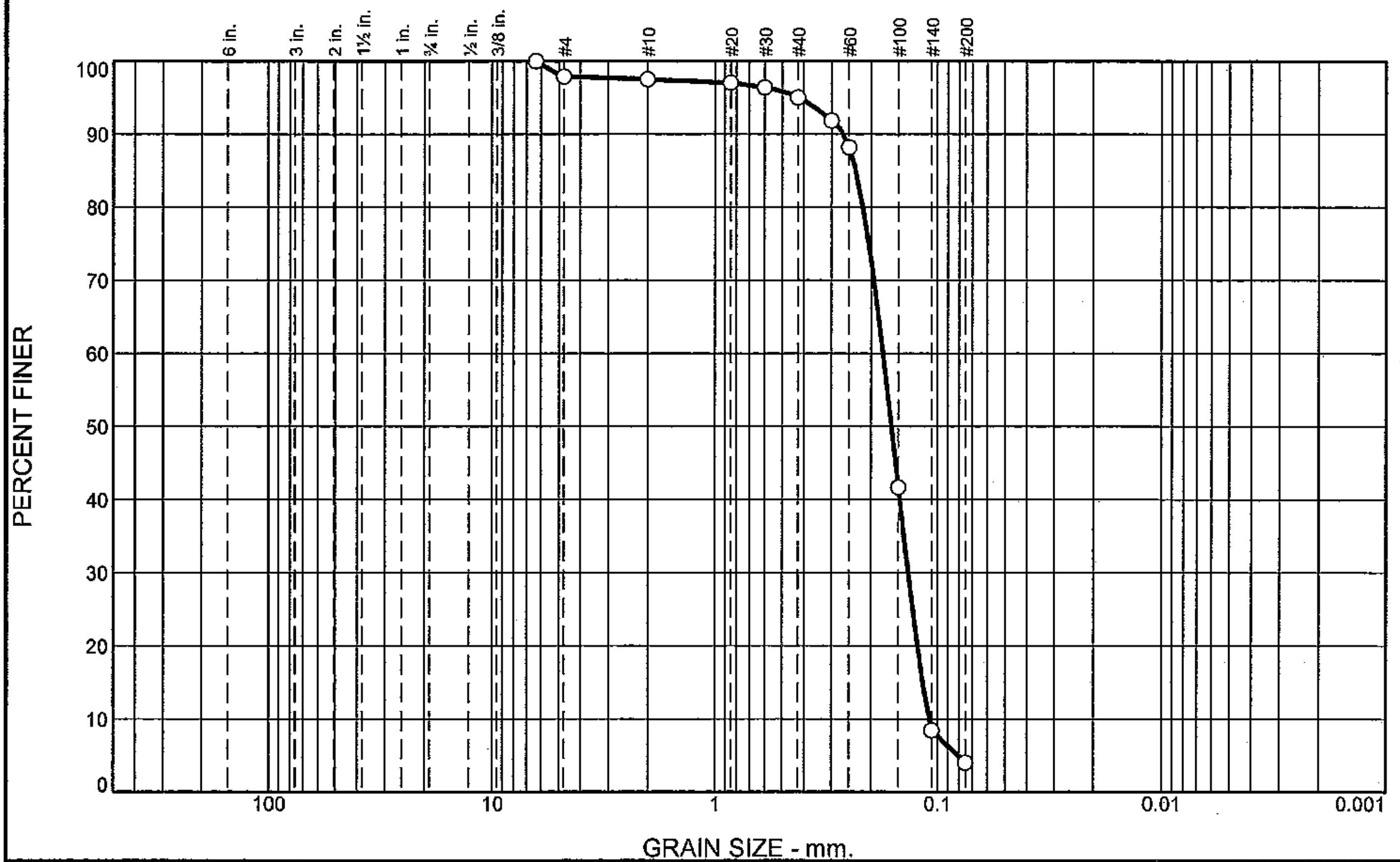
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.1	0.4	2.5	91.0	4.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	97.9		
#10	97.5		
#20	97.0		
#30	96.4		
#40	95.0		
#50	91.9		
#60	88.2		
#100	41.7		
#140	8.4		
#200	4.0		

* (no specification provided)

Soil Description

LGR SP W/ SIF

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2652 D_{85}= 0.2342 D_{60}= 0.1761
D_{50}= 0.1612 D_{30}= 0.1355 D_{15}= 0.1165
D_{10}= 0.1088 C_u= 1.62 C_c= 0.96

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 29.5
Sample Number: 12 **Date:** 12/7/12

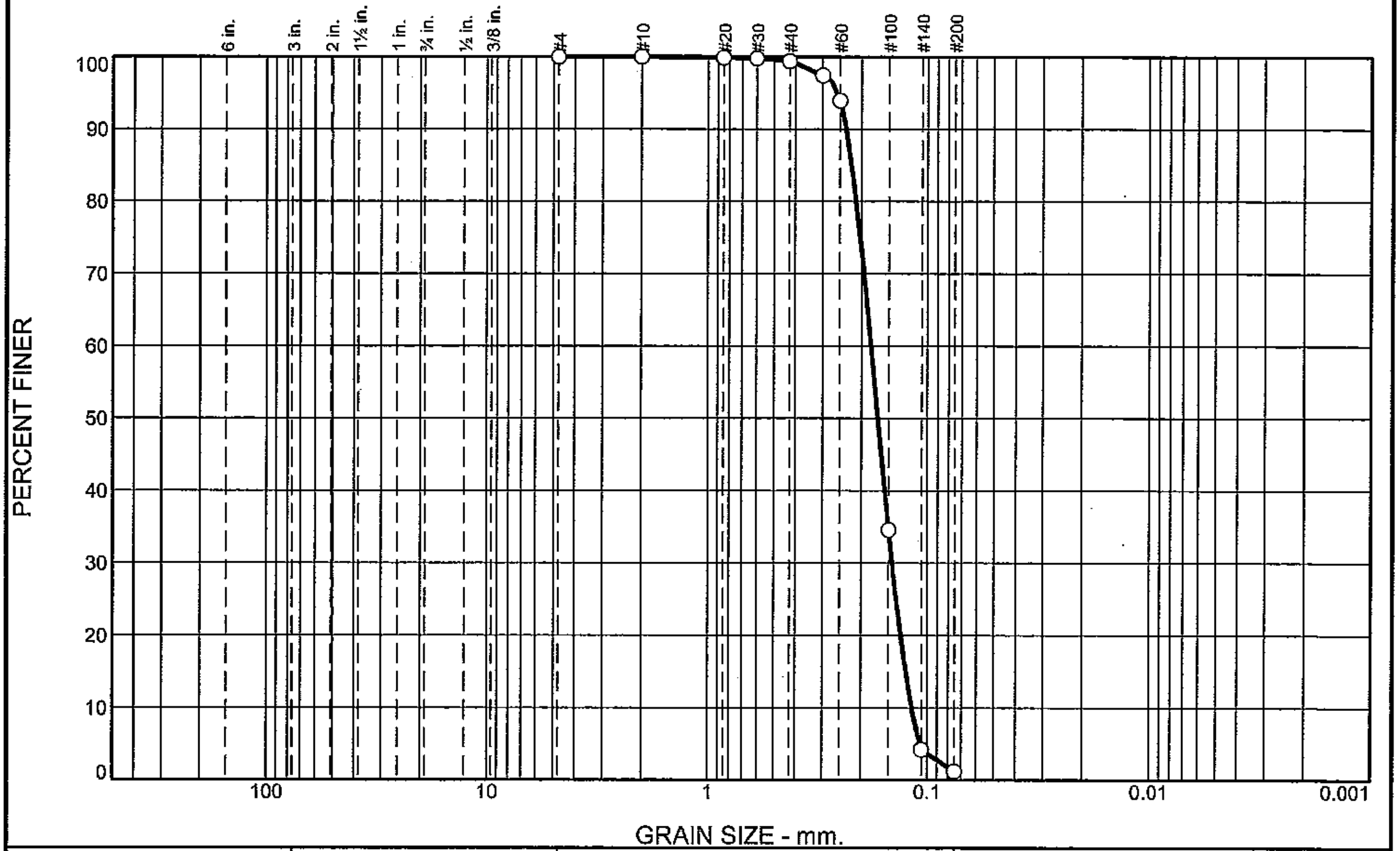
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.6	98.2	1.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.9		
#30	99.8		
#40	99.4		
#50	97.4		
#60	94.0		
#100	34.6		
#140	4.2		
#200	1.2		

* (no specification provided)

Soil Description

LGR SP

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2348 D_{85}= 0.2218 D_{60}= 0.1808
D_{50}= 0.1683 D_{30}= 0.1445 D_{15}= 0.1250
D_{10}= 0.1173 C_u= 1.54 C_c= 0.98

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 39.5
Sample Number: 16

Date: 12/7/12

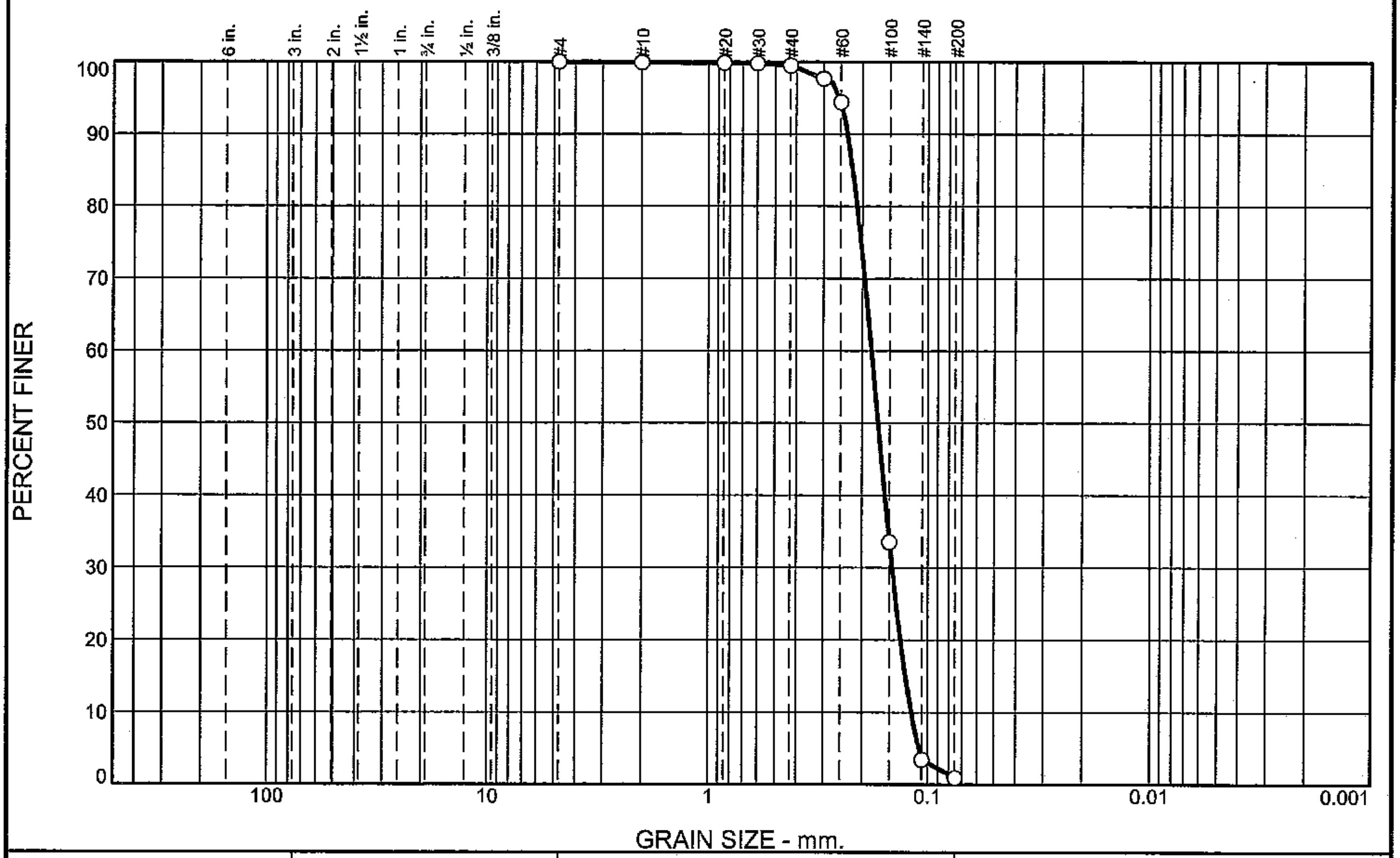
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.4	98.6	0.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.9		
#30	99.8		
#40	99.5		
#50	97.7		
#60	94.4		
#100	33.6		
#140	3.5		
#200	0.9		

* (no specification provided)

Soil Description

LGR SP W/ SIF

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2335 D_{85}= 0.2211 D_{60}= 0.1814
D_{50}= 0.1691 D_{30}= 0.1458 D_{15}= 0.1265
D_{10}= 0.1189 C_u= 1.53 C_c= 0.99

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 49.5
Sample Number: 20 **Date:** 12/7/12

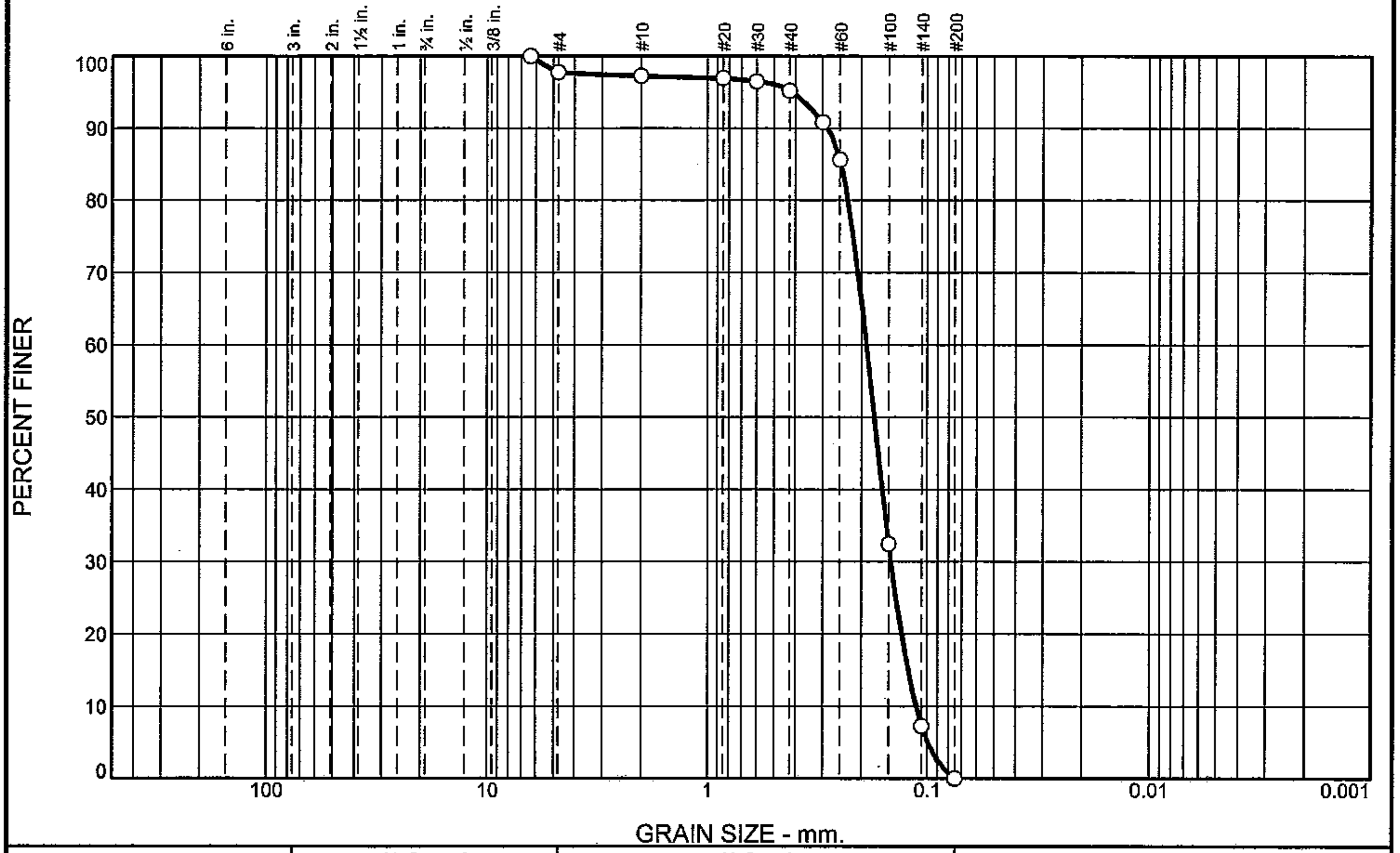
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.2	0.6	2.0	95.2	0.0	0.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	97.8		
#10	97.2		
#20	96.9		
#30	96.5		
#40	95.2		
#50	90.8		
#60	85.7		
#100	32.5		
#140	7.3		
#200	0.0		

* (no specification provided)

Soil Description

LGR SP W/ SIF

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2853 D_{85}= 0.2470 D_{60}= 0.1897
D_{50}= 0.1746 D_{30}= 0.1464 D_{15}= 0.1223
D_{10}= 0.1124 C_u= 1.69 C_c= 1.01

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-05PU **Depth:** 59.5
Sample Number: 24

Date: 12/7/12

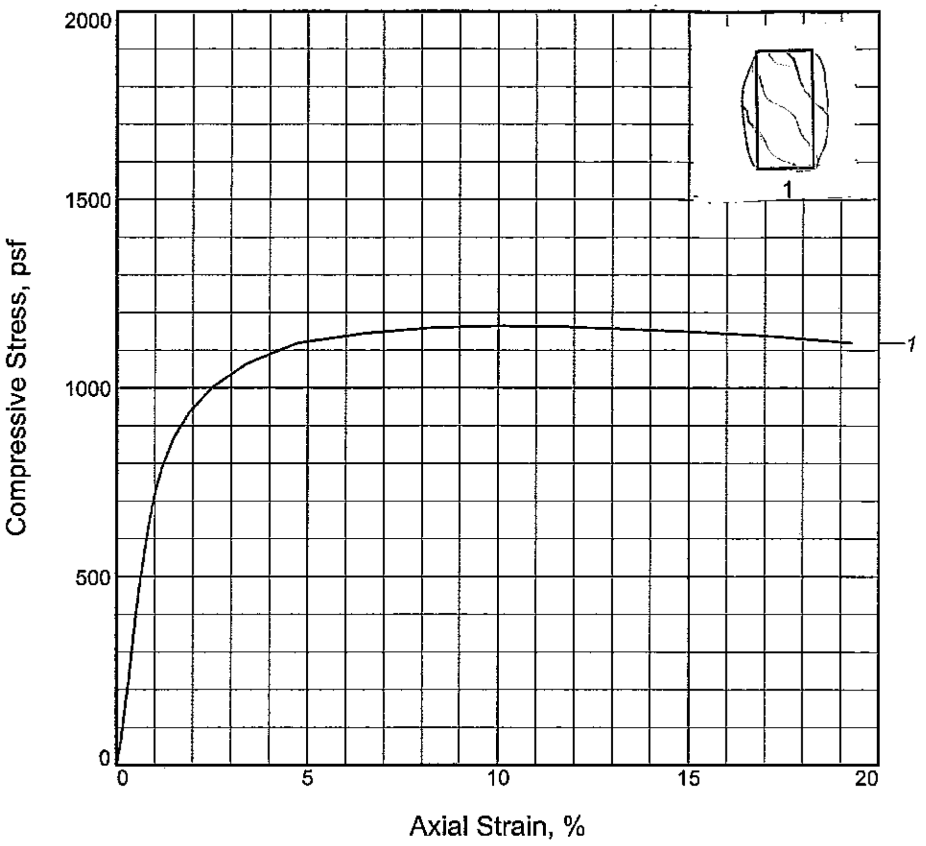
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1164			
Undrained shear strength, psf	582			
Failure strain, %	10.0			
Strain rate, in./min.	1.000			
Water content, %	46.7			
Wet density, pcf	107.5			
Dry density, pcf	73.3			
Saturation, %	96.5			
Void ratio	1.3179			
Specimen diameter, in.	1.387			
Specimen height, in.	3.007			
Height/diameter ratio	2.17			

Description: M BR CH4 W/ ARS SP, ARS ML, O

LL = 87	**PL =** 18	**PI =** 69	**Assumed GS=** 2.72	**Type:** UNDISTURBED

Project No.: 10-017136
Date Sampled: 12/7/12
Remarks:

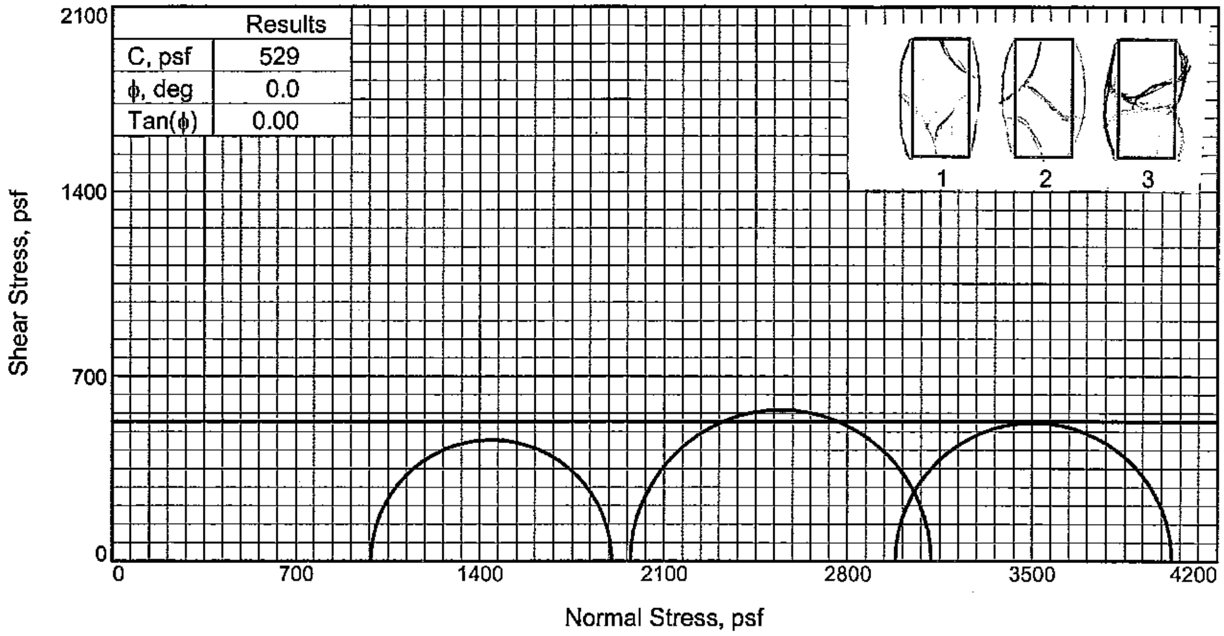
Figure _______

Client: USACE

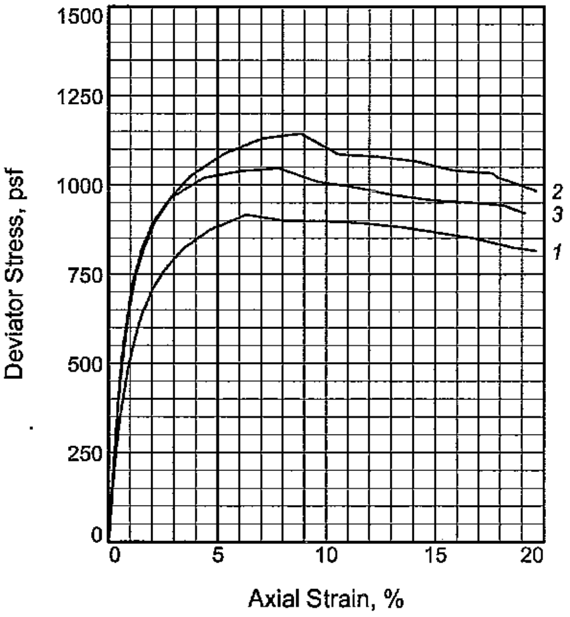
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Source of Sample: 17MVS-05PU **Depth:** 2.0
Sample Number: 2A

UNCONFINED COMPRESSION TEST
Stantec
Saint Rose, Louisiana

Tested By: VF **Checked By:** MJB/JS



	Results
C, psf	529
ϕ, deg	0.0
Tan(ϕ)	0.00



Sample No.		1	2	3
Initial	Water Content, %	38.9	32.8	33.7
	Dry Density, pcf	81.3	87.1	86.8
	Saturation, %	96.7	93.2	95.2
	Void Ratio	1.1032	0.9645	0.9701
	Diameter, in.	1.390	1.395	1.390
	Height, in.	3.008	3.007	3.008
At Test	Water Content, %	38.9	32.8	33.7
	Dry Density, pcf	81.3	87.1	86.8
	Saturation, %	96.7	93.2	95.2
	Void Ratio	1.1032	0.9645	0.9701
	Diameter, in.	1.390	1.395	1.390
	Height, in.	3.008	3.007	3.008
Strain rate, in./min.		1.000	1.000	1.000
Back Pressure, psi		0.00	0.00	0.00
Cell Pressure, psi		6.84	13.70	20.71
Fail. Stress, psf		917	1144	1047
Strain, %		6.3	8.8	7.8
Ult. Stress, psf		867	1067	958
Strain, %		15.1	14.1	14.9
σ_1 Failure, psf		1902	3117	4029
σ_3 Failure, psf		985	1973	2982

Type of Test:
Unconsolidated Undrained

Sample Type: UNDISTURBED

Description: M BR & T CH3 W/ ARS SP, O

LL= 63 **PL=** 20 **PI=** 43

Assumed Specific Gravity= 2.74

Remarks:

Figure _______

Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project
17th Street Canal Reevalution, Jefferson Parish, Louisiana

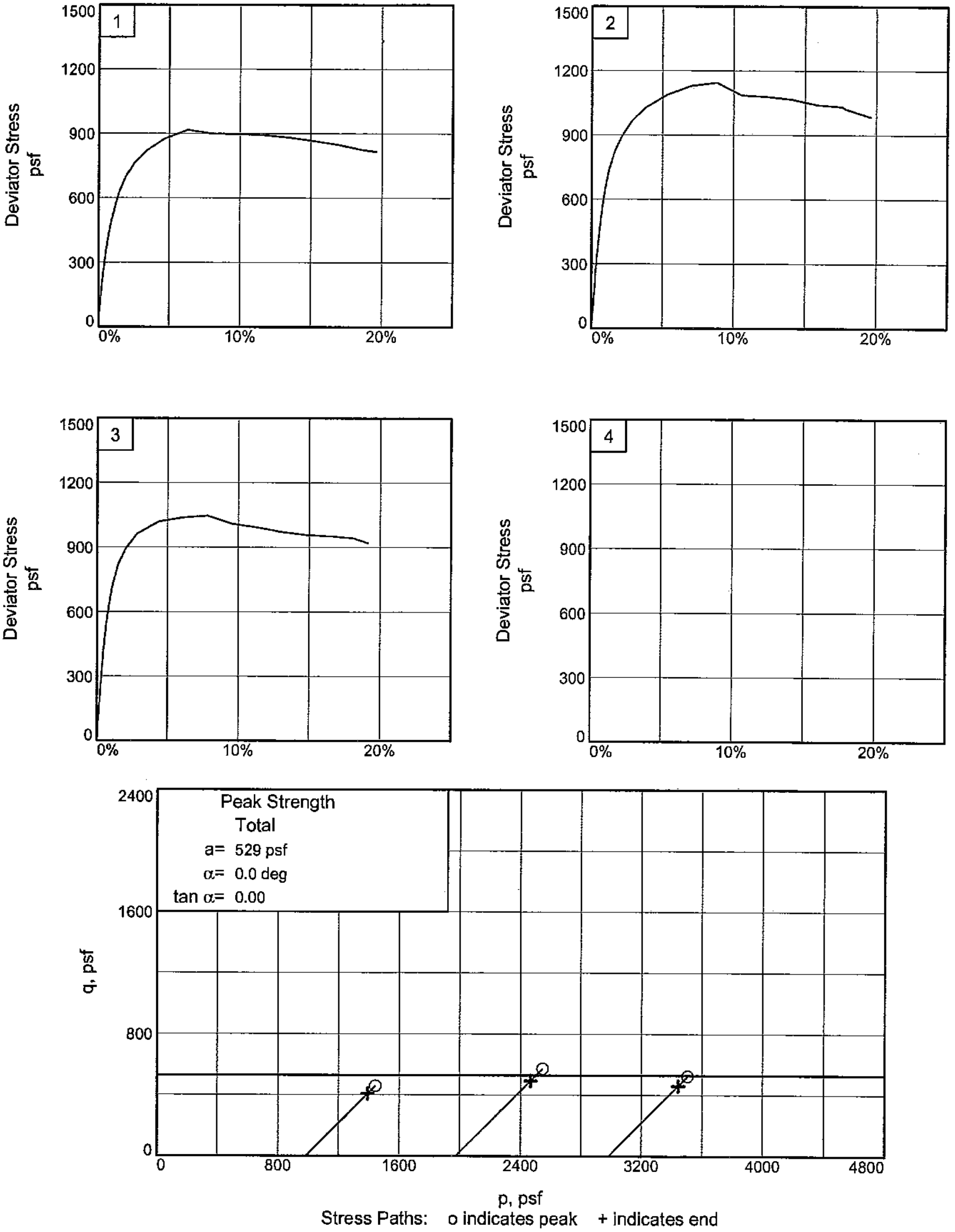
Source of Sample: 17MVS-05PU **Depth:** 3.0

Sample Number: 2B

Proj. No.: 10-017136 **Date Sampled:** 12/7/12

TRIAXIAL SHEAR TEST REPORT
Stantec
Saint Rose, Louisiana

Tested By: VF **Checked By:** MJB/JS



Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana

Source of Sample: 17MVS-05PU **Depth:** 3.0 **Sample Number:** 2B

Project No.: 10-017136 **Figure** ________

Stantec, Inc.

Tested By: VF **Checked By:** MJB/JS

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ______

Project Number: 10-017136
Boring: 17MVS-06PU - Final

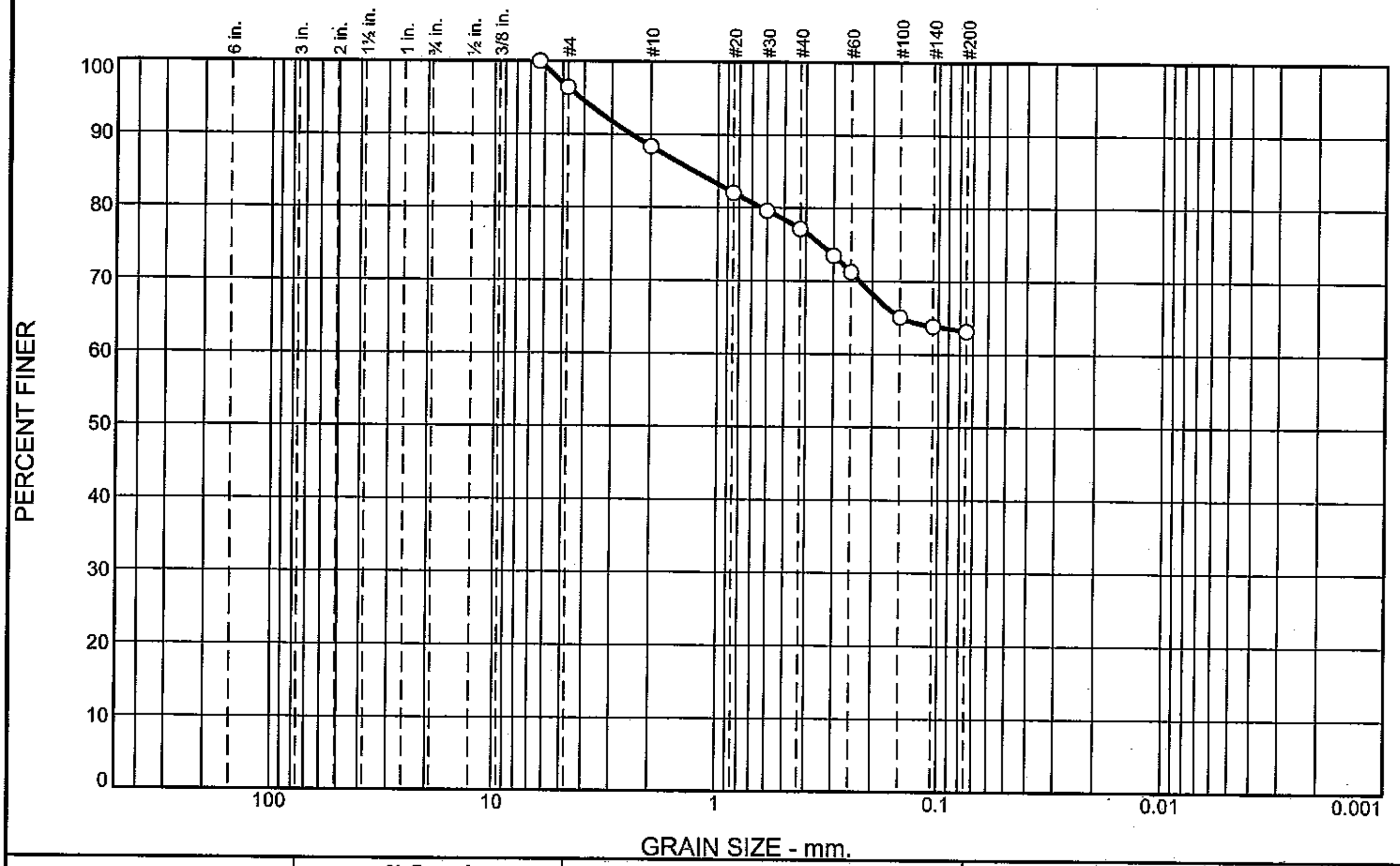
Current Date: 1/17/2013

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR & T ML W/ ARS CH, G, RT	ML		10												SV
1B	1.0	T SM W/ RT, O	SM		2												
1C	2.0	T SM W/ RT	SM		2												SV
2	4.0	T SP W/ RT	SP		25												SV
3	6.5	T SP W/ RT	SP		26												SV
4	9.0	T SP	SP		21												SV
5	11.5	T SP W/ G	SP		20												
6	14.0	T SP W/ G	SP		16												

Remarks: ______
Stantec Consulting Services Inc.

Checked By: ______
File Name: 17MVS-06PU_be_boring_log_v10_0.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.6	8.0	11.2	14.0	63.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	96.4		
#10	88.4		
#20	82.0		
#30	79.6		
#40	77.2		
#50	73.5		
#60	71.2		
#100	65.1		
#140	63.8		
#200	63.2		

* (no specification provided)

Soil Description

BR & T ML W/ ARS CH, G, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.4543 D_{85}= 1.2817 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-06PU **Depth:** 0.0
Sample Number: 1A

Date: 12/7/12

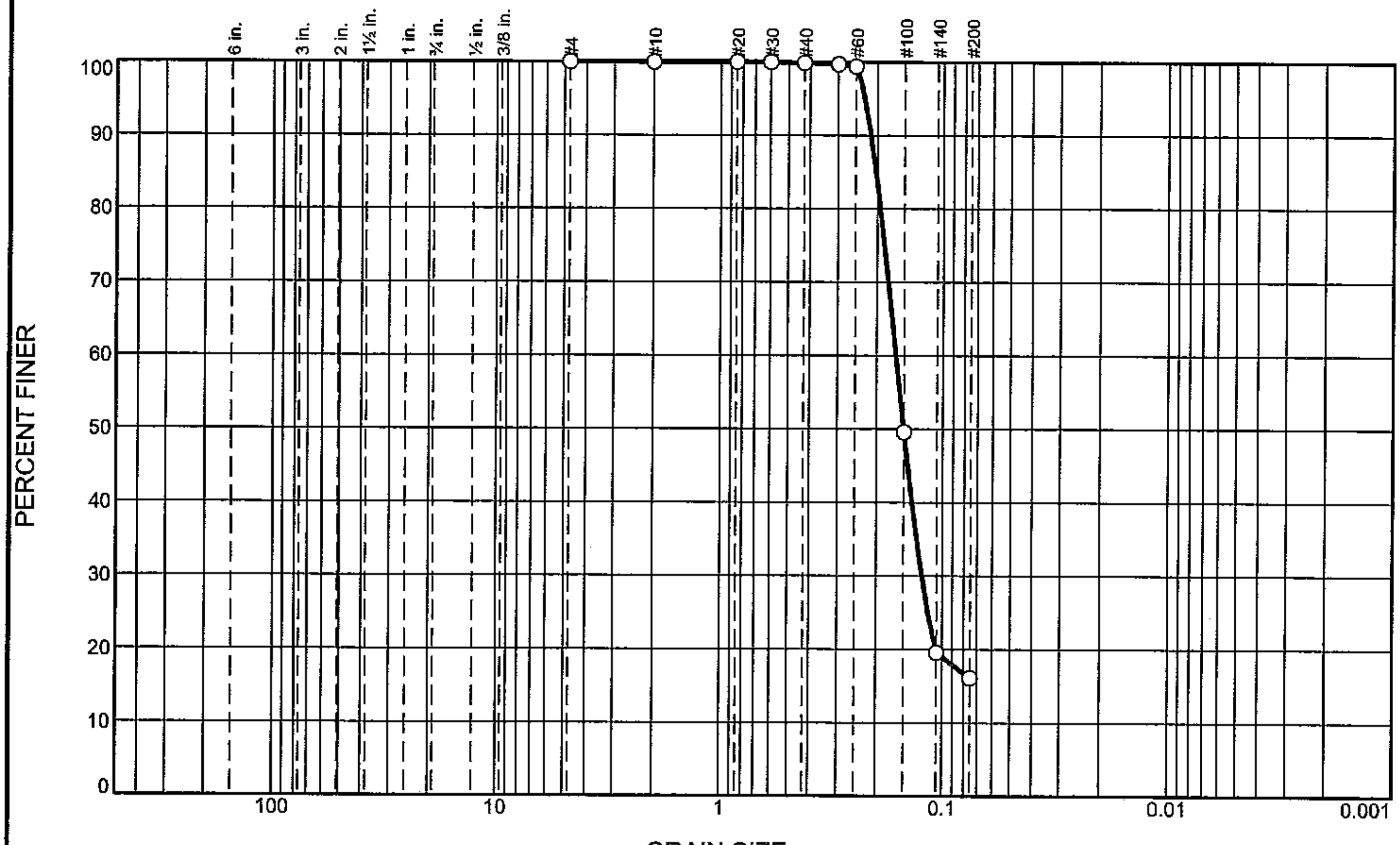
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	83.8	16.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#30	100.0		
#40	99.9		
#50	99.7		
#60	99.4		
#100	49.6		
#140	19.6		
#200	16.1		

* (no specification provided)

Soil Description

T SM W/ RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2137 D_{85}= 0.2026 D_{60}= 0.1635
D_{50}= 0.1505 D_{30}= 0.1241 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-06PU **Depth:** 2.0
Sample Number: 1C

Date: 12/7/12

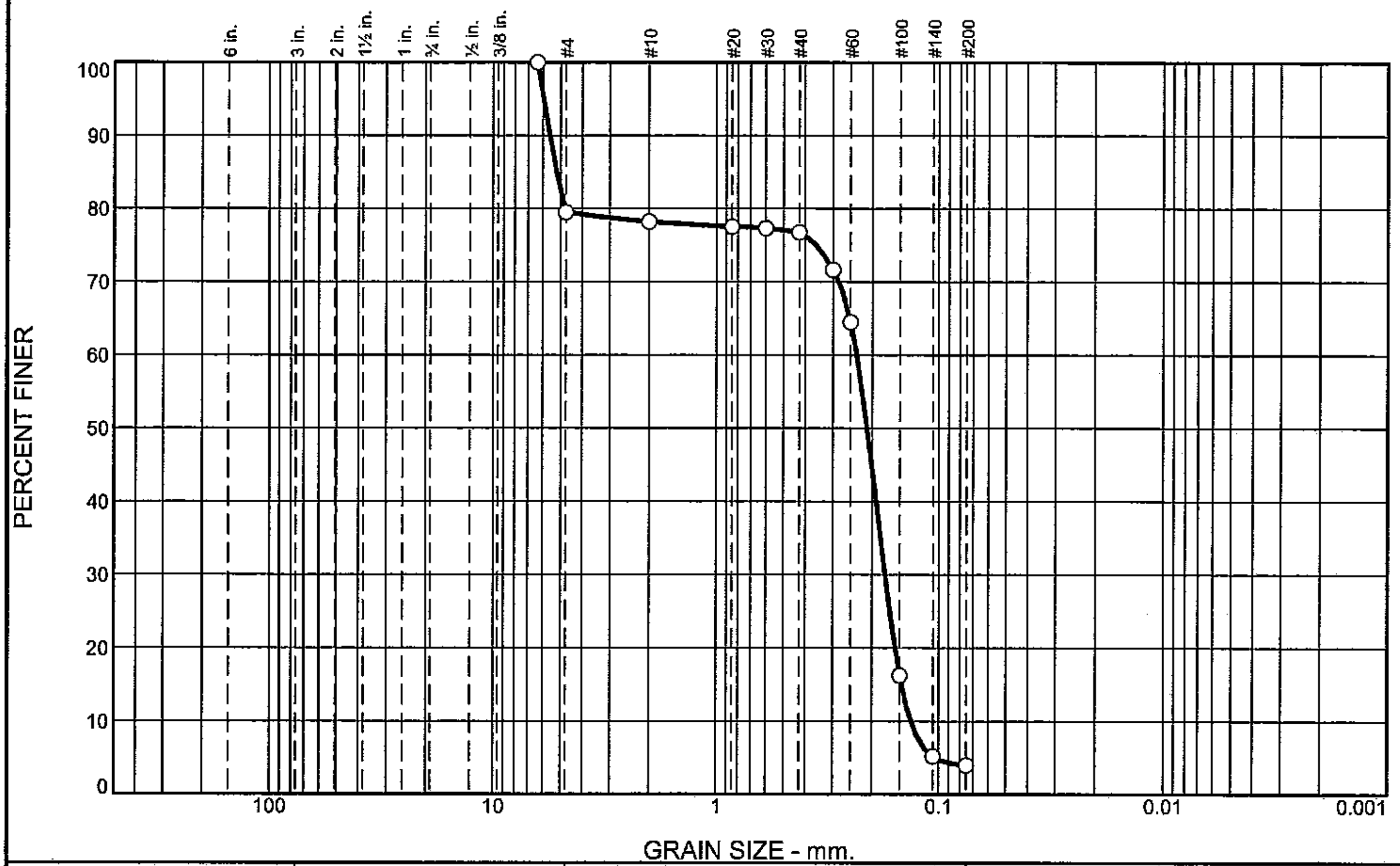
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** M~~JB~~/JS MW

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.5	1.3	1.5	72.7	4.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	79.5		
#10	78.2		
#20	77.5		
#30	77.3		
#40	76.7		
#50	71.6		
#60	64.5		
#100	16.2		
#140	5.2		
#200	4.0		

* (no specification provided)

Soil Description

T SP W/ RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.5889 D_{85}= 5.2086 D_{60}= 0.2348
D_{50}= 0.2109 D_{30}= 0.1749 D_{15}= 0.1473
D_{10}= 0.1337 C_u= 1.76 C_c= 0.97

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-06PU **Depth:** 4.0
Sample Number: 2
Date: 12/7/12

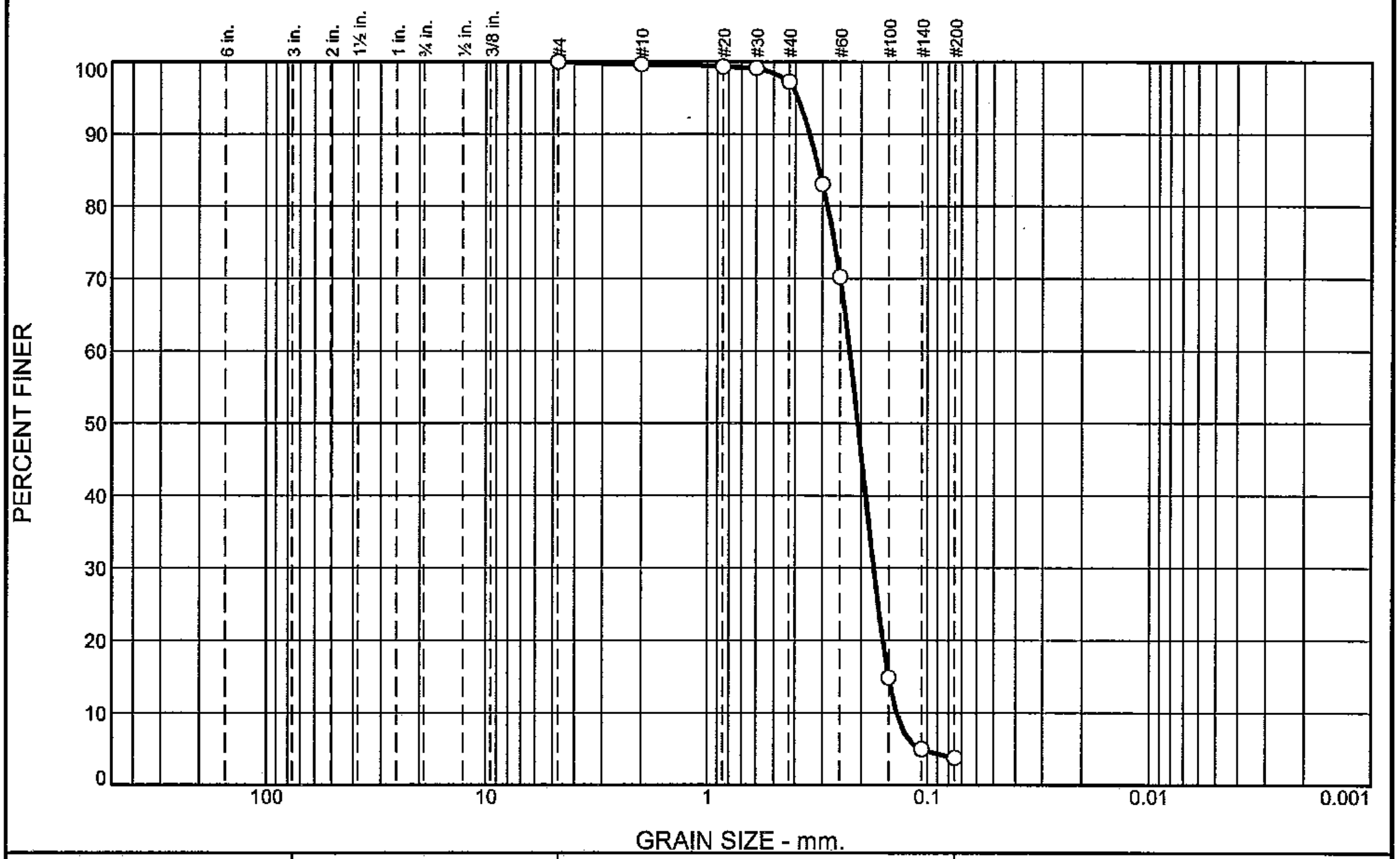
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	2.4	93.5	3.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	99.3		
#30	99.2		
#40	97.3		
#50	83.1		
#60	70.3		
#100	14.9		
#140	5.0		
#200	3.8		

* (no specification provided)

Soil Description

T SP W/ RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3429 D_{85}= 0.3104 D_{60}= 0.2261
D_{50}= 0.2077 D_{30}= 0.1759 D_{15}= 0.1502
D_{10}= 0.1377 C_u= 1.64 C_c= 0.99

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-06PU **Depth:** 6.5
Sample Number: 3
Date: 12/7/12

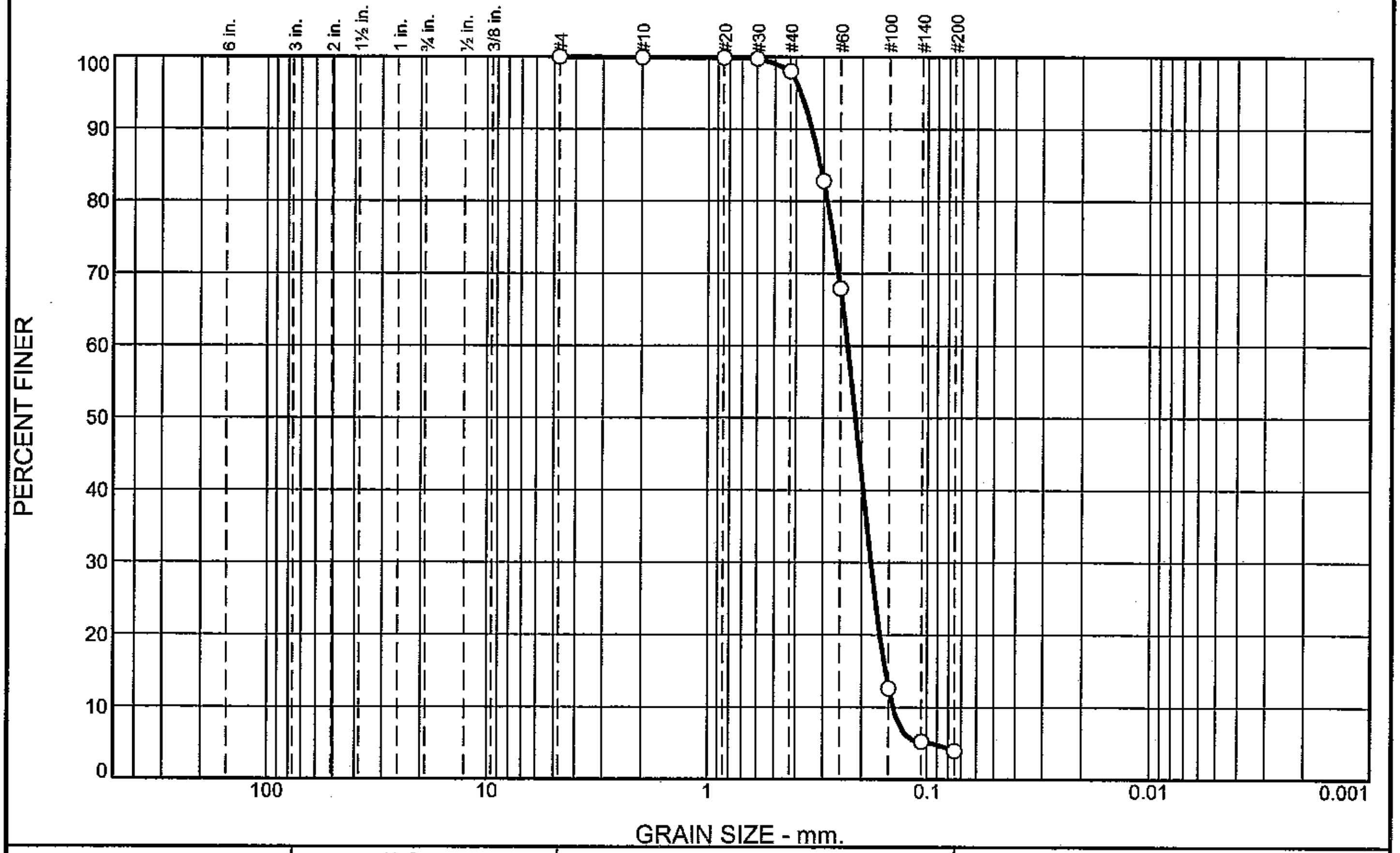
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.9	94.0	4.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.9		
#30	99.7		
#40	98.0		
#50	82.8		
#60	68.0		
#100	12.6		
#140	5.2		
#200	4.0		

* (no specification provided)

Soil Description

T SP

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3391 D_{85}= 0.3104 D_{60}= 0.2322
D_{50}= 0.2135 D_{30}= 0.1810 D_{15}= 0.1552
D_{10}= 0.1432 C_u= 1.62 C_c= 0.99

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-06PU **Depth:** 9.0
Sample Number: 4

Date: 12/7/12

Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Assigned By: ______

Project Number: 10-017136

Current Date: 1/17/2013

Boring: 17MVS-07PU - Final

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR ML W/ ARS CH, O, SIF	ML		16												SV
1B	1.0	ST BR CL6 W/ LYS & ARS SP, G	CL6	5	11	107	119	54	UC	-	1512	3025	45	22	23		
1C	2.0	T SM W/ ARS CH, O, RT	SM		16												SV
2	4.0	T SP W/ ARS CH, RT	SP		18												SV
3	6.5	T SM W/ WD	SM		20												SV
4	9.0	T SM W/ O	SM		20												SV
5	11.5	T SM W/ RT	SM		20												
6	14.0	T SM W/ ARS CH	SM		22												

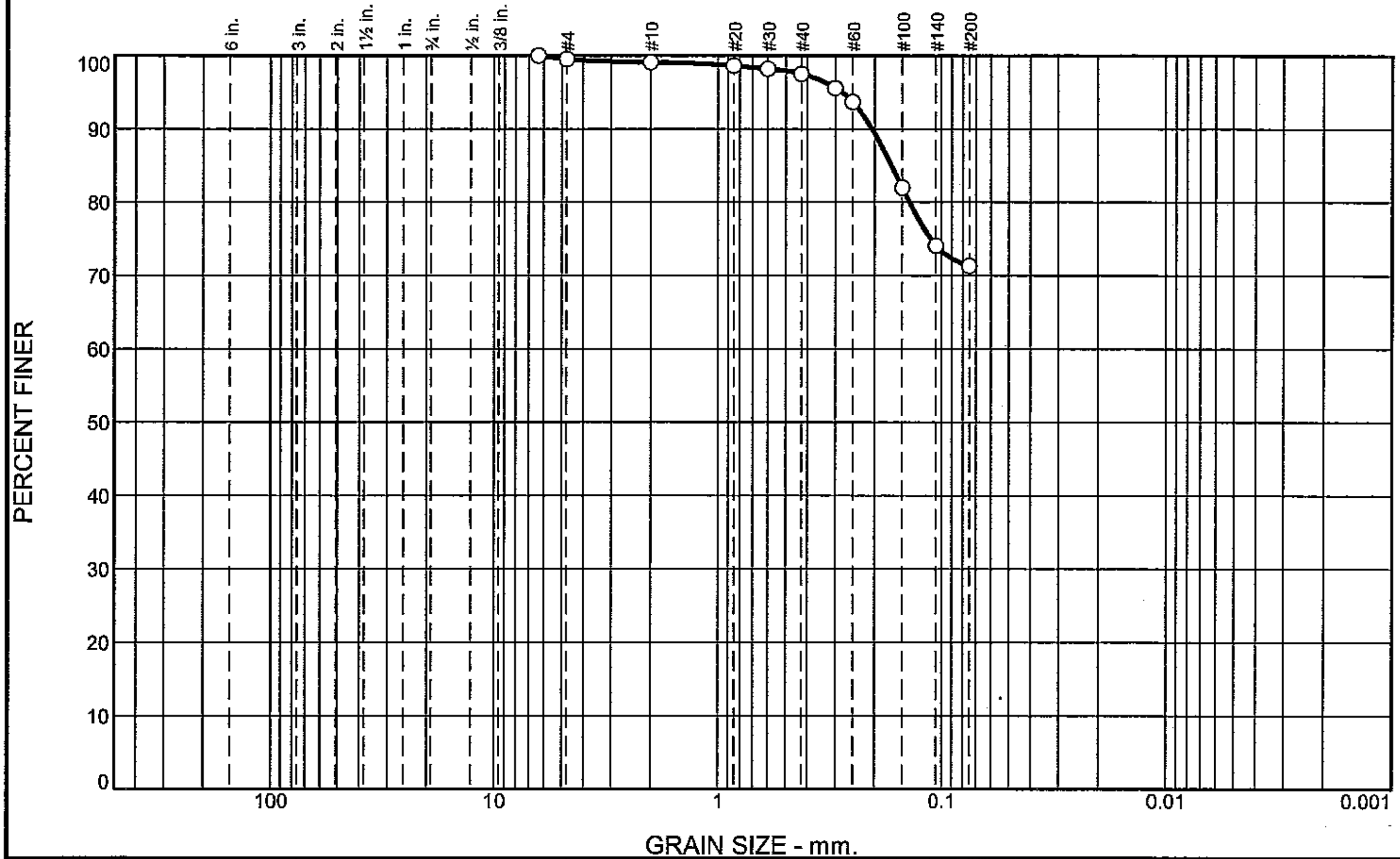
Remarks: ______

Checked By:

Stantec Consulting Services Inc.

File Name: 17MVS-07PU_be_boring_log_v10_0.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	0.4	1.6	26.2	71.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	99.5		
#10	99.1		
#20	98.6		
#30	98.2		
#40	97.5		
#50	95.6		
#60	93.7		
#100	82.0		
#140	74.1		
#200	71.3		

* (no specification provided)

Soil Description

BR ML W/ ARS CH, O, SIF

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2050 D_{85}= 0.1678 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Source of Sample: 17MVS-07PU **Depth:** 0.0
Sample Number: 1A **Date:** 12/7/12

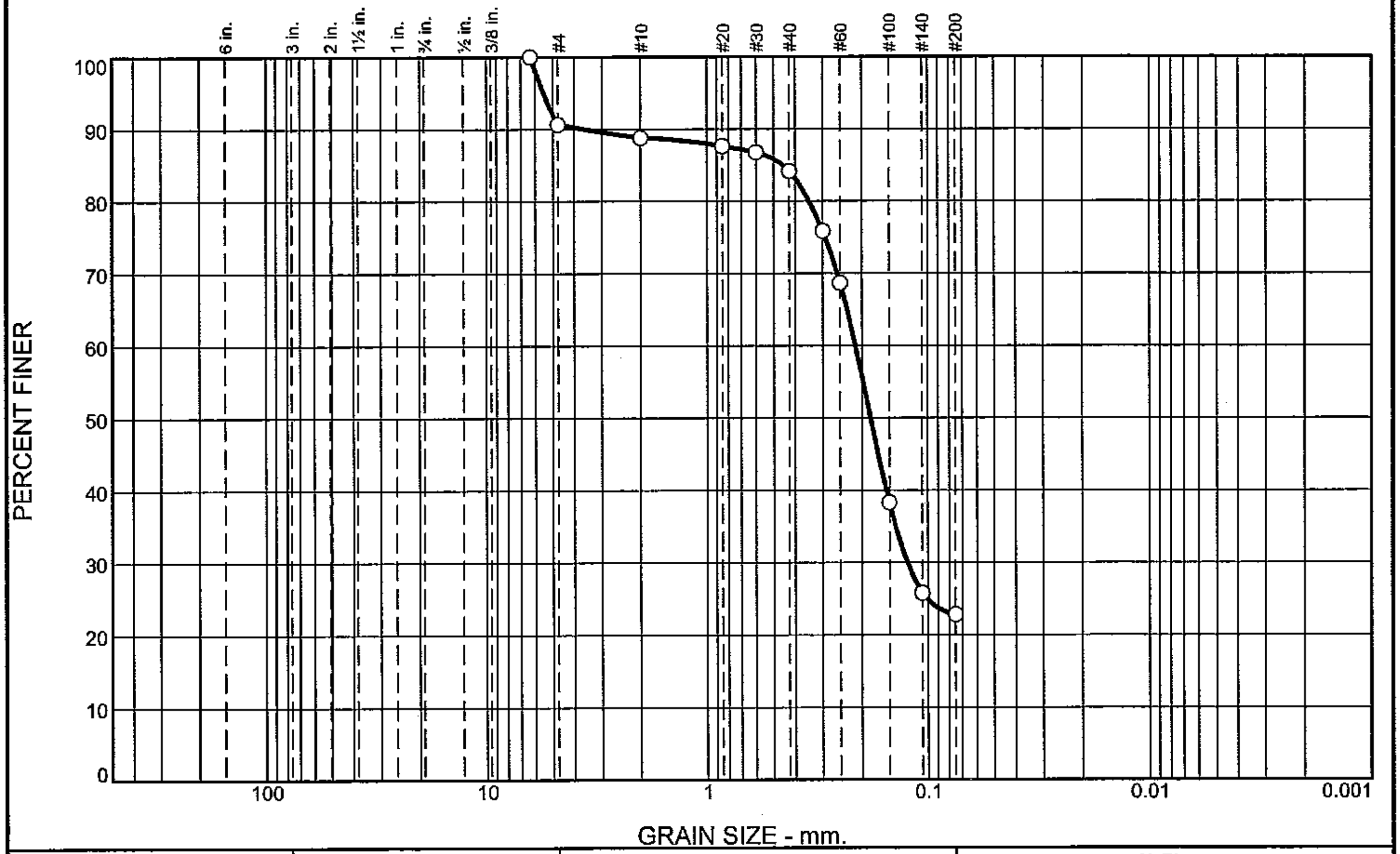
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.3	1.9	4.7	61.3	22.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	90.7		
#10	88.8		
#20	87.7		
#30	86.8		
#40	84.1		
#50	75.9		
#60	68.7		
#100	38.3		
#140	25.8		
#200	22.8		

* (no specification provided)

Soil Description

T SM W/ ARS CH, O, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.6172 D_{85}= 0.4549 D_{60}= 0.2137
D_{50}= 0.1825 D_{30}= 0.1239 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-07PU **Depth:** 2.0
Sample Number: 1C

Date: 12/7/12

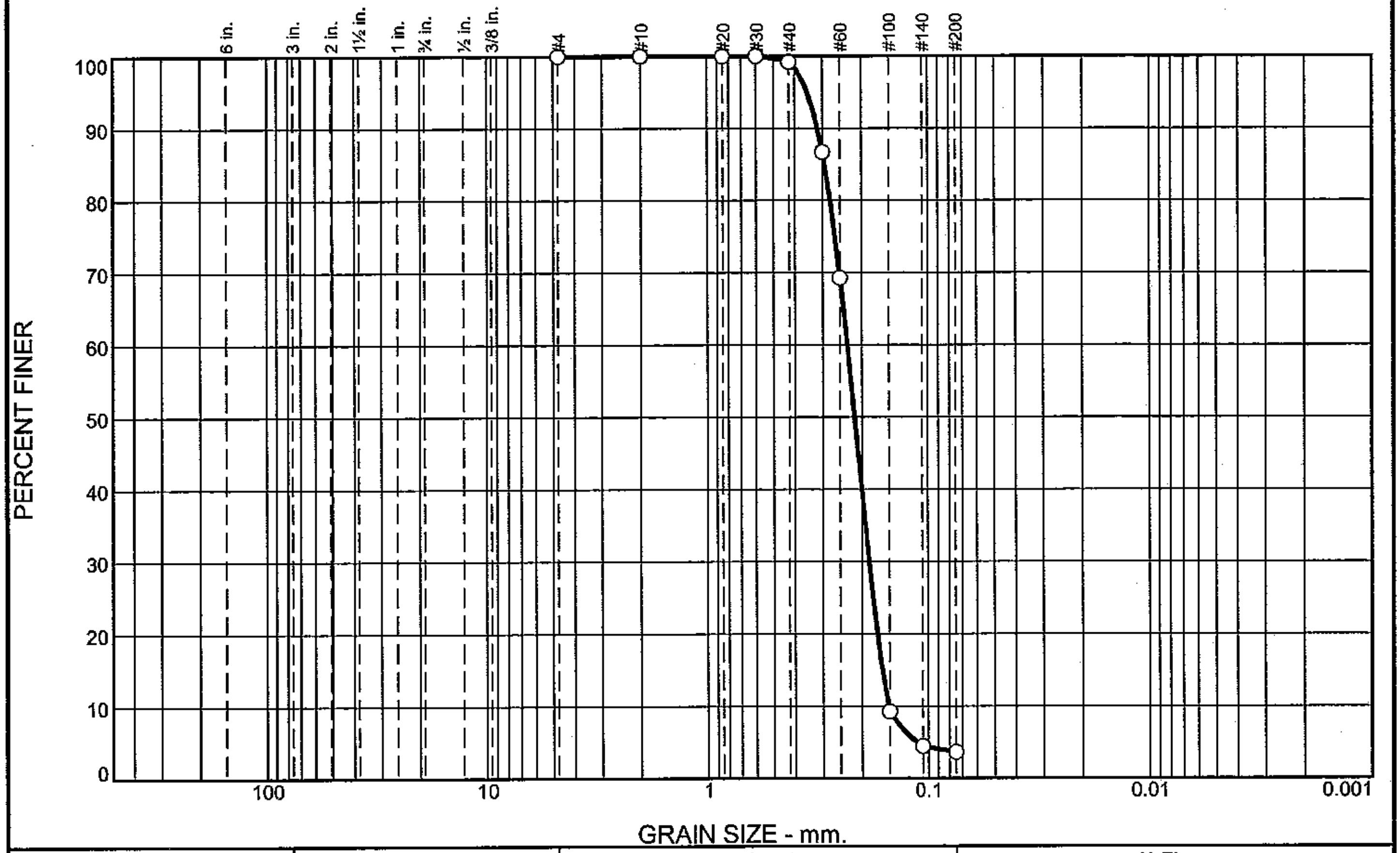
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.8	95.6	3.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#30	100.0		
#40	99.2		
#50	86.7		
#60	69.3		
#100	9.2		
#140	4.4		
#200	3.6		

* (no specification provided)

Soil Description

T SP W/ ARS CH, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3153 D_{85}= 0.2932 D_{60}= 0.2320
D_{50}= 0.2153 D_{30}= 0.1853 D_{15}= 0.1617
D_{10}= 0.1518 C_u= 1.53 C_c= 0.97

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 17MVS-07PU **Depth:** 4.0
Sample Number: 2

Date: 12/7/12

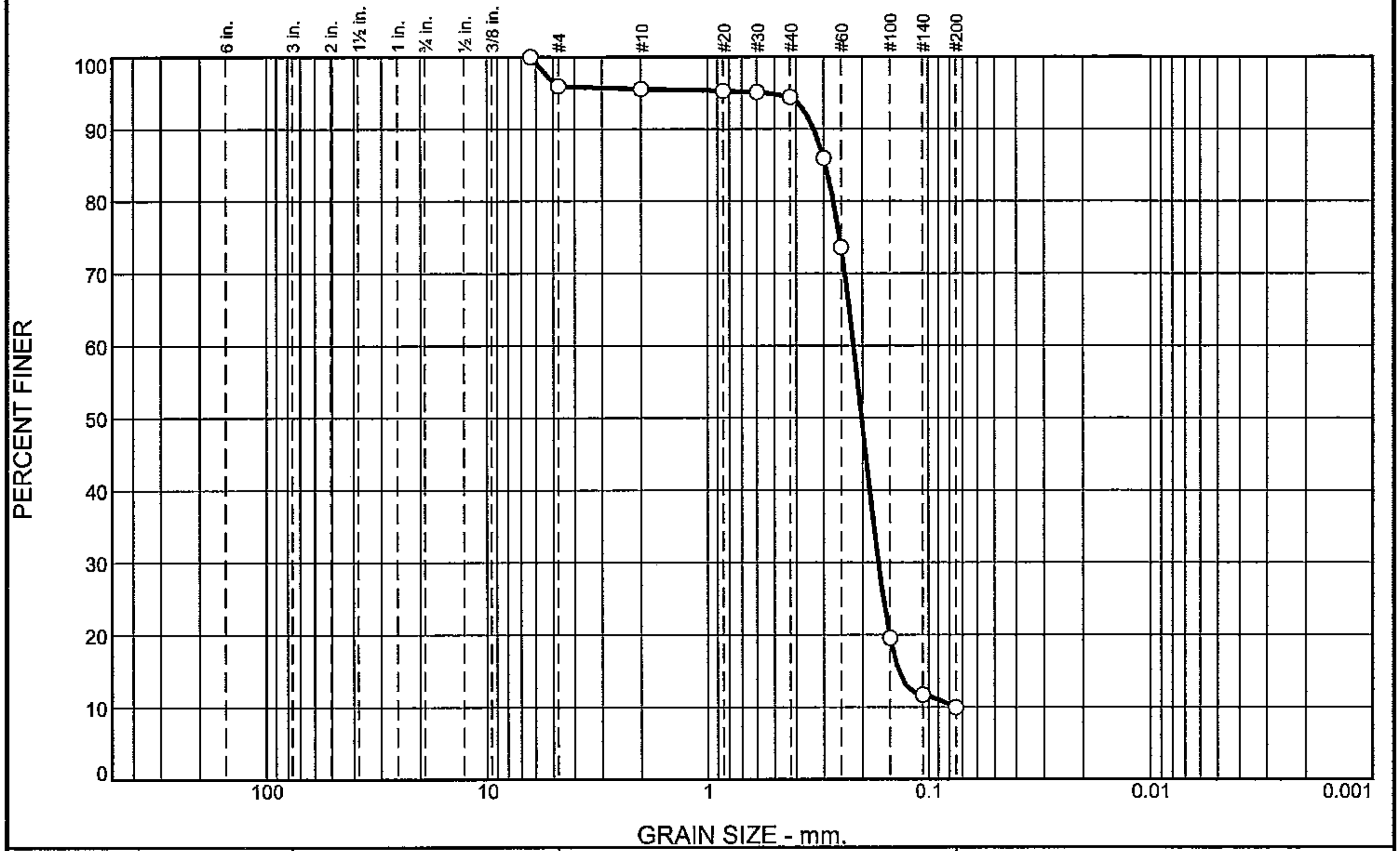
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.0	0.5	1.1	84.5	9.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	96.0		
#10	95.5		
#20	95.3		
#30	95.1		
#40	94.4		
#50	86.0		
#60	73.6		
#100	19.6		
#140	11.7		
#200	9.9		

* (no specification provided)

Soil Description

T SM W/ WD

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3322 D_{85}= 0.2944 D_{60}= 0.2196
D_{50}= 0.2019 D_{30}= 0.1695 D_{15}= 0.1367
D_{10}= 0.0759 C_u= 2.89 C_c= 1.72

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-07PU **Depth:** 6.5
Sample Number: 3

Date: 12/7/12

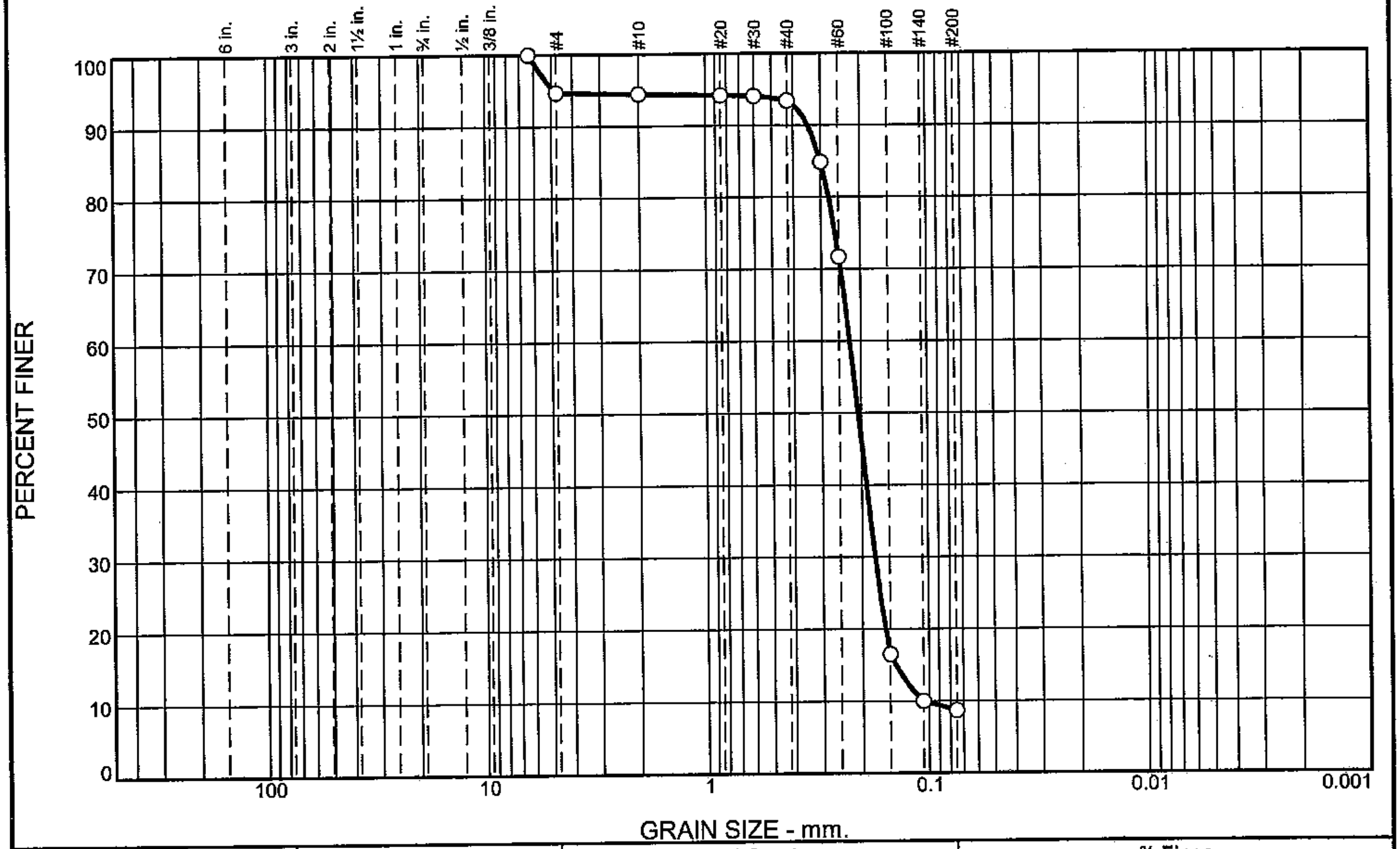
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MWB/JS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.3	0.3	1.0	84.7	8.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/4	100.0		
#4	94.7		
#10	94.4		
#20	94.2		
#30	94.1		
#40	93.4		
#50	84.9		
#60	71.7		
#100	16.5		
#140	10.0		
#200	8.7		

* (no specification provided)

Soil Description

T SM W/ O

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3418 D_{85}= 0.3006 D_{60}= 0.2243
D_{50}= 0.2065 D_{30}= 0.1747 D_{15}= 0.1413
D_{10}= 0.1063 C_u= 2.11 C_c= 1.28

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-07PU **Depth:** 9.0
Sample Number: 4

Date: 12/7/12

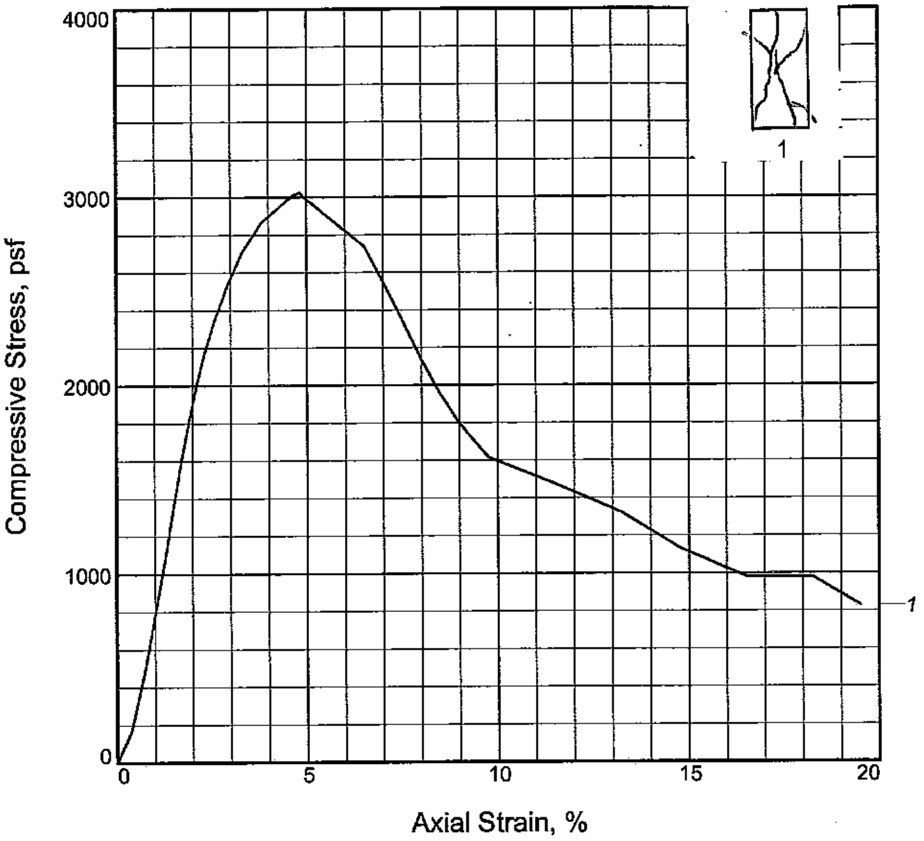
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC **Checked By:** MJB/JS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	3025			
Undrained shear strength, psf	1513			
Failure strain, %	4.8			
Strain rate, in./min.	1.000			
Water content, %	11.5			
Wet density, pcf	119.1			
Dry density, pcf	106.7			
Saturation, %	53.8			
Void ratio	0.5790			
Specimen diameter, in.	1.387			
Specimen height, in.	3.009			
Height/diameter ratio	2.17			

Description: ST BR CL6 W/ LYS & ARS SP, G

LL = 45 **PL =** 22 **PI =** 23 **Assumed GS=** 2.70 **Type:** UNDISTURBED

Project No.: 10-017136
Date Sampled: 12/7/12
Remarks:

Figure _______

Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Source of Sample: 17MVS-07PU **Depth:** 1.0
Sample Number: 1B

UNCONFINED COMPRESSION TEST
Stantec
Saint Rose, Louisiana

Tested By: VF **Checked By:** MJB/JS

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ______

Project Number: 10-017136
Boring: 17MVS-08PU - Final

Current Date: 12/13/2012

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR & T ML W/ ARS CH	ML		10								NP	NP			
1B	1.0	T & BR ML W/ ARS SP, RT, O, WD	ML		12												
2A	2.0	T ML W/ ARS CH, RT	ML		17												SV
2B	3.0	T SM W/ O, ARS CH, SIF, RT	SM		21												
3A	4.0	M GR & BR CH4 W/ LYS & ARS SM	CH4		43	79	113	100	UU	0	658		83	17	66	0.61	
3B	5.0	ST GR & T CH2 W/ ARS SP, O, RT	CH2		31												SV
4	8.0	T SM	SM		30												SV
5	10.5	T SM	SM		30												SV
6	13.0	T SM W/ O	SM		32												SV
7	15.5	T SM	SM		29												

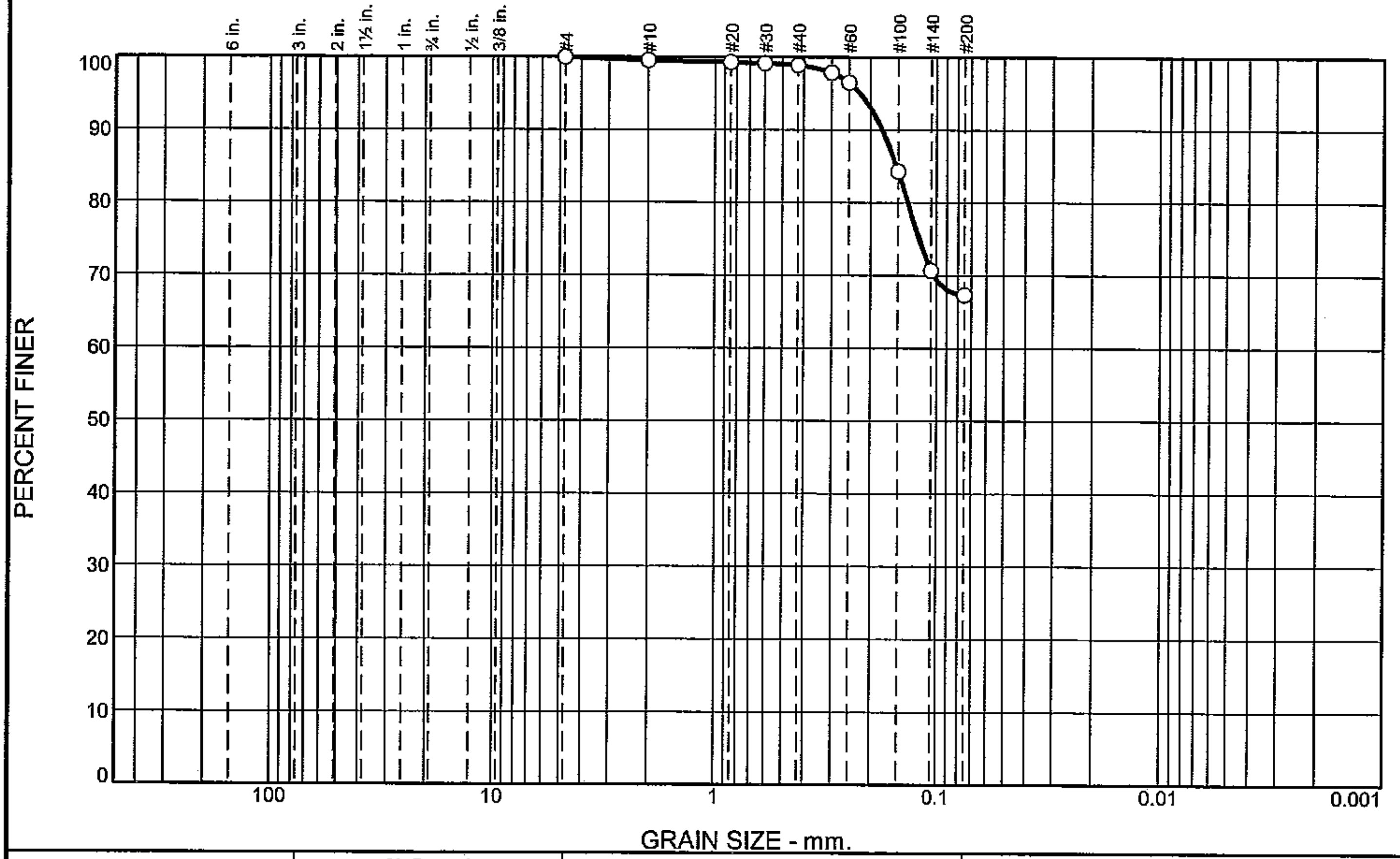
Remarks: ______

Stantec Consulting Services Inc.

Checked By: ______

File Name: 17MVS-08PU_be_boring_log_v10_0.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			0.4	0.7	31.6	67.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	99.3		
#30	99.1		
#40	98.9		
#50	97.8		
#60	96.5		
#100	84.3		
#140	70.7		
#200	67.3		

* (no specification provided)

Soil Description

T ML W/ ARS CH, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1772 D_{85}= 0.1526 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Source of Sample: 17MVS-08PU **Depth:** 2.0
Sample Number: 2A

Date: 12/7/12

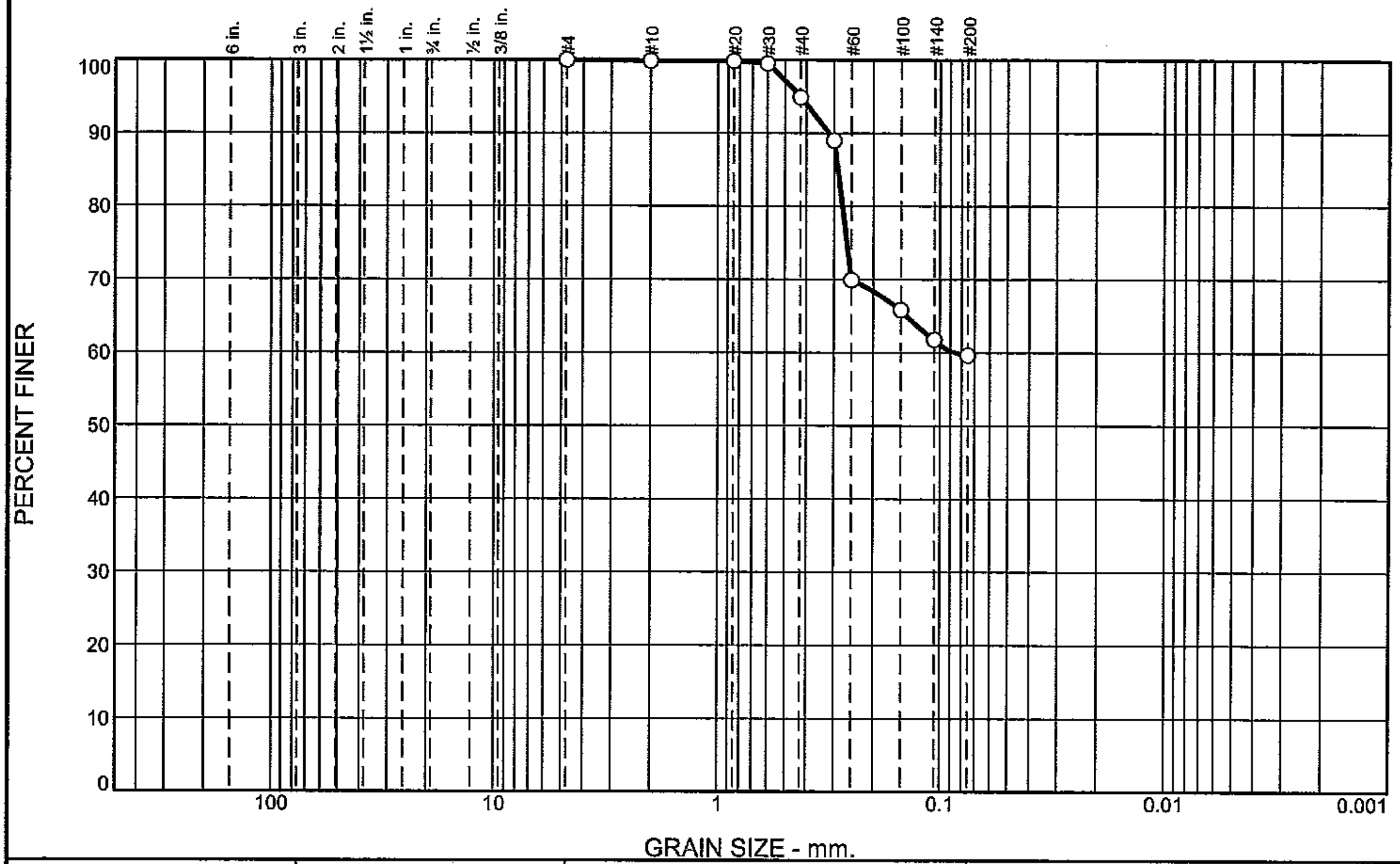
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	5.0	35.2	59.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.8		
#30	99.5		
#40	94.9		
#50	89.0		
#60	69.9		
#100	65.8		
#140	61.8		
#200	59.7		

* (no specification provided)

Soil Description

ST GR & T CH2 W/ ARS SP, O, RT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3168 D_{85}= 0.2875 D_{60}= 0.0859

D_{50}= D_{30}= D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= CH2 AASHTO=

Remarks

Source of Sample: 17MVS-08PU **Depth:** 5.0
Sample Number: 3B

Date: 12/7/12

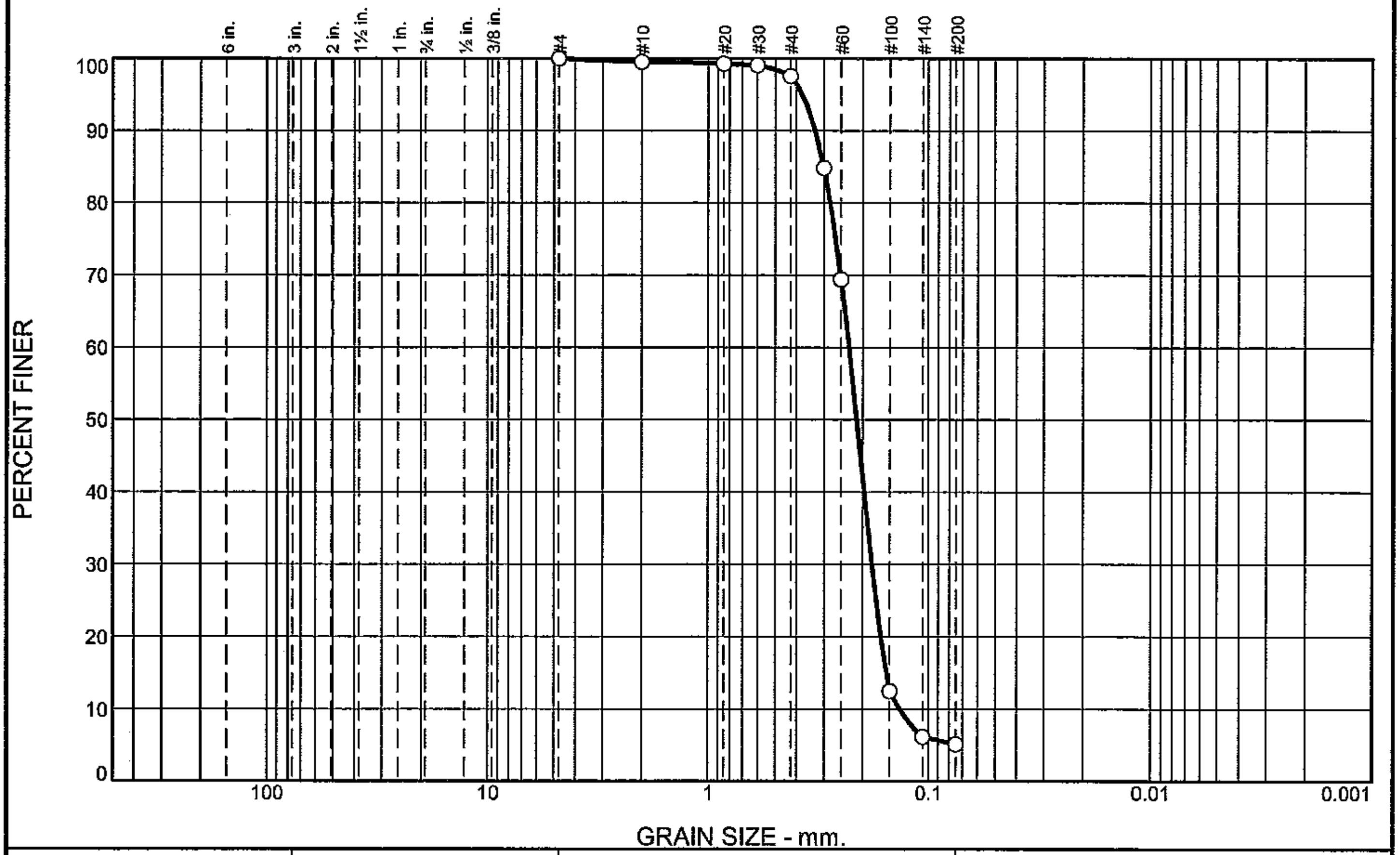
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	1.9	92.5	5.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.5		
#20	99.3		
#30	99.1		
#40	97.6		
#50	84.9		
#60	69.4		
#100	12.5		
#140	6.2		
#200	5.1		

* (no specification provided)

Soil Description

T SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3286 D_{85}= 0.3007 D_{60}= 0.2302
D_{50}= 0.2124 D_{30}= 0.1809 D_{15}= 0.1555
D_{10}= 0.1349 C_u= 1.71 C_c= 1.05

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-08PU **Depth:** 8.0
Sample Number: 4

Date: 12/7/12

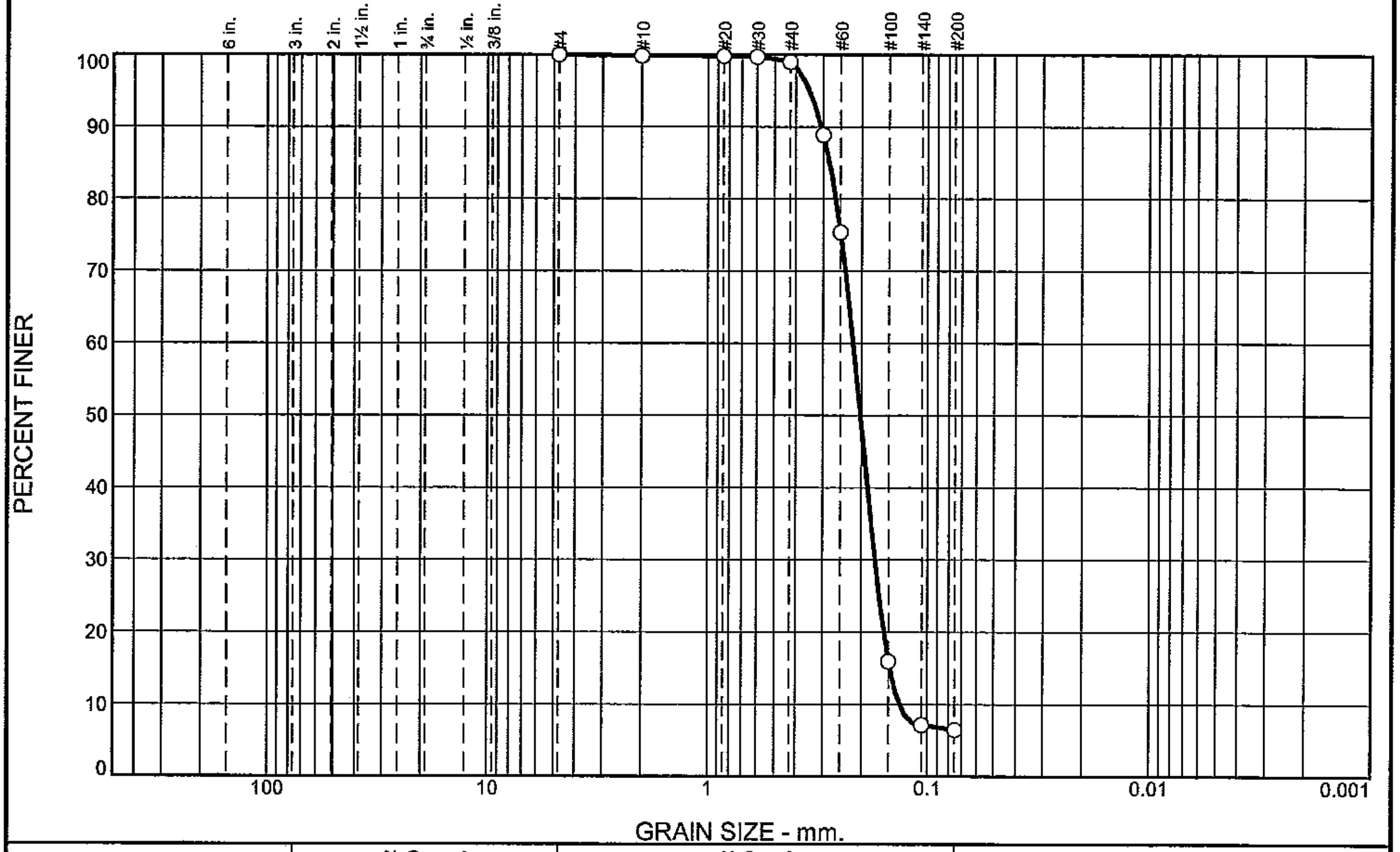
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.9	92.5	6.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.8		
#30	99.7		
#40	99.0		
#50	88.9		
#60	75.4		
#100	16.0		
#140	7.1		
#200	6.5		

* (no specification provided)

Soil Description

T SM

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3064 D_{85}= 0.2812 D_{60}= 0.2187
D_{50}= 0.2026 D_{30}= 0.1732 D_{15}= 0.1480
D_{10}= 0.1337 C_u= 1.64 C_c= 1.03

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-08PU **Depth:** 8.0
Sample Number: 5 **Date:** 12/7/12

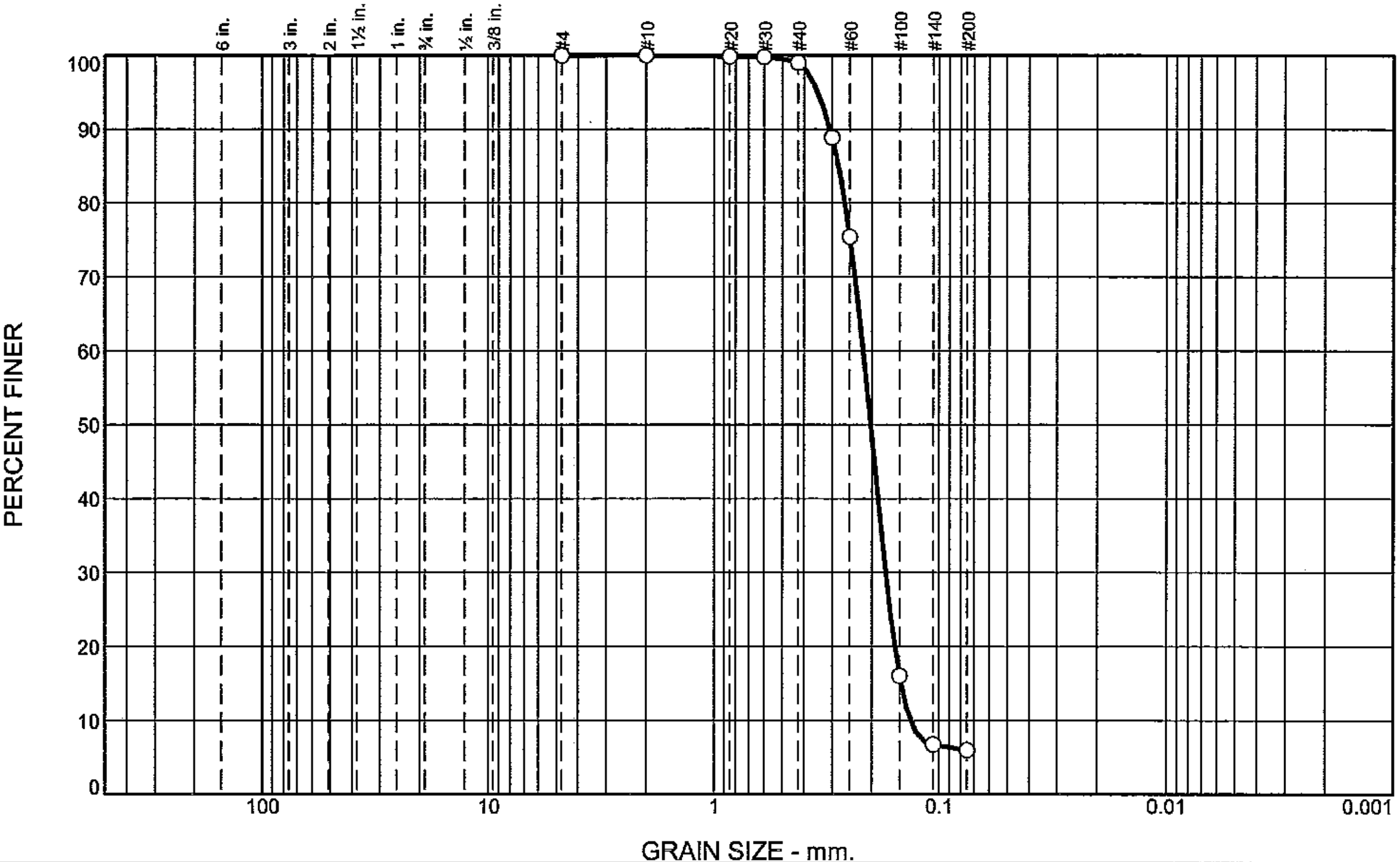
Stantec

Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.0	93.0	6.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.9		
#30	99.8		
#40	99.0		
#50	88.9		
#60	75.4		
#100	16.1		
#140	6.8		
#200	6.0		

* (no specification provided)

Soil Description

T SM W/ O

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3066 D_{85}= 0.2812 D_{60}= 0.2185
D_{50}= 0.2023 D_{30}= 0.1730 D_{15}= 0.1478
D_{10}= 0.1339 C_u= 1.63 C_c= 1.02

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: 17MVS-08PU **Depth:** 13.0
Sample Number: 6

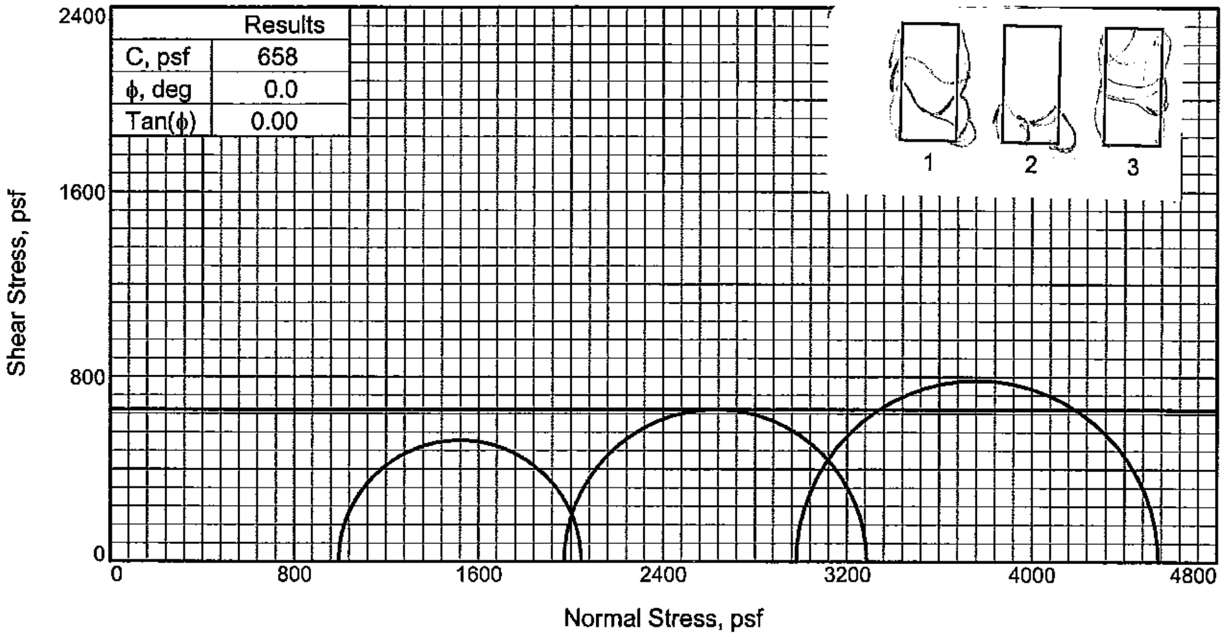
Date: 12/7/12

Stantec

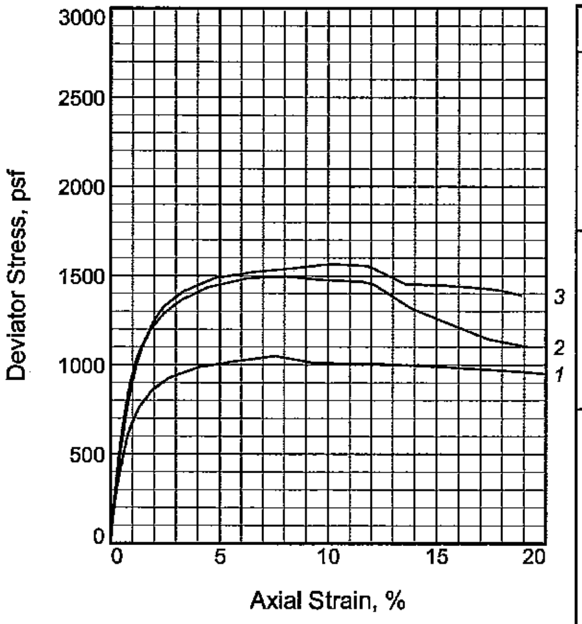
Saint Rose, Louisiana

Client: USACE
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana
Project No: 10-017136 **Figure**

Tested By: JC



	Results
C, psf	658
ϕ, deg	0.0
Tan(ϕ)	0.00



Sample No.		1	2	3
Initial	Water Content, %	42.8	42.9	43.2
	Dry Density, pcf	79.0	78.0	77.7
	Saturation, %	100.4	98.6	98.6
	Void Ratio	1.1664	1.1917	1.2018
	Diameter, in.	1.391	1.392	1.395
	Height, in.	3.005	3.008	3.006
At Test	Water Content, %	42.8	42.9	43.2
	Dry Density, pcf	79.0	78.0	77.7
	Saturation, %	100.4	98.6	98.6
	Void Ratio	1.1664	1.1917	1.2018
	Diameter, in.	1.391	1.392	1.395
	Height, in.	3.005	3.008	3.006
Strain rate, in./min.		1.000	1.000	1.000
Back Pressure, psi		0.00	0.00	0.00
Cell Pressure, psi		6.91	13.69	20.70
Fail. Stress, psf		1050	1316	1567
Strain, %		7.6	13.8	10.1
Ult. Stress, psf		992	1316	1453
Strain, %		14.6	13.8	13.6
σ_1 Failure, psf		2045	3287	4547
σ_3 Failure, psf		995	1971	2981

Type of Test:
Unconsolidated Undrained
Sample Type: UNDISTURBED
Description: M GR & BR CH4 W/ LYS & ARS SM
LL= 83 **PL=** 17 **PI=** 66
Assumed Specific Gravity= 2.74
Remarks:

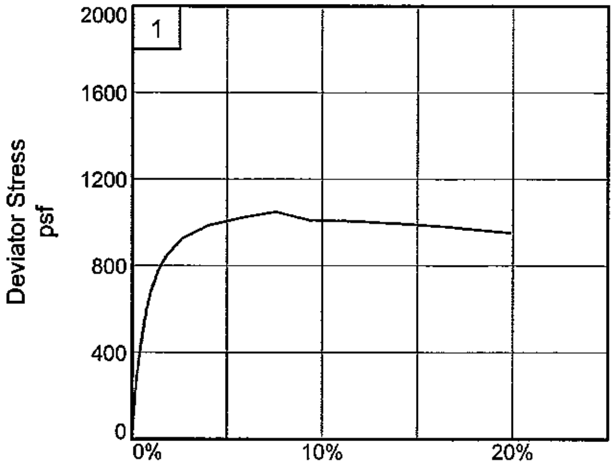
Figure _______

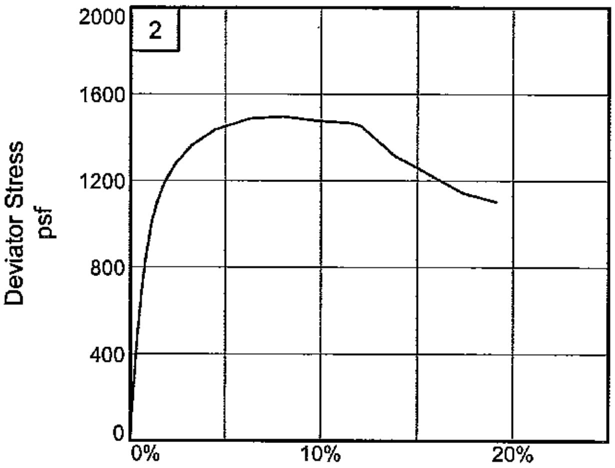
Client: USACE

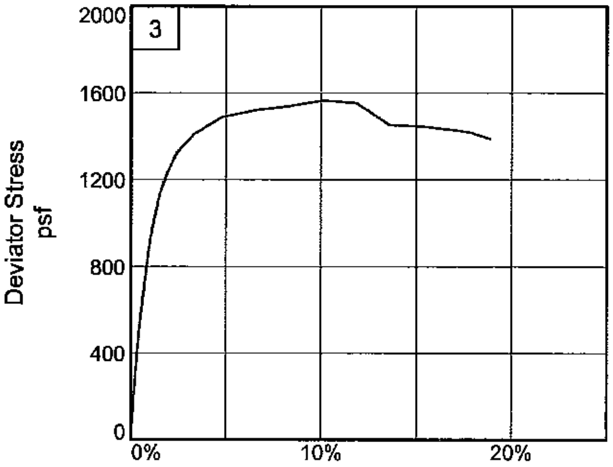
Project: Lake Pontchartrain & Vicinity Hurricane Protection Project
17th Street Canal Reevalution, Jefferson Parish, Louisiana
Source of Sample: 17MVS-08PU **Depth:** 4.0
Sample Number: 3A
Proj. No.: 10-017136 **Date Sampled:** 12/7/12

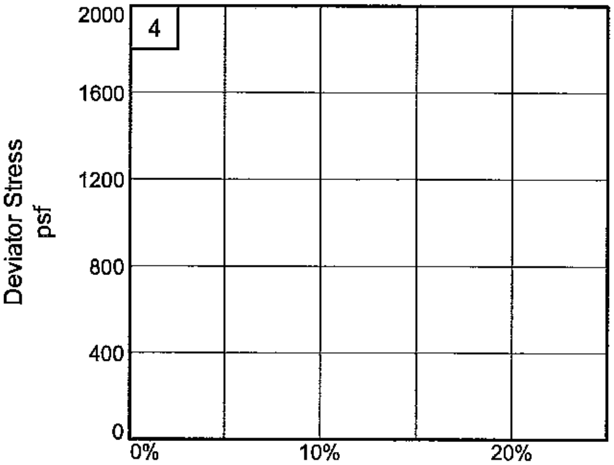
TRIAXIAL SHEAR TEST REPORT
Stantec
Saint Rose, Louisiana

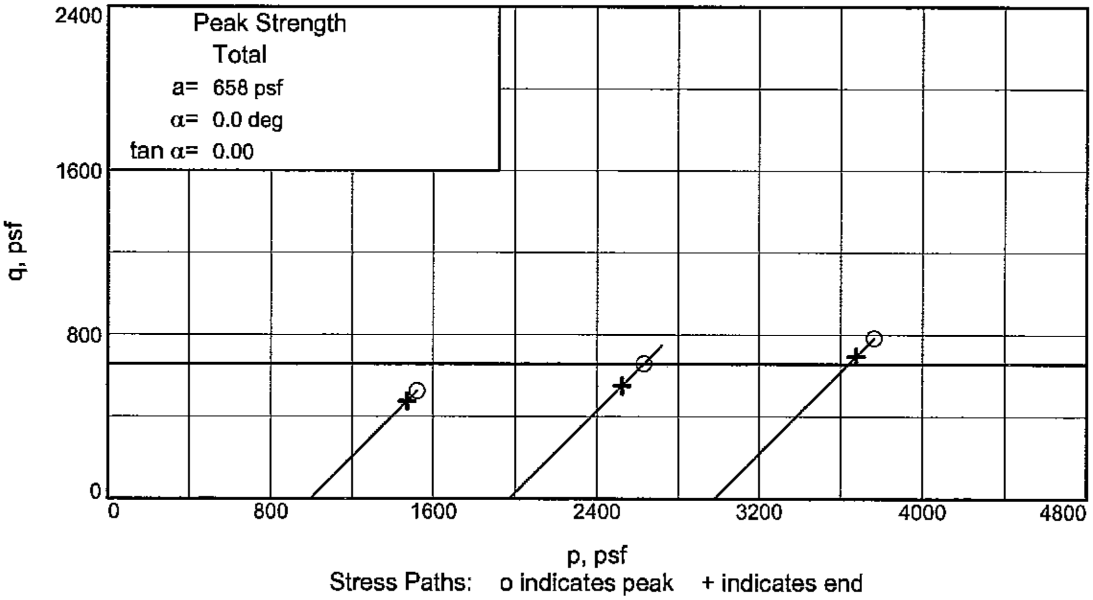
Tested By: VF











Client: USACE

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Canal Reevalution, Jefferson Parish, Louisiana

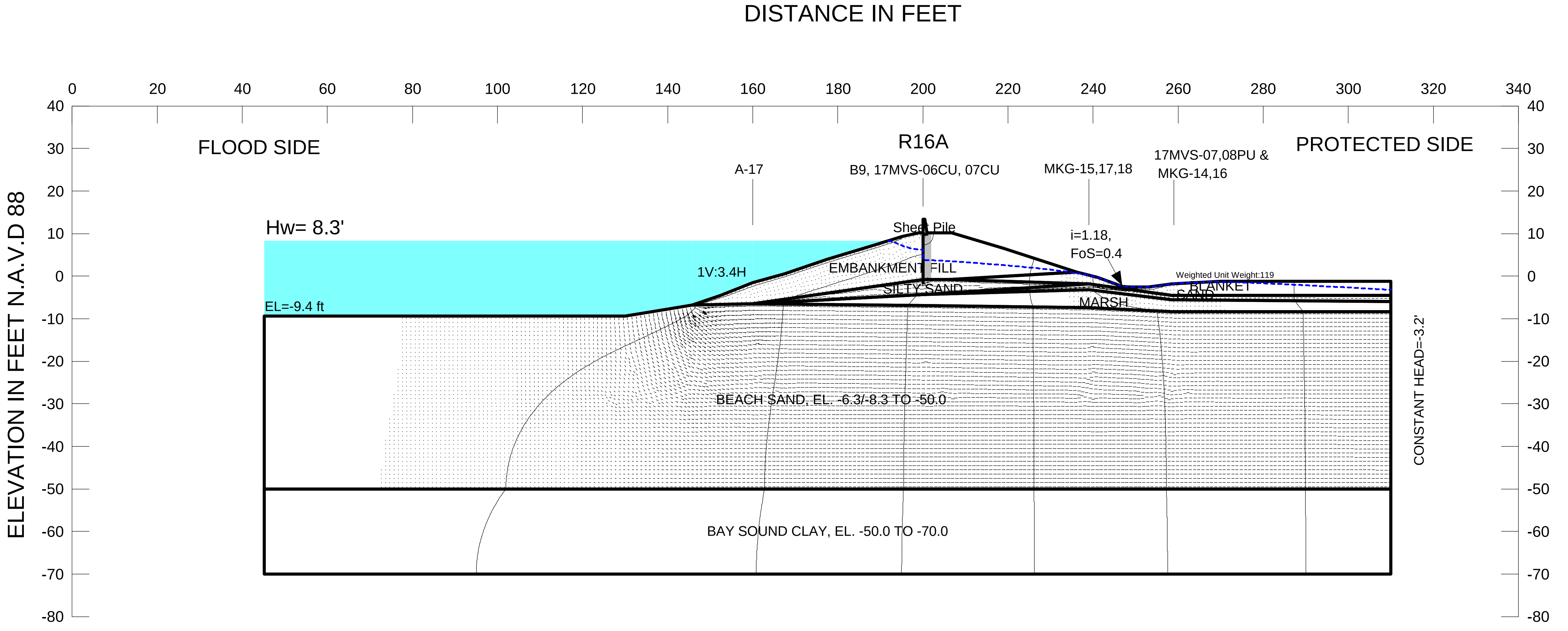
Source of Sample: 17MVS-08PU **Depth:** 4.0 **Sample Number:** 3A

Project No.: 10-017136 **Figure** ________

Stantec, Inc.

Tested By: VF

Appendix B: Seepage Analysis



Name: EMBANKMENT FILL Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: BEACH SAND, EL. -6.3/-8.3 TO -50.0 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -50.0 TO -70.0 Model: Saturated Only K-Sat: 2.62e-007 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: MARSH Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BLANKET Model: Saturated Only K-Sat: 1.64e-005 ft/sec K-Ratio: 1
Name: SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: SILTY SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION
SHEAR STRENGTHS AND UNIT WEIGHTS OF
THE SOIL WERE BASED ON THE RESULTS OF
UNDISTURBED BORINGS. SEE BORING PLATES.

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Saint Louis District

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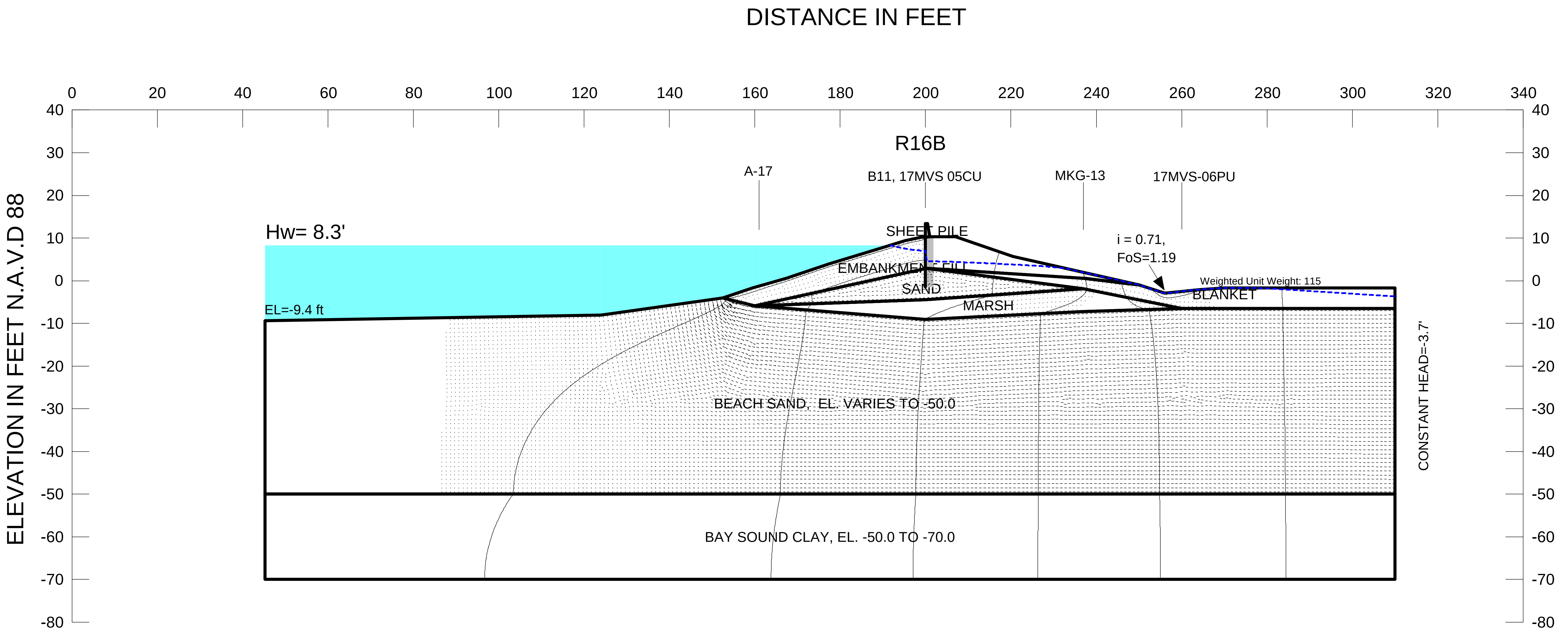
LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16A,
CASE: Seepage Analysis
STA. 655+00 to 658+00
ORLEANS PARISH, LOUISIANA



Name: EMBANKMENT FILL Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: BEACH SAND, EL. VARIES TO -50.0 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -50.0 TO -70.0 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: SHEET PILE Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: BLANKET Model: Saturated Only K-Sat: 1.64e-005 ft/sec K-Ratio: 1
Name: MARSH Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION
SHEAR STRENGTHS AND UNIT WEIGHTS OF
THE SOIL WERE BASED ON THE RESULTS OF
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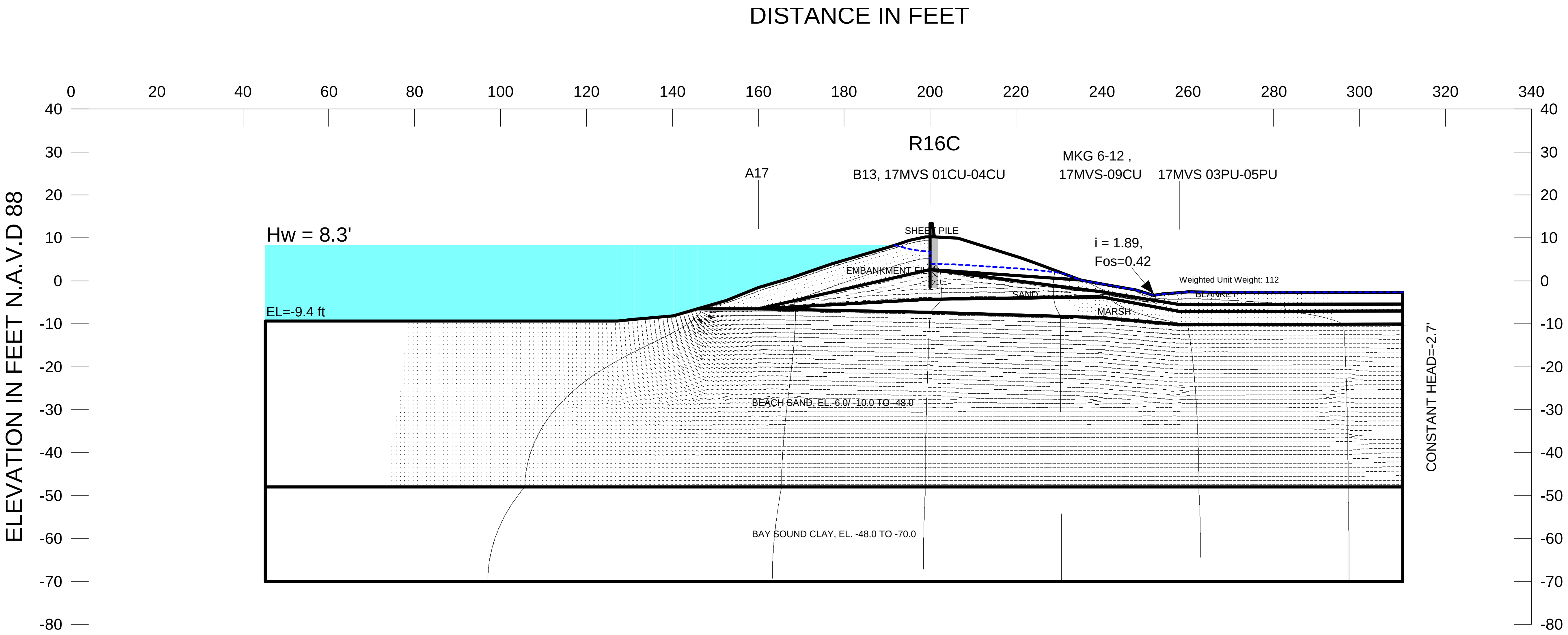
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16B,
CASE: Seepage Analysis
STA. 652+00 TO 655+00
ORLEANS PARISH, LOUISIANA



Name: EMBANKMENT FILL Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: MARSH Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BEACH SAND, EL.-6.0/ -10.0 TO -48.0 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -48.0 TO -70.0 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: SHEET PILE Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BLANKET Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS . SEE BORING PLATES.

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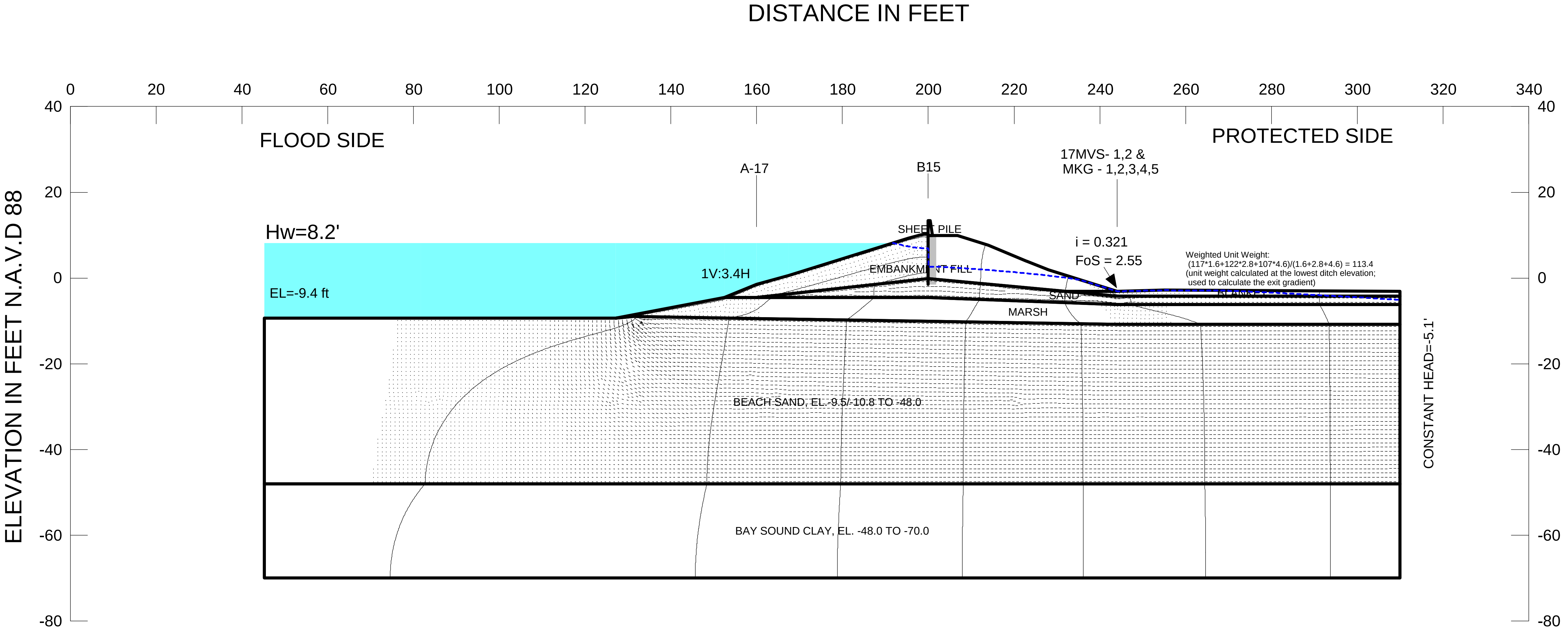
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16C
CASE: Seepage Analysis
STA. 646+41 TO 652+00
ORLEANS PARISH, LOUISIANA



Name: EMBANKMENT FILL Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: MARSH Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BEACH SAND, EL.-9.5/-10.8 TO -48.0 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -48.0 TO -70.0 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: SHEET PILE Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BLANKET Model: Saturated Only K-Sat: 1.64e-005 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION
SHEAR STRENGTHS AND UNIT WEIGHTS OF
THE SOIL WERE BASED ON THE RESULTS OF
UNDISTURBED BORINGS. SEE BORING PLATES.

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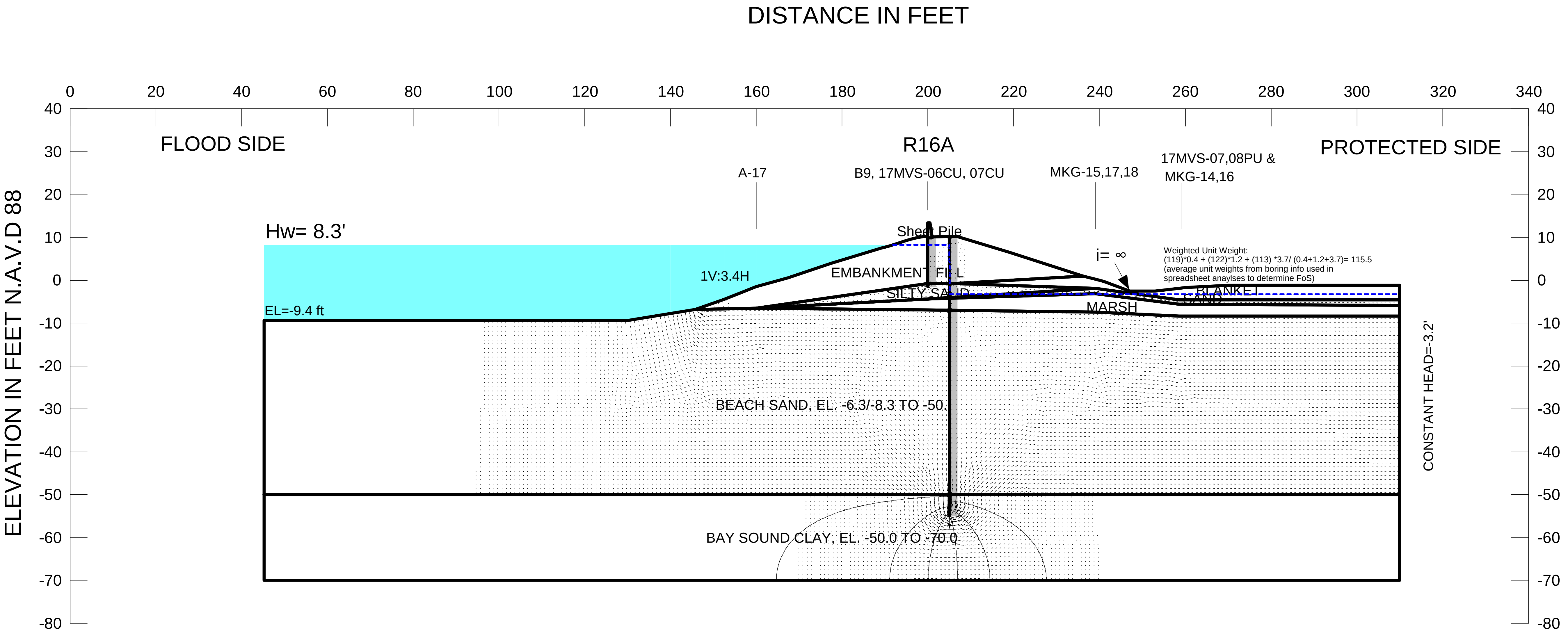
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16D,
CASE: Seepage Analysis
STA. 641+85 TO 646+41
ORLEANS PARISH, LOUISIANA



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Name: BEACH SAND, EL. -6.3/-8.3 TO -50.0 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -50.0 TO -70.0 Model: Saturated Only K-Sat: 2.62e-007 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: MARSH Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BLANKET Model: Saturated Only K-Sat: 1.64e-005 ft/sec K-Ratio: 1
Name: SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: SILTY SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION
SHEAR STRENGTHS AND UNIT WEIGHTS OF
THE SOIL WERE BASED ON THE RESULTS OF
UNDISTURBED BORINGS. SEE BORING PLATES.

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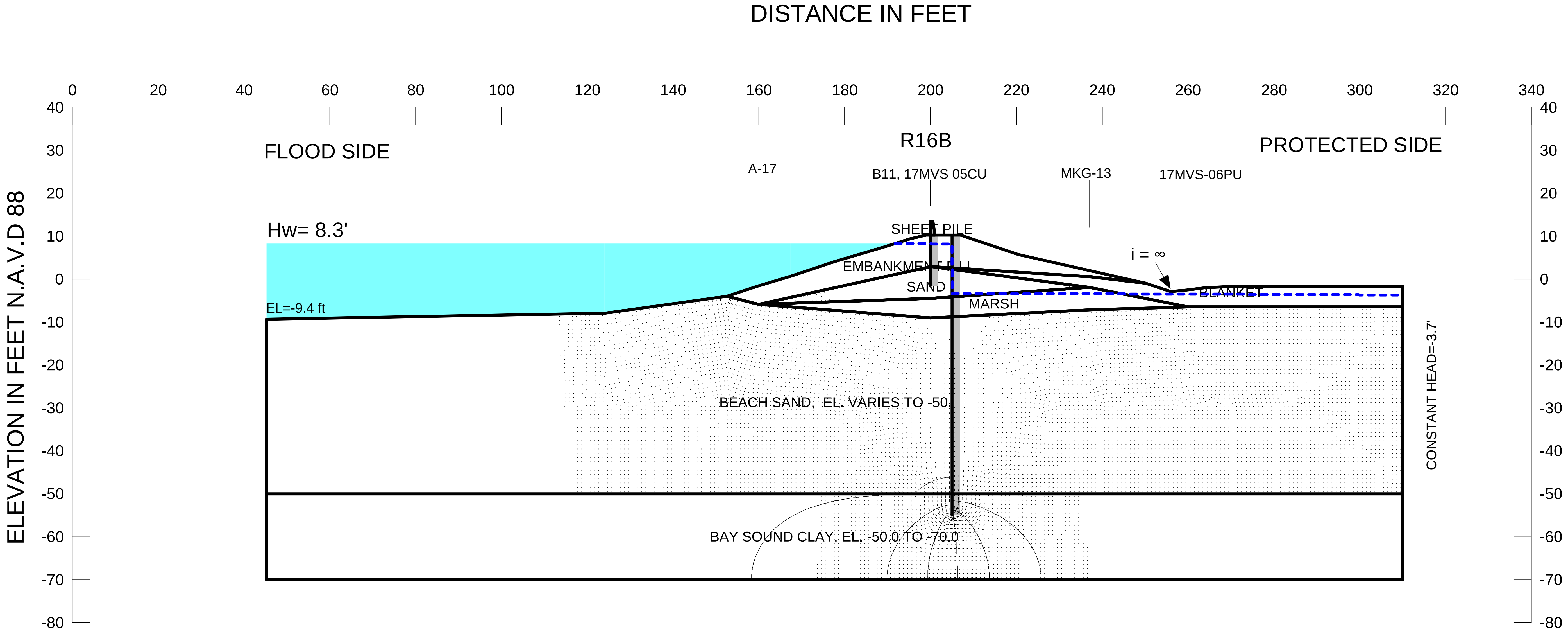
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16A,
CASE: Seepage Analysis with Sheetpile
STA. 655+00 to 658+00
ORLEANS PARISH, LOUISIANA



Name: EMBANKMENT FILL Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: BEACH SAND, EL. VARIES TO -50.0 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -50.0 TO -70.0 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: SHEET PILE Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: BLANKET Model: Saturated Only K-Sat: 1.64e-005 ft/sec K-Ratio: 1
Name: MARSH Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION
SHEAR STRENGTHS AND UNIT WEIGHTS OF
THE SOIL WERE BASED ON THE RESULTS OF
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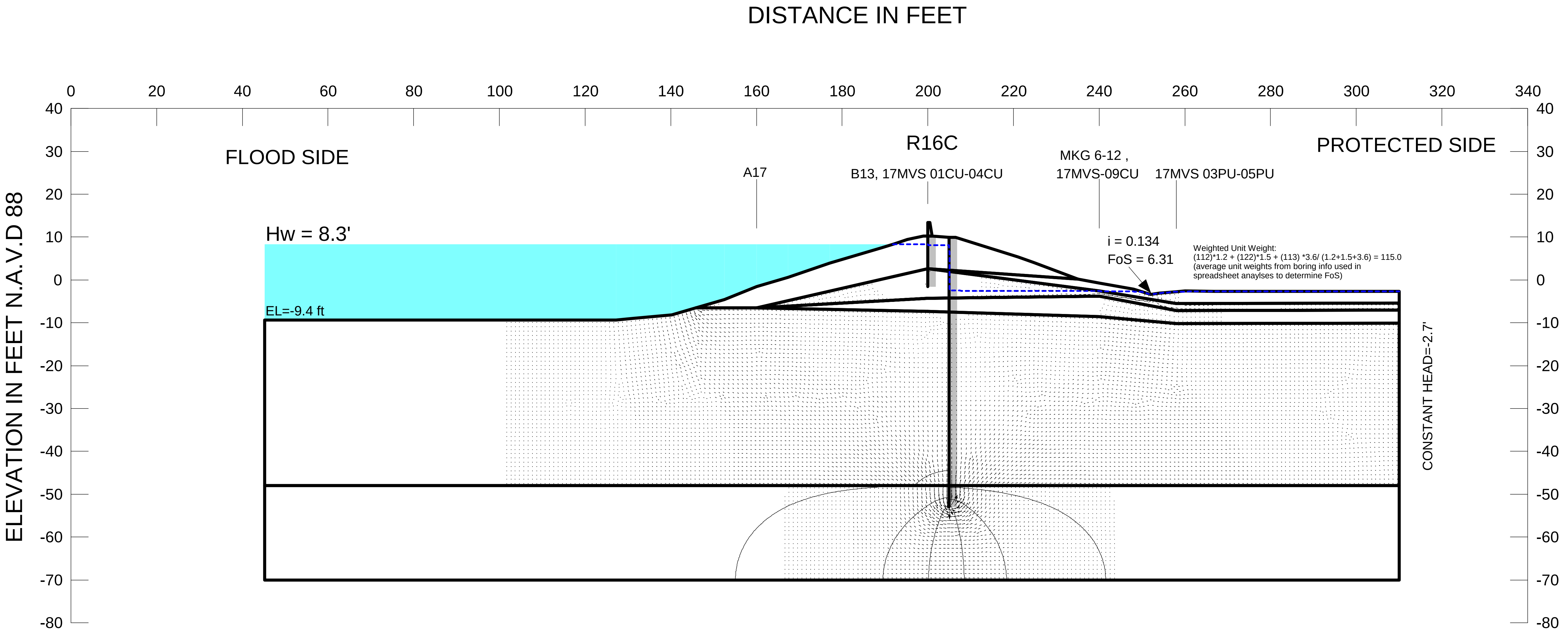
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16B,
CASE: Seepage Analysis with Sheetpile
STA. 652+00 to 655+00
ORLEANS PARISH, LOUISIANA



i = 0.134
FoS = 6.31

Weighted Unit Weight:
(112)*1.2 + (122)*1.5 + (113) *3.6/ (1.2+1.5+3.6) = 115.0
(average unit weights from boring info used in
spreadsheet anaylses to determine FoS)

Name: EMBANKMENT FILL Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: MARSH Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BEACH SAND, EL.-6.0/ -10.0 TO -48.0 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -48.0 TO -70.0 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: SHEET PILE Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SAND Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BLANKET Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION
SHEAR STRENGTHS AND UNIT WEIGHTS OF
THE SOIL WERE BASED ON THE RESULTS OF
UNDISTURBED BORINGS. SEE BORING PLATES.

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LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16C,
CASE: Seepage Analysis with Sheetpile
STA. 646+41 to 652+00
ORLEANS PARISH, LOUISIANA

Seepage Analysis Reach 16A Station 655+00 to 658+00

File Information

Created By: Liljegren, James
Revision Number: 464
Last Edited By: Goltz, Amanda MVS
Date: 3/11/2013
Time: 10:26:50 AM
File Name: R16A_new CL borings.gsz
Directory: Z:\
Last Solved Date: 3/11/2013
Last Solved Time: 10:27:12 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Seepage Analysis

Kind: SEEP/W
Method: Steady-State
Settings
    Include Air Flow: No
Control
    Apply Runoff: No
Convergence
    Convergence Type: Head Vector Norm
    Maximum Number of Iterations: 500
    Tolerance: 0.001
    Maximum Change in K: 0.1
    Rate of Change in K: 1.02

Minimum Change in K: 1e-005
Equation Solver: Parallel Direct
Potential Seepage Max # of Reviews: 10

Time

Starting Time: 0 sec
Duration: 0 sec
Ending Time: 0 sec

Materials

EMBANKMENT FILL

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BEACH SAND, EL. -6.3/-8.3 TO -50.0

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BAY SOUND CLAY, EL. -50.0 TO -70.0

Model: Saturated Only

Hydraulic

K-Sat: 2.62e-007 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

Sheet Pile

Model: Saturated Only

Hydraulic

K-Sat: 1e-010 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

MARSH

Model: Saturated Only
Hydraulic
K-Sat: 1.31e-005 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BLANKET

Model: Saturated Only
Hydraulic
K-Sat: 1.64e-005 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SAND

Model: Saturated Only
Hydraulic
K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SILTY SAND

Model: Saturated Only
Hydraulic
K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

Boundary Conditions

Drainage

Review: true
Type: Total Flux (Q) 0

Curb

Type: Head (H) -3.2

Max Operating Level (8.3 ft)

Type: Head (H) 8.3

Regions

	Material	Points	Area (ft²)
Region 1	Sheet Pile	2,6,7,29,8,14	2.6250625
Region 2	BAY SOUND CLAY, EL. -50.0 TO -70.0	27,28,15,10,9	5296
Region 3	BLANKET	38,35,41,23,5,22,30,42,31,32,26,49,47,43	245.10608
Region 4	MARSH	52,34,44,46,25,40,48,45,51	391.22
Region 5	SILTY SAND	52,33,38,43,34	141.46146
Region 6	SAND	34,43,47,49,25,46,44	109.8675
Region 7	EMBANKMENT FILL	36,19,18,17,16,20,24,1,13,21,12,2,14,8,29,3,4,35,38,33,52	603.33579
Region 8	BEACH SAND, EL. -6.3/-8.3 TO -50.0	9,11,37,50,36,52,51,45,48,40,27	11089.463

Lines

	Start Point	End Point	Left Side Material	Hydraulic Boundary
Line 1	2	6		
Line 2	6	7		
Line 3	8	14	Sheet Pile	
Line 4	14	2		
Line 5	27	28		Curb
Line 6	28	15		
Line 7	15	10		
Line 8	10	9		Max Operating Level (8.3 ft)
Line 9	7	29		
Line 10	29	8		
Line 11	38	35		
Line 12	14	39	Sheet Pile	
Line 13	46	25		
Line 14	44	46		

Line 15	43	47		
Line 16	47	49		
Line 17	38	43		
Line 18	35	41		Drainage
Line 19	41	23		Drainage
Line 20	23	5		Drainage
Line 21	5	22		Drainage
Line 22	22	30		Drainage
Line 23	30	42		Drainage
Line 24	42	31		Drainage
Line 25	31	32		Drainage
Line 26	32	26		Drainage
Line 27	26	49		Curb
Line 28	52	34		
Line 29	34	44		
Line 30	25	40		Curb
Line 31	40	48		
Line 32	48	45		
Line 33	45	51		
Line 34	51	52		
Line 35	27	9		
Line 36	52	33		
Line 37	33	38		
Line 38	43	34		
Line 39	49	25		
Line 40	36	19		Max Operating Level (8.3 ft)
Line 41	19	18		Max Operating Level (8.3 ft)
Line 42	18	17		Max Operating Level (8.3 ft)
Line 43	17	16		Max Operating Level (8.3 ft)
Line 44	16	20		Max Operating Level (8.3 ft)
Line 45	20	24		Max Operating Level (8.3 ft)
Line 46	24	1		Max Operating Level (8.3 ft)
Line 47	1	13		Max Operating Level (8.3 ft)
Line 48	13	21		
Line 49	21	12		
Line 50	12	2		

Line 51	29	3		
Line 52	3	4		Drainage
Line 53	35	4		Drainage
Line 54	36	52		
Line 55	9	11		Max Operating Level (8.3 ft)
Line 56	11	37		Max Operating Level (8.3 ft)
Line 57	37	50		Max Operating Level (8.3 ft)
Line 58	50	36		Max Operating Level (8.3 ft)
Line 59	40	27		Curb

Points

	X (ft)	Y (ft)
Point 1	192.2	8.4
Point 2	200	10.2
Point 3	206.8	10.216
Point 4	219	6.558
Point 5	247	-2.455
Point 6	200	13.4
Point 7	200.5	13.4
Point 8	201	9.9
Point 9	45.2	-50
Point 10	45.2	-70
Point 11	45.2	-9.4
Point 12	199	10.2
Point 13	195.2	9.4
Point 14	200	9.9
Point 15	177.4	-70
Point 16	177.43556	4
Point 17	167.4	0.6
Point 18	160	-1.5
Point 19	152.5	-4.5
Point 20	189.18	7.5
Point 21	198.05	10
Point 22	249	-2.521
Point 23	241	-0.259

Point 24	190.85778	8
Point 25	310	-5.93
Point 26	310	-1.203
Point 27	310	-50
Point 28	310	-70
Point 29	200.96775	10.126
Point 30	253	-2.518
Point 31	260	-1.683
Point 32	270	-1.203
Point 33	200	-0.8
Point 34	200	-4.3
Point 35	236.1	1
Point 36	145.73143	-6.8
Point 37	130	-9.33585
Point 38	206.14634	-0.8
Point 39	200	-1.5
Point 40	310	-8.39
Point 41	239	0.255
Point 42	258.5	-1.86
Point 43	239	-1.845
Point 44	239	-3.145
Point 45	239	-7.445
Point 46	258.5	-5.59
Point 47	258.5	-4.56
Point 48	258.5	-8.39
Point 49	310	-4.56
Point 50	140	-7.74001
Point 51	200	-6.9
Point 52	160	-6.5

Seepage Analysis Reach 16B Station 652+00 TO 655+00

File Information

Created By: Liljegren, James
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Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Seepage Analysis

Kind: SEEP/W
Method: Steady-State
Settings
    Include Air Flow: No
Control
    Apply Runoff: No
Convergence
    Convergence Type: Head Vector Norm
    Maximum Number of Iterations: 500
    Tolerance: 0.001
    Maximum Change in K: 0.1
    Rate of Change in K: 1.02

Minimum Change in K: 1e-005
Equation Solver: Parallel Direct
Potential Seepage Max # of Reviews: 10
Time
Starting Time: 0 sec
Duration: 0 sec
Ending Time: 0 sec

Materials

EMBANKMENT FILL

Model: Saturated Only
Hydraulic
K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BEACH SAND, EL. VARIES TO -50.0

Model: Saturated Only
Hydraulic
K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BAY SOUND CLAY, EL. -50.0 TO -70.0

Model: Saturated Only
Hydraulic
K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SHEET PILE

Model: Saturated Only
Hydraulic
K-Sat: 1e-010 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BLANKET

Model: Saturated Only
Hydraulic
K-Sat: 1.64e-005 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

MARSH

Model: Saturated Only
Hydraulic
K-Sat: 1.31e-005 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SAND

Model: Saturated Only
Hydraulic
K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

Boundary Conditions

Drainage

Review: true
Type: Total Flux (Q) 0

Curb

Type: Head (H) -3.7

Max Operating Level (8.3 ft)

Type: Head (H) 8.3

Regions

	Material	Points	Area (ft²)
Region 1	SHEET PILE	1,5,6,7	2.376
Region 2	BAY SOUND	11,9,8,10	5296

	CLAY, EL. -50.0 TO -70.0		
Region 3	BLANKET	27,4,37,21,38,23,24,30,25,26,22,20,32,31	355.37951
Region 4	EMBANKMENT FILL	23,3,2,7,1,13,14,18,15,16,36,17,35,39,27,4,37,21,38	449.1938
Region 5	SAND	35,34,31,27,39	284.9
Region 6	MARSH	35,34,31,32,33,28	336.1
Region 7	BEACH SAND, EL. VARIES TO -50.0	10,12,19,17,35,28,33,32,20,8	11261.645

Lines

	Start Point	End Point	Hydraulic Boundary	Right Side Material	Left Side Material
Line 1	1	5			
Line 2	5	6			
Line 3	6	7	Drainage		
Line 4	9	8	Curb		
Line 5	10	11	Max Operating Level (8.3 ft)		
Line 6	9	11			
Line 7	4	23			
Line 8	1	7		SHEET PILE	SHEET PILE
Line 9	1	29			SHEET PILE
Line 10	10	8			
Line 11	27	4			
Line 12	23	24	Drainage		
Line 13	24	30	Drainage		
Line 14	30	25	Drainage		
Line 15	25	26	Drainage		
Line 16	26	22	Drainage		
Line 17	22	20	Curb		
Line 18	20	32			
Line 19	31	27			
Line 20	31	32			
Line 21	28	33			
Line 22	32	33			

Line 23	4	37			
Line 24	37	21			
Line 25	21	38			
Line 26	38	23			
Line 27	23	3	Drainage		
Line 28	3	2	Drainage		
Line 29	2	7			
Line 30	1	13			
Line 31	13	14	Max Operating Level (8.3 ft)		
Line 32	14	18	Max Operating Level (8.3 ft)		
Line 33	18	15	Max Operating Level (8.3 ft)		
Line 34	15	16	Max Operating Level (8.3 ft)		
Line 35	16	36	Max Operating Level (8.3 ft)		
Line 36	36	17	Max Operating Level (8.3 ft)		
Line 37	17	35			
Line 38	35	39			
Line 39	39	27			
Line 40	35	34			
Line 41	34	31			
Line 42	28	35			
Line 43	10	12	Max Operating Level (8.3 ft)		
Line 44	12	19	Max Operating Level (8.3 ft)		
Line 45	19	17	Max Operating Level (8.3 ft)		
Line 46	8	20	Curb		

Points

	X (ft)	Y (ft)

Point 1	200	10.2
Point 2	207	10.296
Point 3	220.5	5.682
Point 4	237	0.581
Point 5	200	13.4
Point 6	200.5	13.4
Point 7	201	10.296
Point 8	310	-50
Point 9	310	-70
Point 10	45.2	-50
Point 11	45.2	-70
Point 12	45.2	-9.4
Point 13	199	10.2
Point 14	195.2	9.4
Point 15	177.43556	4
Point 16	167.4	0.6
Point 17	152.5	-4
Point 18	189.18	7.5
Point 19	124	-8
Point 20	310	-6.5
Point 21	244	-0.255
Point 22	310	-1.683
Point 23	250	-0.976
Point 24	256	-2.92
Point 25	264	-2.048
Point 26	270	-1.683
Point 27	200	2.9
Point 28	200	-9.1
Point 29	200	-1.5
Point 30	260	-2.5
Point 31	237	-1.919
Point 32	260	-6.5
Point 33	237	-7.219
Point 34	200	-4.5
Point 35	160	-5.9
Point 36	159.5	-1.7

Point 37	237.4	0.53323
Point 38	244.5	-0.31508
Point 39	199.3	2.746

Seepage Analysis Reach 16C Station 646+41 to 652+00

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File Information

Created By: Liljegren, James
Revision Number: 462
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File Name: R16C_new CL borings.gsz
Directory: Z:\
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Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Seepage Analysis

Kind: SEEP/W
Method: Steady-State
Settings
  Include Air Flow: No
Control
  Apply Runoff: No
Convergence
  Convergence Type: Head Vector Norm
  Maximum Number of Iterations: 500
  Tolerance: 0.001
  Maximum Change in K: 0.1
  Rate of Change in K: 1.02

Minimum Change in K: 1e-005
Equation Solver: Parallel Direct
Potential Seepage Max # of Reviews: 10

Time

Starting Time: 0 sec
Duration: 0 sec
Ending Time: 0 sec

Materials

EMBANKMENT FILL

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

MARSH

Model: Saturated Only

Hydraulic

K-Sat: 1.31e-005 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BEACH SAND, EL.-6.0/ -10.0 TO -48.0

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BAY SOUND CLAY, EL. -48.0 TO -70.0

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SHEET PILE

Model: Saturated Only

Hydraulic

K-Sat: 1e-010 ft/sec

Volumetric Water Content: 0 ft³/ft³

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

SAND

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec

Volumetric Water Content: 0 ft³/ft³

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

BLANKET

Model: Saturated Only

Hydraulic

K-Sat: 1.31e-005 ft/sec

Volumetric Water Content: 0 ft³/ft³

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

Boundary Conditions

Drainage

Review: true

Type: Total Flux (Q) 0

Curb

Type: Head (H) -2.7

Safe Operating Level (8.3 ft)

Type: Head (H) 8.3

Flux Sections

Flux Section 1

Coordinates

Coordinate: (252, -28) ft

Coordinate: (252, 0) ft

Regions

	Material	Points	Area (ft²)
Region 1	SHEET PILE	5,10,11,12	2.4
Region 2	BEACH SAND, EL.-6.0/ -10.0 TO -48.0	20,37,46,27,13,41,15,1,25,2,40,39	10408.286
Region 3	BAY SOUND CLAY, EL. -48.0 TO -70.0	13,14,42,41	5825.6
Region 4	EMBANKMENT FILL	21,29,7,6,12,5,16,17,4,26,3,22,23,24,40,39,9	462.37572
Region 5	BLANKET	9,21,34,30,31,28,43,32,33,8,19,44,35	220.125
Region 6	SAND	39,9,35,44,19,38,49,45,36,47	415.57006
Region 7	MARSH	39,47,36,45,49,38,27,46,37,20	439.29994

Lines

	Start Point	End Point	Hydraulic Boundary	Right Side Material	Left Side Material
Line 1	5	10			
Line 2	10	11			
Line 3	11	12	Drainage		
Line 4	5	12		SHEET PILE	
Line 5	39	9			
Line 6	27	13	Curb		
Line 7	41	15	Safe Operating Level (8.3 ft)		
Line 8	1	25	Safe Operating Level (8.3 ft)		
Line 9	25	2	Safe Operating Level (8.3 ft)		
Line 10	2	40	Safe Operating Level (8.3 ft)		
Line 11	40	39			
Line 12	13	14	Curb		
Line 13	14	42			
Line 14	42	41	Safe Operating Level (8.3 ft)		
Line 15	41	13			

Line 16	1	15	Safe Operating Level (8.3 ft)		
Line 17	21	9			
Line 18	21	29	Drainage		
Line 19	29	7	Drainage		
Line 20	7	6	Drainage		
Line 21	5	16	Safe Operating Level (8.3 ft)		
Line 22	17	4	Safe Operating Level (8.3 ft)		
Line 23	4	26	Safe Operating Level (8.3 ft)		
Line 24	26	3	Safe Operating Level (8.3 ft)		
Line 25	3	22	Safe Operating Level (8.3 ft)		
Line 26	22	23	Safe Operating Level (8.3 ft)		
Line 27	23	24	Safe Operating Level (8.3 ft)		
Line 28	24	40	Safe Operating Level (8.3 ft)		
Line 29	17	16	Safe Operating Level (8.3 ft)		
Line 30	12	6	Drainage		
Line 31	21	34	Drainage		
Line 32	34	30	Drainage		
Line 33	30	31	Drainage		
Line 34	31	28	Drainage		
Line 35	32	33	Drainage		
Line 36	33	8	Drainage		
Line 37	8	19	Curb		
Line 38	28	43	Drainage		
Line 39	43	32	Drainage		
Line 40	46	37			
Line 41	36	45			
Line 42	35	44			

Line 43	9	35			
Line 44	37	20			
Line 45	27	46			
Line 46	44	19			
Line 47	39	47			
Line 48	19	38			
Line 49	9	48			SHEET PILE
Line 50	5	9			SHEET PILE
Line 51	45	49			
Line 52	49	38			
Line 53	38	27	Curb		
Line 54	47	36			
Line 55	20	39			

Points

	X (ft)	Y (ft)
Point 1	127.2	-9.4
Point 2	140.2	-8.1
Point 3	177.1	3.9
Point 4	192.2	8.4
Point 5	200	10.2
Point 6	206.5	9.9
Point 7	221	5.39
Point 8	310	-2.659
Point 9	200	2.6
Point 10	200	13.4
Point 11	200.5	13.4
Point 12	201	10.2
Point 13	310	-48
Point 14	310	-70
Point 15	45.2	-9.4
Point 16	199	10.2
Point 17	195.2	9.4
Point 18	310	-11
Point 19	310	-5.359

Point 20	200	-7.3
Point 21	235	0.192
Point 22	167.4	0.6
Point 23	160	-1.5
Point 24	152.5	-4.6
Point 25	131.2	-9
Point 26	189.18	7.5
Point 27	310	-10.029
Point 28	254	-3.1
Point 29	224.78	4
Point 30	248	-2.169
Point 31	252	-3.378
Point 32	260	-2.595
Point 33	267	-2.659
Point 34	240	-0.72
Point 35	240	-2.52
Point 36	240	-3.82
Point 37	240	-8.52
Point 38	310	-7.029
Point 39	160	-6.5
Point 40	145.8	-6.5
Point 41	45.2	-48
Point 42	45.2	-70
Point 43	258	-2.76
Point 44	258	-5.46
Point 45	258	-7.13
Point 46	258	-10.13
Point 47	200	-4.3
Point 48	200	-1.5
Point 49	259	-7.12806

Seepage Analysis Reach 16D Station 641+85 to 646+41

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File Information

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Last Solved Date: 3/11/2013
Last Solved Time: 9:29:21 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Seepage Analysis

Kind: SEEP/W
Method: Steady-State
Settings
    Include Air Flow: No
Control
    Apply Runoff: No
Convergence
    Convergence Type: Head Vector Norm
    Maximum Number of Iterations: 500
    Tolerance: 0.001
    Maximum Change in K: 0.1
    Rate of Change in K: 1.02

Minimum Change in K: 1e-005
Equation Solver: Parallel Direct
Potential Seepage Max # of Reviews: 10

Time

Starting Time: 0 sec
Duration: 0 sec
Ending Time: 0 sec

Materials

EMBANKMENT FILL

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

MARSH

Model: Saturated Only

Hydraulic

K-Sat: 1.31e-005 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BEACH SAND, EL.-9.5/-10.8 TO -48.0

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BAY SOUND CLAY, EL. -48.0 TO -70.0

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SHEET PILE

Model: Saturated Only

Hydraulic

K-Sat: 1e-010 ft/sec

Volumetric Water Content: 0 ft^3/ft^3

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

SAND

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec

Volumetric Water Content: 0 ft^3/ft^3

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

BLANKET

Model: Saturated Only

Hydraulic

K-Sat: 1.64e-005 ft/sec

Volumetric Water Content: 0 ft^3/ft^3

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

Boundary Conditions

Drainage

Review: true

Type: Total Flux (Q) 0

Curb

Type: Head (H) -5.1

Safe Operating Level (8.2 ft)

Type: Head (H) 8.2

Regions

	Material	Points	Area (ft^2)
Region 1	SHEET PILE	2,8,9,10,18	2.625
Region 2	BAY SOUND	13,34,11,12	5825.6

	CLAY, EL. -48.0 TO -70.0		
Region 3	EMBANKMENT FILL	5,22,32,31,4,3,10,18,2,16,27,37,23,24,25,33,30,36	561.59935
Region 4	BEACH SAND, EL.-9.5/-10.8 TO -48.0	19,44,38,11,12,14,15,1,26,35,21	10073.27
Region 5	MARSH	1,25,33,20,28,45,43,29,38,44,19,21,35,26	823.93009
Region 6	BLANKET	36,40,41,42,6,39,5	87.252
Region 7	SAND	33,30,36,40,41,42,29,43,45,28,20	364.99996

Lines

	Start Point	End Point	Left Side Material	Hydraulic Boundary
Line 1	2	8		
Line 2	8	9		
Line 3	9	10		
Line 4	10	18	SHEET PILE	
Line 5	18	2		
Line 6	21	19		
Line 7	25	33		
Line 8	33	30		
Line 9	30	7	SHEET PILE	
Line 10	18	30	SHEET PILE	
Line 11	13	34		
Line 12	34	11		Curb
Line 13	12	13		Safe Operating Level (8.2 ft)
Line 14	11	12		
Line 15	26	35		
Line 16	35	21		
Line 17	36	30		
Line 18	5	36		
Line 19	5	22		Drainage
Line 20	22	32		Drainage
Line 21	32	31		
Line 22	31	4		Drainage
Line 23	4	3		Drainage

Line 24	3	10		Drainage
Line 25	2	16		Safe Operating Level (8.2 ft)
Line 26	16	27		Safe Operating Level (8.2 ft)
Line 27	27	37		Safe Operating Level (8.2 ft)
Line 28	37	23		Safe Operating Level (8.2 ft)
Line 29	23	24		Safe Operating Level (8.2 ft)
Line 30	24	25		Safe Operating Level (8.2 ft)
Line 31	38	11		Curb
Line 32	12	14		Safe Operating Level (8.2 ft)
Line 33	14	15		Safe Operating Level (8.2 ft)
Line 34	15	1		Safe Operating Level (8.2 ft)
Line 35	1	26		Safe Operating Level (8.2 ft)
Line 36	1	25		Safe Operating Level (8.2 ft)
Line 37	33	20		
Line 38	20	28		
Line 39	29	38		Curb
Line 40	36	40		
Line 41	40	41		
Line 42	41	42		
Line 43	42	6		Curb
Line 44	6	39		Drainage
Line 45	39	5		Drainage
Line 46	42	29		Curb
Line 47	43	29		
Line 48	38	44		
Line 49	44	19		
Line 50	28	45		
Line 51	45	43		

Points

	X (ft)	Y (ft)
Point 1	127.2	-9.4
Point 2	200	10.2
Point 3	206.8	9.9
Point 4	214	7.6

Point 5	244	-3.1
Point 6	310	-3.1
Point 7	200	-1.5
Point 8	200	13.4
Point 9	200.5	13.4
Point 10	201	9.9
Point 11	310	-48
Point 12	45.2	-48
Point 13	45.2	-70
Point 14	45.2	-9.4
Point 15	81.7	-9.4
Point 16	199	10.2
Point 17	195.2	9.4
Point 18	200	9.9
Point 19	244	-10.8
Point 20	200	-4.6
Point 21	200	-10.1
Point 22	228	1.878
Point 23	167.4	0.6
Point 24	160	-1.5
Point 25	152.5	-4.6
Point 26	131.2	-9
Point 27	198.05	10
Point 28	244	-6.2
Point 29	310	-6.2
Point 30	200	-0.1
Point 31	222.8	4
Point 32	223.1	3.87758
Point 33	160	-4.6
Point 34	310	-70
Point 35	160	-9.45727
Point 36	232	-3.08182
Point 37	195.3	9.3
Point 38	310	-10.8
Point 39	255	-2.856
Point 40	244	-4.2

Point 41	255	-4.2
Point 42	310	-4.2
Point 43	255	-6.2
Point 44	255	-10.8
Point 45	244.3	-6.2

Seepage Analysis with Sheetpile Reach 16A Station 655+00 to 658+00

File Information

Created By: Liljegren, James
Revision Number: 466
Last Edited By: Goltz, Amanda MVS
Date: 3/11/2013
Time: 10:40:12 AM
File Name: R16A_new CL borings.gsz
Directory: Z:\
Last Solved Date: 3/11/2013
Last Solved Time: 10:41:13 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Seepage Analysis

Kind: SEEP/W
Method: Steady-State
Settings
  Include Air Flow: No
Control
  Apply Runoff: No
Convergence
  Convergence Type: Head Vector Norm
  Maximum Number of Iterations: 500
  Tolerance: 0.001
  Maximum Change in K: 0.1
  Rate of Change in K: 1.02

        Minimum Change in K: 1e-005
        Equation Solver: Parallel Direct
        Potential Seepage Max # of Reviews: 10
    Time
        Starting Time: 0 sec
        Duration: 0 sec
        Ending Time: 0 sec

Materials

EMBANKMENT FILL

Model: Saturated Only
Hydraulic
    K-Sat: 9.8e-006 ft/sec
    Volumetric Water Content: 0 ft³/ft³
    Mv: 0 /psf
    K-Ratio: 1
    K-Direction: 0 °

BEACH SAND, EL. -6.3/-8.3 TO -50.0

Model: Saturated Only
Hydraulic
    K-Sat: 0.00049 ft/sec
    Volumetric Water Content: 0 ft³/ft³
    Mv: 0 /psf
    K-Ratio: 1
    K-Direction: 0 °

BAY SOUND CLAY, EL. -50.0 TO -70.0

Model: Saturated Only
Hydraulic
    K-Sat: 2.62e-007 ft/sec
    Volumetric Water Content: 0 ft³/ft³
    Mv: 0 /psf
    K-Ratio: 1
    K-Direction: 0 °

Sheet Pile

Model: Saturated Only
Hydraulic
    K-Sat: 1e-010 ft/sec
    Volumetric Water Content: 0 ft³/ft³
    Mv: 0 /psf
    K-Ratio: 1
    K-Direction: 0 °

MARSH

Model: Saturated Only
Hydraulic
K-Sat: 1.31e-005 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BLANKET

Model: Saturated Only
Hydraulic
K-Sat: 1.64e-005 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SAND

Model: Saturated Only
Hydraulic
K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SILTY SAND

Model: Saturated Only
Hydraulic
K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

Boundary Conditions

Drainage

Review: true
Type: Total Flux (Q) 0

Curb

Type: Head (H) -3.2

Max Operating Level (8.3 ft)

Type: Head (H) 8.3

Regions

	Material	Points	Area (ft²)
Region 1	Sheet Pile	2,6,7,29,8,14	2.6250625
Region 2	BAY SOUND CLAY, EL. -50.0 TO -70.0	27,28,15,10,9	5296
Region 3	BLANKET	38,35,41,23,5,22,30,42,31,32,26,49,47,43	245.10608
Region 4	MARSH	52,34,44,46,25,40,48,45,51	391.22
Region 5	SILTY SAND	52,33,38,43,34	141.46146
Region 6	SAND	34,43,47,49,25,46,44	109.8675
Region 7	EMBANKMENT FILL	36,19,18,17,16,20,24,1,13,21,12,2,14,8,29,53,3,4,35,38,33,52	603.33578
Region 8	BEACH SAND, EL. -6.3/-8.3 TO -50.0	9,11,37,50,36,52,51,45,48,40,27	11089.463

Lines

	Start Point	End Point	Left Side Material	Hydraulic Boundary
Line 1	2	6		
Line 2	6	7		
Line 3	8	14	Sheet Pile	
Line 4	14	2		
Line 5	27	28		Curb
Line 6	28	15		
Line 7	15	10		
Line 8	10	9		Max Operating Level (8.3 ft)
Line 9	7	29		
Line 10	29	8		
Line 11	38	35		
Line 12	14	39	Sheet Pile	
Line 13	46	25		
Line 14	44	46		

Line 15	43	47		
Line 16	47	49		
Line 17	38	43		
Line 18	35	41		Drainage
Line 19	41	23		Drainage
Line 20	23	5		Drainage
Line 21	5	22		Drainage
Line 22	22	30		Drainage
Line 23	30	42		Drainage
Line 24	42	31		Drainage
Line 25	31	32		Drainage
Line 26	32	26		Drainage
Line 27	26	49		Curb
Line 28	52	34		
Line 29	34	44		
Line 30	25	40		Curb
Line 31	40	48		
Line 32	48	45		
Line 33	45	51		
Line 34	51	52		
Line 35	27	9		
Line 36	52	33		
Line 37	33	38		
Line 38	43	34		
Line 39	49	25		
Line 40	36	19		Max Operating Level (8.3 ft)
Line 41	19	18		Max Operating Level (8.3 ft)
Line 42	18	17		Max Operating Level (8.3 ft)
Line 43	17	16		Max Operating Level (8.3 ft)
Line 44	16	20		Max Operating Level (8.3 ft)
Line 45	20	24		Max Operating Level (8.3 ft)
Line 46	24	1		Max Operating Level (8.3 ft)
Line 47	1	13		Max Operating Level (8.3 ft)
Line 48	13	21		
Line 49	21	12		
Line 50	12	2		

Line 51	3	4		Drainage
Line 52	35	4		Drainage
Line 53	36	52		
Line 54	9	11		Max Operating Level (8.3 ft)
Line 55	11	37		Max Operating Level (8.3 ft)
Line 56	37	50		Max Operating Level (8.3 ft)
Line 57	50	36		Max Operating Level (8.3 ft)
Line 58	40	27		Curb
Line 59	29	53		
Line 60	53	3		
Line 61	53	54	Sheet Pile	

Points

	X (ft)	Y (ft)
Point 1	192.2	8.4
Point 2	200	10.2
Point 3	206.8	10.216
Point 4	219	6.558
Point 5	247	-2.455
Point 6	200	13.4
Point 7	200.5	13.4
Point 8	201	9.9
Point 9	45.2	-50
Point 10	45.2	-70
Point 11	45.2	-9.4
Point 12	199	10.2
Point 13	195.2	9.4
Point 14	200	9.9
Point 15	177.4	-70
Point 16	177.43556	4
Point 17	167.4	0.6
Point 18	160	-1.5
Point 19	152.5	-4.5
Point 20	189.18	7.5
Point 21	198.05	10

Point 22	249	-2.521
Point 23	241	-0.259
Point 24	190.85778	8
Point 25	310	-5.93
Point 26	310	-1.203
Point 27	310	-50
Point 28	310	-70
Point 29	200.96775	10.126
Point 30	253	-2.518
Point 31	260	-1.683
Point 32	270	-1.203
Point 33	200	-0.8
Point 34	200	-4.3
Point 35	236.1	1
Point 36	145.73143	-6.8
Point 37	130	-9.33585
Point 38	206.14634	-0.8
Point 39	200	-1.5
Point 40	310	-8.39
Point 41	239	0.255
Point 42	258.5	-1.86
Point 43	239	-1.845
Point 44	239	-3.145
Point 45	239	-7.445
Point 46	258.5	-5.59
Point 47	258.5	-4.56
Point 48	258.5	-8.39
Point 49	310	-4.56
Point 50	140	-7.74001
Point 51	200	-6.9
Point 52	160	-6.5
Point 53	205	10.18822
Point 54	205	-55

Seepage Analysis with Sheetpile Reach 16B Station 652+00 to 655+00

File Information

Created By: Liljegren, James
Revision Number: 452
Last Edited By: Goltz, Amanda MVS
Date: 3/11/2013
Time: 10:53:19 AM
File Name: R16Bgsz.gsz
Directory: Z:\
Last Solved Date: 3/11/2013
Last Solved Time: 10:53:32 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Seepage Analysis

Kind: SEEP/W
Method: Steady-State
Settings
- Include Air Flow: No

Control
- Apply Runoff: No

Convergence
- Convergence Type: Head Vector Norm
- Maximum Number of Iterations: 500
- Tolerance: 0.001
- Maximum Change in K: 0.1
- Rate of Change in K: 1.02

Minimum Change in K: 1e-005
Equation Solver: Parallel Direct
Potential Seepage Max # of Reviews: 10
Time
Starting Time: 0 sec
Duration: 0 sec
Ending Time: 0 sec

Materials

EMBANKMENT FILL

Model: Saturated Only
Hydraulic
K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BEACH SAND, EL. VARIES TO -50.0

Model: Saturated Only
Hydraulic
K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BAY SOUND CLAY, EL. -50.0 TO -70.0

Model: Saturated Only
Hydraulic
K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SHEET PILE

Model: Saturated Only
Hydraulic
K-Sat: 1e-010 ft/sec
Volumetric Water Content: 0 ft³/ft³
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BLANKET

Model: Saturated Only

Hydraulic

K-Sat: 1.64e-005 ft/sec

Volumetric Water Content: 0 ft^3/ft^3

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

MARSH

Model: Saturated Only

Hydraulic

K-Sat: 1.31e-005 ft/sec

Volumetric Water Content: 0 ft^3/ft^3

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

SAND

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec

Volumetric Water Content: 0 ft^3/ft^3

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

Boundary Conditions

Drainage

Review: true

Type: Total Flux (Q) 0

Curb

Type: Head (H) -3.7

Max Operating Level (8.3 ft)

Type: Head (H) 8.3

Regions

	Material	Points	Area (ft^2)
Region 1	SHEET PILE	1,5,6,7	2.376
Region 2	BAY SOUND	11,9,8,10	5296

	CLAY, EL. -50.0 TO -70.0		
Region 3	BLANKET	27,4,37,21,38,23,24,30,25,26,22,20,32,31	355.37951
Region 4	EMBANKMENT FILL	23,3,2,40,7,1,13,14,18,15,16,36,17,35,39,27,4,37,21,38	449.1938
Region 5	SAND	35,34,31,27,39	284.9
Region 6	MARSH	35,34,31,32,33,28	336.1
Region 7	BEACH SAND, EL. VARIES TO -50.0	10,12,19,17,35,28,33,32,20,8	11261.645

Lines

	Start Point	End Point	Hydraulic Boundary	Right Side Material	Left Side Material
Line 1	1	5			
Line 2	5	6			
Line 3	6	7	Drainage		
Line 4	9	8	Curb		
Line 5	10	11	Max Operating Level (8.3 ft)		
Line 6	9	11			
Line 7	4	23			
Line 8	1	7		SHEET PILE	SHEET PILE
Line 9	1	29			SHEET PILE
Line 10	10	8			
Line 11	27	4			
Line 12	23	24	Drainage		
Line 13	24	30	Drainage		
Line 14	30	25	Drainage		
Line 15	25	26	Drainage		
Line 16	26	22	Drainage		
Line 17	22	20	Curb		
Line 18	20	32			
Line 19	31	27			
Line 20	31	32			
Line 21	28	33			
Line 22	32	33			

Line 23	4	37			
Line 24	37	21			
Line 25	21	38			
Line 26	38	23			
Line 27	23	3	Drainage		
Line 28	3	2	Drainage		
Line 29	1	13			
Line 30	13	14	Max Operating Level (8.3 ft)		
Line 31	14	18	Max Operating Level (8.3 ft)		
Line 32	18	15	Max Operating Level (8.3 ft)		
Line 33	15	16	Max Operating Level (8.3 ft)		
Line 34	16	36	Max Operating Level (8.3 ft)		
Line 35	36	17	Max Operating Level (8.3 ft)		
Line 36	17	35			
Line 37	35	39			
Line 38	39	27			
Line 39	35	34			
Line 40	34	31			
Line 41	28	35			
Line 42	10	12	Max Operating Level (8.3 ft)		
Line 43	12	19	Max Operating Level (8.3 ft)		
Line 44	19	17	Max Operating Level (8.3 ft)		
Line 45	8	20	Curb		
Line 46	2	40			
Line 47	40	7			
Line 48	40	41			SHEET PILE

Points

	X (ft)	Y (ft)
Point 1	200	10.2
Point 2	207	10.296
Point 3	220.5	5.682
Point 4	237	0.581
Point 5	200	13.4
Point 6	200.5	13.4
Point 7	201	10.296
Point 8	310	-50
Point 9	310	-70
Point 10	45.2	-50
Point 11	45.2	-70
Point 12	45.2	-9.4
Point 13	199	10.2
Point 14	195.2	9.4
Point 15	177.43556	4
Point 16	167.4	0.6
Point 17	152.5	-4
Point 18	189.18	7.5
Point 19	124	-8
Point 20	310	-6.5
Point 21	244	-0.255
Point 22	310	-1.683
Point 23	250	-0.976
Point 24	256	-2.92
Point 25	264	-2.048
Point 26	270	-1.683
Point 27	200	2.9
Point 28	200	-9.1
Point 29	200	-1.5
Point 30	260	-2.5
Point 31	237	-1.919
Point 32	260	-6.5
Point 33	237	-7.219

Point 34	200	-4.5
Point 35	160	-5.9
Point 36	159.5	-1.7
Point 37	237.4	0.53323
Point 38	244.5	-0.31508
Point 39	199.3	2.746
Point 40	205	10.296
Point 41	205	-55

Seepage Analysis with Sheetpile Reach 16C Station 646+41 to 652+00

File Information

Created By: Liljegren, James
Revision Number: 463
Last Edited By: Goltz, Amanda MVS
Date: 3/11/2013
Time: 11:01:07 AM
File Name: R16C_new CL borings.gsz
Directory: Z:\
Last Solved Date: 3/11/2013
Last Solved Time: 11:01:24 AM

Project Settings

Length(L) Units: feet
Time(t) Units: Seconds
Force(F) Units: lbf
Pressure(p) Units: psf
Mass(M) Units: lbs
Mass Flux Units: lbs/sec
Unit Weight of Water: 62.4 pcf
View: 2D

Analysis Settings

Seepage Analysis water level at 8.2

Kind: SEEP/W
Method: Steady-State
Settings
    Include Air Flow: No
Control
    Apply Runoff: No
Convergence
    Convergence Type: Head Vector Norm
    Maximum Number of Iterations: 500
    Tolerance: 0.001
    Maximum Change in K: 0.1
    Rate of Change in K: 1.02

Minimum Change in K: 1e-005
Equation Solver: Parallel Direct
Potential Seepage Max # of Reviews: 10

Time

Starting Time: 0 sec
Duration: 0 sec
Ending Time: 0 sec

Materials

EMBANKMENT FILL

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

MARSH

Model: Saturated Only

Hydraulic

K-Sat: 1.31e-005 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BEACH SAND, EL.-6.0/ -10.0 TO -48.0

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

BAY SOUND CLAY, EL. -48.0 TO -70.0

Model: Saturated Only

Hydraulic

K-Sat: 9.8e-006 ft/sec
Volumetric Water Content: 0 ft^3/ft^3
Mv: 0 /psf
K-Ratio: 1
K-Direction: 0 °

SHEET PILE

Model: Saturated Only

Hydraulic

K-Sat: 1e-010 ft/sec

Volumetric Water Content: 0 ft³/ft³

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

SAND

Model: Saturated Only

Hydraulic

K-Sat: 0.00049 ft/sec

Volumetric Water Content: 0 ft³/ft³

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

BLANKET

Model: Saturated Only

Hydraulic

K-Sat: 1.31e-005 ft/sec

Volumetric Water Content: 0 ft³/ft³

Mv: 0 /psf

K-Ratio: 1

K-Direction: 0 °

Boundary Conditions

Drainage

Review: true

Type: Total Flux (Q) 0

Curb

Type: Head (H) -2.7

Safe Operating Level (8.3 ft)

Type: Head (H) 8.3

Flux Sections

Flux Section 1

Coordinates

Coordinate: (252, -28) ft

Coordinate: (252, 0) ft

Regions

	Material	Points	Area (ft²)
Region 1	SHEET PILE	5,10,11,12	2.4
Region 2	BEACH SAND, EL.-6.0/ -10.0 TO -48.0	20,37,46,27,13,41,15,1,25,2,40,39	10408.286
Region 3	BAY SOUND CLAY, EL. -48.0 TO -70.0	13,14,42,41	5825.6
Region 4	EMBANKMENT FILL	21,29,7,6,50,12,5,16,17,4,26,3,22,23,24,40,39,9	462.37573
Region 5	BLANKET	9,21,34,30,31,28,43,32,33,8,19,44,35	220.125
Region 6	SAND	39,9,35,44,19,38,49,45,36,47	415.57006
Region 7	MARSH	39,47,36,45,49,38,27,46,37,20	439.29994

Lines

	Start Point	End Point	Hydraulic Boundary	Right Side Material	Left Side Material
Line 1	5	10			
Line 2	10	11			
Line 3	11	12	Drainage		
Line 4	5	12		SHEET PILE	
Line 5	39	9			
Line 6	27	13	Curb		
Line 7	41	15	Safe Operating Level (8.3 ft)		
Line 8	1	25	Safe Operating Level (8.3 ft)		
Line 9	25	2	Safe Operating Level (8.3 ft)		
Line 10	2	40	Safe Operating Level (8.3 ft)		
Line 11	40	39			
Line 12	13	14	Curb		
Line 13	14	42			
Line 14	42	41	Safe Operating Level (8.3 ft)		

Line 15	41	13			
Line 16	1	15	Safe Operating Level (8.3 ft)		
Line 17	21	9			
Line 18	21	29	Drainage		
Line 19	29	7	Drainage		
Line 20	7	6	Drainage		
Line 21	5	16	Safe Operating Level (8.3 ft)		
Line 22	17	4	Safe Operating Level (8.3 ft)		
Line 23	4	26	Safe Operating Level (8.3 ft)		
Line 24	26	3	Safe Operating Level (8.3 ft)		
Line 25	3	22	Safe Operating Level (8.3 ft)		
Line 26	22	23	Safe Operating Level (8.3 ft)		
Line 27	23	24	Safe Operating Level (8.3 ft)		
Line 28	24	40	Safe Operating Level (8.3 ft)		
Line 29	17	16	Safe Operating Level (8.3 ft)		
Line 30	21	34	Drainage		
Line 31	34	30	Drainage		
Line 32	30	31	Drainage		
Line 33	31	28	Drainage		
Line 34	32	33	Drainage		
Line 35	33	8	Drainage		
Line 36	8	19	Curb		
Line 37	28	43	Drainage		
Line 38	43	32	Drainage		
Line 39	46	37			
Line 40	36	45			
Line 41	35	44			

Line 42	9	35			
Line 43	37	20			
Line 44	27	46			
Line 45	44	19			
Line 46	39	47			
Line 47	19	38			
Line 48	9	48			SHEET PILE
Line 49	5	9			SHEET PILE
Line 50	45	49			
Line 51	49	38			
Line 52	38	27	Curb		
Line 53	47	36			
Line 54	20	39			
Line 55	12	50	Drainage		
Line 56	50	6	Drainage		
Line 57	50	51			SHEET PILE

Points

	X (ft)	Y (ft)
Point 1	127.2	-9.4
Point 2	140.2	-8.1
Point 3	177.1	3.9
Point 4	192.2	8.4
Point 5	200	10.2
Point 6	206.5	9.9
Point 7	221	5.39
Point 8	310	-2.659
Point 9	200	2.6
Point 10	200	13.4
Point 11	200.5	13.4
Point 12	201	10.2
Point 13	310	-48
Point 14	310	-70
Point 15	45.2	-9.4
Point 16	199	10.2

Point 17	195.2	9.4
Point 18	310	-11
Point 19	310	-5.359
Point 20	200	-7.3
Point 21	235	0.192
Point 22	167.4	0.6
Point 23	160	-1.5
Point 24	152.5	-4.6
Point 25	131.2	-9
Point 26	189.18	7.5
Point 27	310	-10.029
Point 28	254	-3.1
Point 29	224.78	4
Point 30	248	-2.169
Point 31	252	-3.378
Point 32	260	-2.595
Point 33	267	-2.659
Point 34	240	-0.72
Point 35	240	-2.52
Point 36	240	-3.82
Point 37	240	-8.52
Point 38	310	-7.029
Point 39	160	-6.5
Point 40	145.8	-6.5
Point 41	45.2	-48
Point 42	45.2	-70
Point 43	258	-2.76
Point 44	258	-5.46
Point 45	258	-7.13
Point 46	258	-10.13
Point 47	200	-4.3
Point 48	200	-1.5
Point 49	259	-7.12806
Point 50	205	9.98182
Point 51	205	-53

17th Street Outfall Canal Reach 16 Seepage Factor of Safety Calculations

Reach 16A

		Weighted Unit weight			119.0													
			Critical gradient		0.907													
Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft^3/sec)	Cumulative Water Flux (ft^3)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft^3/ft^3)	Slope of Vol. Water Content Fn. (/psf)
13823	247	-2.455	0	-2.455	0	0	-3.76E-05	0	6.59E-06	3.61E-05	3.67E-05	6.04E-01	2.18E+00	2.27E+00	1.64E-05	1.64E-05	0	0
13815	246.8	-2.931	0	-1.2748	103.34702	1.6562	None	None	2.37E-05	2.05E-05	3.13E-05	0.3002728	1.13E+00	1.1698144	8.96E-05	8.96E-05	0	0
	0.51631			1.1802														
		exit gradient	2.286		FS	0.40												

Reach 16B

		Weighted Unit weight			115.0													
			Critical gradient		0.843													
Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft^3/sec)	Cumulative Water Flux (ft^3)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft^3/ft^3)	Slope of Vol. Water Content Fn. (/psf)
14546	256	-2.92	0	-2.92	0	0	-1.91E-05	0	7.58E-06	1.54E-05	1.72E-05	2.00E-01	9.29E-01	9.50E-01	1.64E-05	1.64E-05	0	0
14544	256	-6.6250435	0	-0.2864	395.52977	6.33862	None	None	5.04E-06	9.04E-06	1.04E-05	0.0628896	3.48E-01	0.35386047	8.01E-05	8.01E-05	0	0
	3.705044			2.63357														
		exit gradient	0.711		FS	1.19												

Reach 16C

			Weighted Unit weight		112																
			Critical gradient		0.795																
Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Wate	Pressure Head (ft)	Water Flux	Cumulative	X-Velocity M	Y-Velocity M	XY-Velocit	X-Gradient	Y-Gradient	XY-Gradier	X-Conducti	Y-Conduct	Vol. Water	Slope of Vol. Water Content Fn. (/psf)			
14116	252	-3.378	0	-3.378	0	0	-2.98E-05	0	6.39E-06	2.48E-05	2.56E-05	2.37E-01	1.88E+00	1.89E+00	1.31E-05	1.31E-05	0	0			
14115	252	-4.48	0	-1.2907425	199.0097	3.1892575	None	None	1.00E-05	1.48E-05	1.79E-05	0.210644	9.48E-01	0.971004	8.01E-05	8.01E-05	0	0			
	1.102			2.0872575																	
		exit gradient	1.894		FS	0.42															

17th Street Outfall Canal Reach 16 Seepage Factor of Safety Calculations

Reach 16D

		Weighted Unit weight			113.4													
			Critical gradient		0.817													
Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
13615	244	-3.1	0	-3.1	0	0	-2.50E-05	0	2.11E-06	1.81E-05	1.82E-05	4.68E-01	1.31E+00	1.39E+00	1.38E-05	1.38E-05	0	0
13612	244	-10.8	0	-0.6312	634.53533	10.16884	None	None	6.08E-06	2.59E-06	6.61E-06	0.0758858	1.09E-01	0.13267936	8.01E-05	8.01E-05	0	0
	7.7			2.46884														
		exit gradient	0.321		FS	2.55												

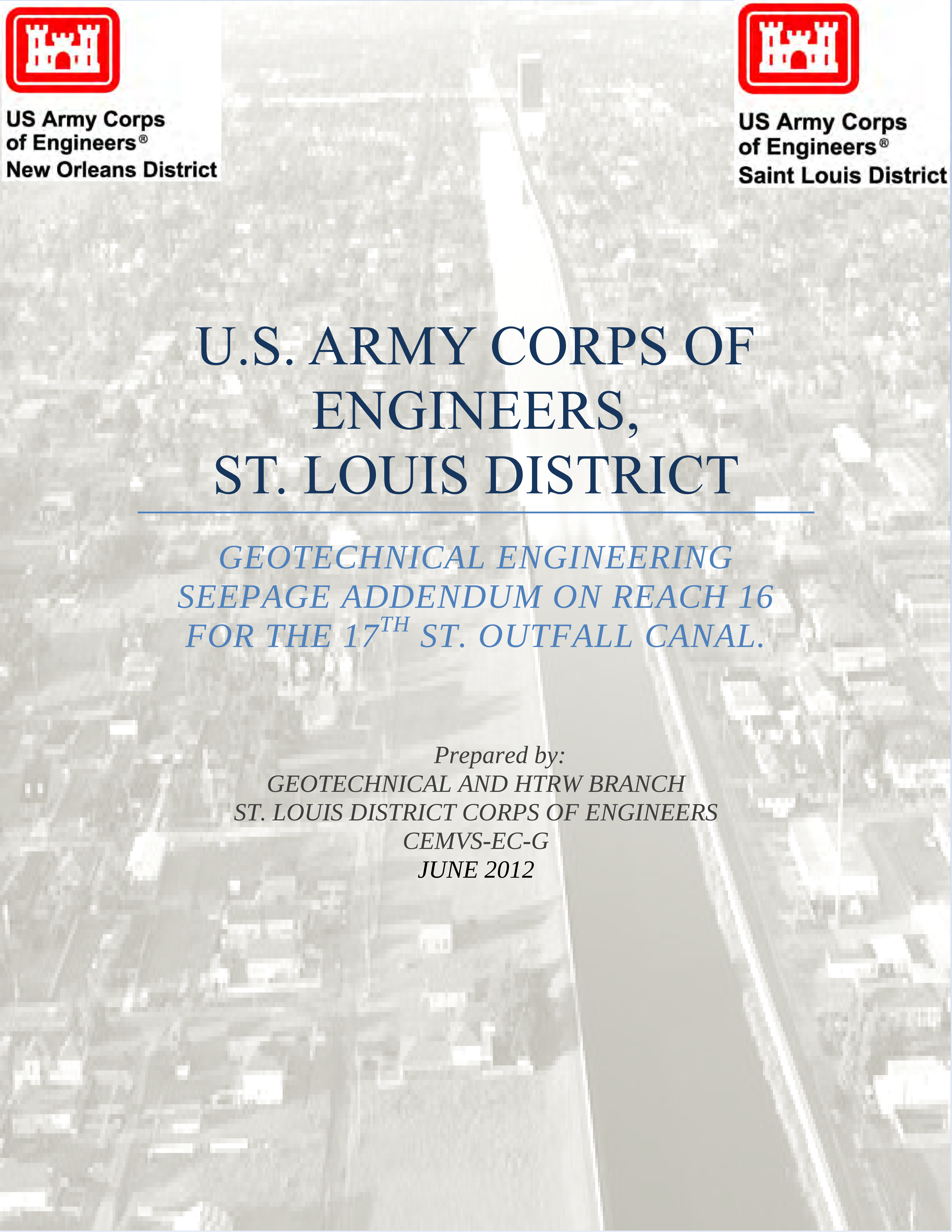
Reach 16C with Sheetpile

			Weighted Unit weight		115															
			Critical gradient		0.843															
Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Wate	Pressure Head (ft)	Water Flux	Cumulative	X-Velocity M	Y-Velocity M	XY-Velocit	X-Gradient	Y-Gradient	XY-Gradier	X-Conducti	Y-Conduct	Vol. Water	Slope of Vol. Water Content Fn. (		
14114	252	-3.378	0	-3.378	0	0	-9.89E-06	0	4.97E-06	7.50E-06	9.00E-06	1.28E-01	5.57E-01	5.71E-01	1.31E-05	1.31E-05	0	0		
14111	252	-9.5933333	0	-2.5475259	439.6584	7.0458074	None	None	4.06E-07	6.30E-07	7.49E-07	0.005594	2.77E-02	0.02824	8.01E-05	8.01E-05	0	0		
	6.215333			0.8304741																
		exit gradient	0.134		FS	6.31														

Appendix C: Seepage Addendum Reach 16, June 2012

US Army Corps
of Engineers®
New Orleans District

US Army Corps
of Engineers®
Saint Louis District



U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT

GEOTECHNICAL ENGINEERING SEEPAGE ADDENDUM ON REACH 16 FOR THE 17TH ST. OUTFALL CANAL.

Prepared by:
GEOTECHNICAL AND HTRW BRANCH
ST. LOUIS DISTRICT CORPS OF ENGINEERS
CEMVS-EC-G
JUNE 2012

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Summary

The seepage addendum 2 (September 2011) shown that there are two areas along Reach 16 with factor of safety less than 1.6. In order to confirm and to validate if these two areas are representative for the entire reach, MVS has performed additional seepages analyses. Reach 16 was divided in four different sub-reaches to calculate different seepage factors of safety due to the variation in elevation at the levee toe and to the variation in blanket thickness along it. These sub-reaches include reach 16A (655+00 to 657+87), 16B (652+00 to 655+00), 16C (646+41 to 652+00), and 16D (642+65 to 646+41) and were chosen due to their proximity to low spots along the levee toe and the existence of a sandy silt strata within the fine grain blanket. A summary of the results are provided on Table 1 and the permeability values used for the fine grain blanket and levee core are shown on Table 2 and were obtained from the DIVR 1110-1-400.

The main difference between URS and MVS seepage factor if safety is that URS used the lowest elevation and kept it constant to model the GSE on the protected side, while MVS took in consideration the existence of the inlet drainage ditch in their Seep/W model. MVS exit gradients concentrate more at the low spot area while URS exit gradient are more spread due to the flat ground on the protected side.

Table 1 Summary of Factors of Safety for Seepage Analysis in Reach 16

Reach	URS Existing Conditions	MVS Existing Conditions
16A	1.66 [1]	1.70 [3]
16B	2.06 [1]	1.59 [3]
16C	1.60 [2]	1.32 [4]
16D	1.40 [2]	2.76 [4]

Note: [1] Water elevation in canal EL. 10ft
[2] Water elevation in canal EL. 8ft
[3] Water elevation in canal EL. 8.5ft
[4] Water elevation in canal EL. 8.2ft

Table 2 Suggested Design Values for Ratio of Permeability of Pervious Substratum to Landslide Top Stratum and Permeability of Top Stratum

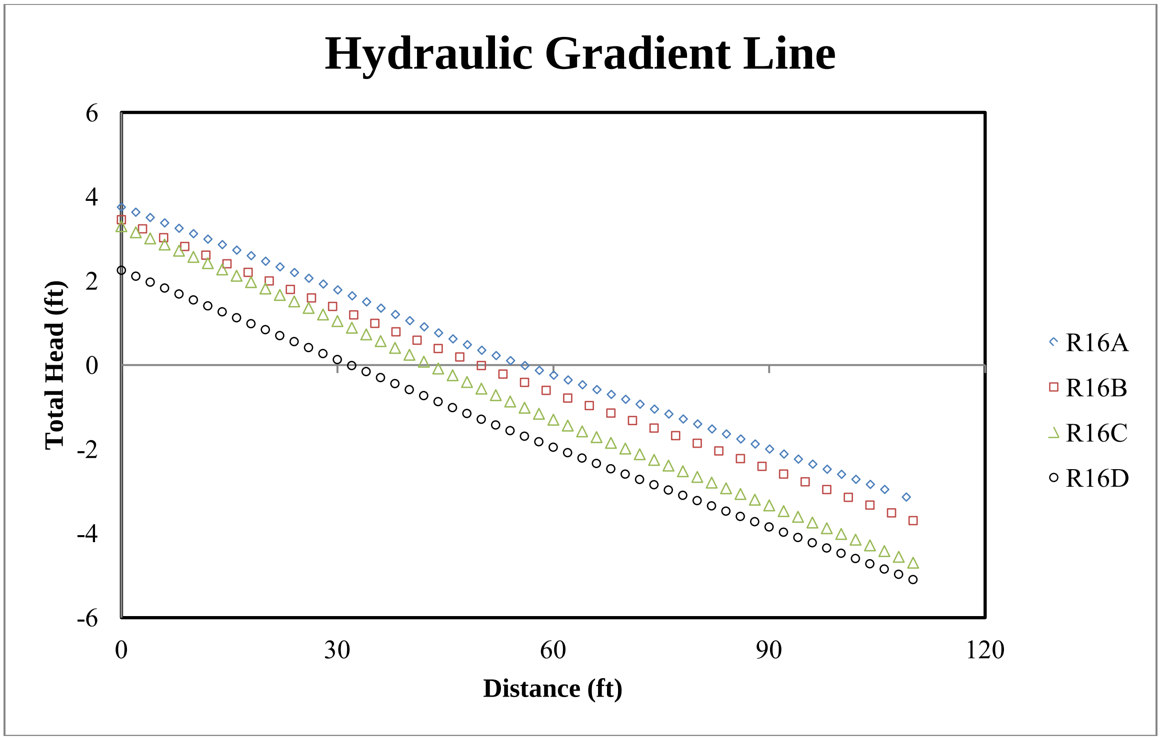
Soil Type	Blanket Thickness (ft)	Suggested Design Values *kbl* (ft/sec)
Silty Sand	<5	3.28E-05
	5 to 10	2.62E-05
	>10	1.97E-05
Sand and Silty Sand	<5	1.64E-05
	5 to 10	1.31E-05
	10 to 15	9.80E-06
	>15	6.56E-06
Clay and Silty Clay	<5	1.31E-05
	5 to 10	9.80E-06
	10 to 15	4.92E-06
	15 to 20	1.64E-06
	>20	2.62E-07

Seepage analysis

The critical seepage gradient for the landside blanket is determined by dividing the buoyant unit weight of the soils in the blanket by the unit weight of water. The method for determining the average unit weight for layered soils is shown in the example below. The factor of safety for seepage is determined by dividing the critical gradient by the calculated gradient across the blanket. A factor of safety of at least 1.6 is required per Corps criteria. The seepage factor of safety was calculated for two water levels 8.5' (Between 658+00 and 652+00) and 8.2' (Between 652+00 and 641+85).

The hydraulic grade line, or total head at the top of the aquifer, was plotted from the results of each SEEP/W analysis and is shown in table 3. Seepage gradients were calculated at offsets from the levee centerline using the June 2011 survey points for points selected at the levee toe and drainage ditch.

Table 3 Hydraulic Gradient Line



Reach 16A

Below is a geological section (Figure 1) and the boring logs (figure 2) used to develop the stratigraphy on Reach 16A (655+00 to 657+87), a table showing hydraulic properties used for the Seep/W (figure 2) analysis (Table 4), and a plan view cross section extent (figure 3). Two blanket soil materials are present in this reach at the lowest point inside the ditch, silty sand and marsh. The silty sand has a unit weight of 122 pcf and the marsh has a unit weight of 101 pcf. Assuming this stratigraphy is consistent through the subreach. The calculated average unit weight is 109 pcf.

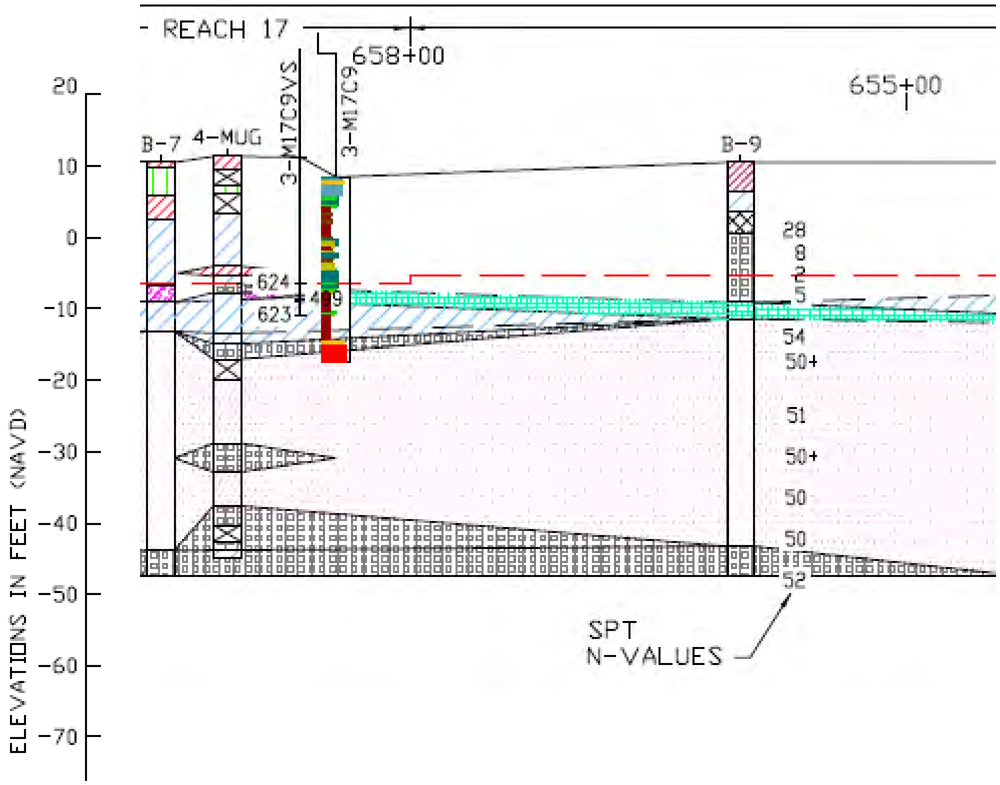
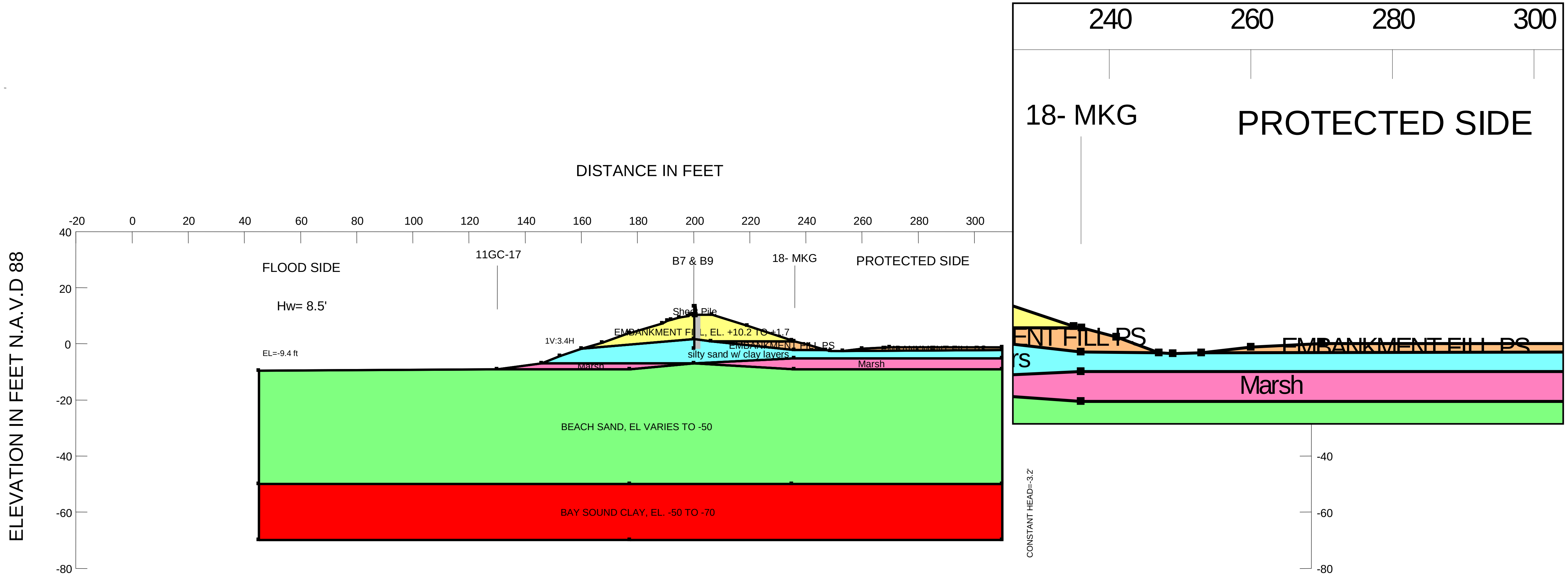


Figure 1 Reach 16A (655+00 to 657+87) (From the MWOL Orleans Canal March 2011 report)

Table 4 Summary of Hydraulic Property Values for landside blanket for R16A (655+00 to 657+87)

Reach 16A Hydraulic Properties							
Unit	Classification (USCS) (Typical)	Saturated Permeability (Kx)	Permeability Ratio (Ky/ Kx)	Top Elevation of Blanket (ft)	Bottom Elevation of Blanket (ft)	Thickness of Blanket (ft)	Unit Weight (PCF)
Levee Embankment CL	CH, CL	9.8e-006 ft/sec	1	N/A	N/A	N/A	N/A
Levee Embankment PS	CH, CL	1.64e-006 ft/sec	1	N/A	N/A	N/A	N/A
Silty Sand w/ Clay Layers	SM	3.28e-005 ft/sec	1	-2.5	-5.1	2.6	122
Marsh	CHO	1.31e-005 ft/sec	1	-5.1	-9.3	4.2	101



Name: EMBANKMENT FILL, EL. +10.2 TO +1.7 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: BEACH SAND, EL VARIES TO -50 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -50 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: Marsh Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: silty sand w/ clay layers Model: Saturated Only K-Sat: 3.28e-005 ft/sec K-Ratio: 1
Name: EMBANKMENT FILL PS Model: Saturated Only K-Sat: 1.64e-006 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALSWERE ASSUMED TO VARY LINEARLY BETWEENTHE VALUES INDICATED FOR THESE LOCATIONS.

Name: Seepage Analysis
File Name: R16A - Final.gsz Directory: Z:\OfficePrivateShares\ED-G\PRO Work\17th Street Canal\report B&V\Appendix E\calculations\SeepW R16_&_R30\R16A\
Last Edited By: Rosario-gonzalez, Pedro MVS

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16A,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 657+65 WEST
ORLEANS PARISH, LOUISIANA

Figure 2 SLOPE/W Model Plot with Screen Shot of Drainage Inlet

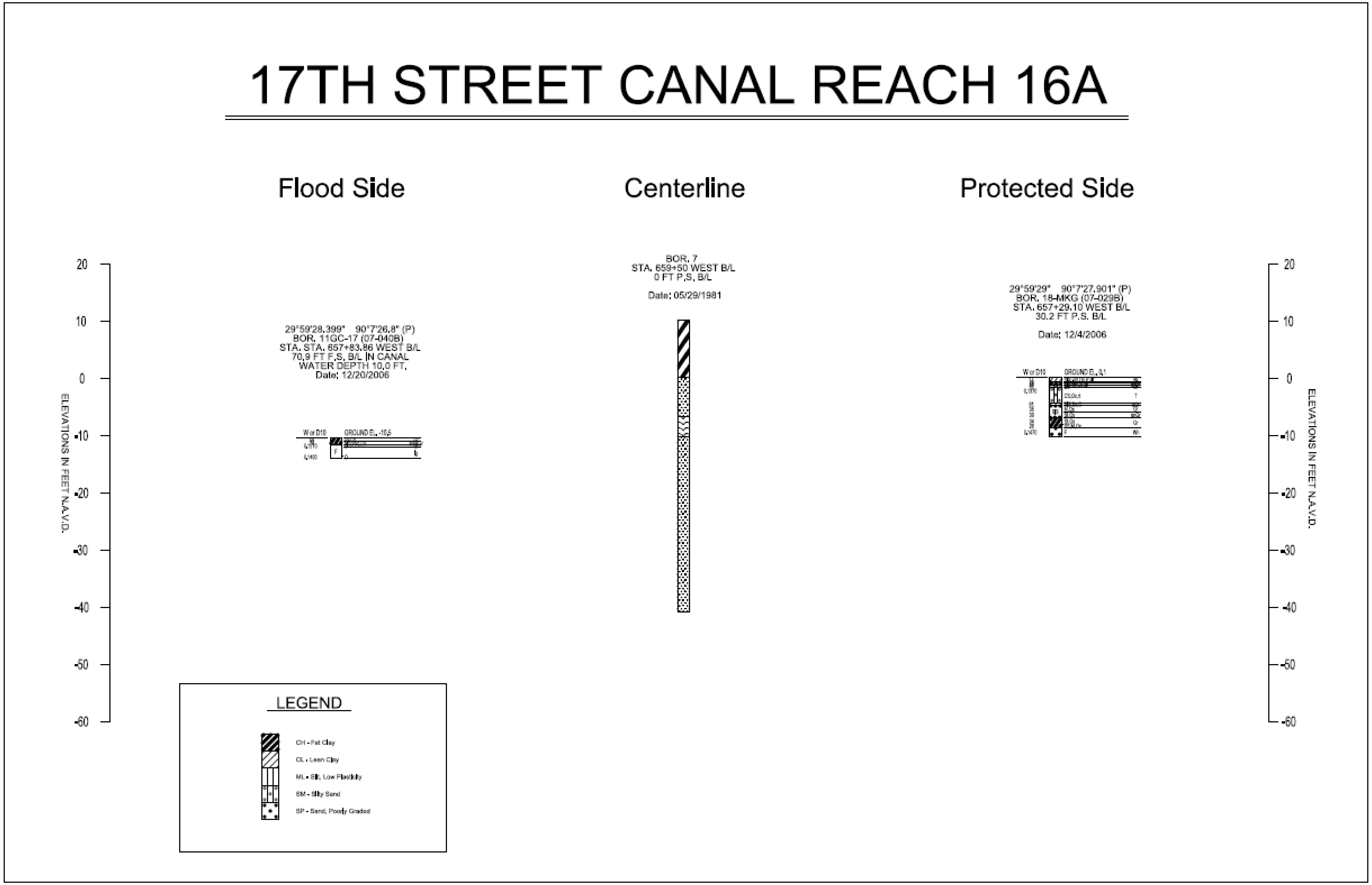


Figure 3 Reach 16A Boring Logs

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 12-017136 **Current Date:** 11/27/2012

Boring: 17MVS-08PU

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR & T ML W/ ARS & LYS SP, LYS CH, RT	ML		10												
1B	1.0	T & BR ML W/ ARS SP, RT, O, WD	ML		12												
2A	2.0	T SM W/ ARS CH, RT	SM		17												
2B	3.0	T SM W/ O, ARS CH, SIF, RT	SM		21												
3A	4.0	ST GR & BR CH2 W/ LYS & ARS SM	CH2		31												
3B	5.0	ST GR & T CH2 W/ ARS SP, O, RT, SIF	CH2		31												
4A	8.0	T SP	SP		30												
5A	10.5	T SP W/ O	SP		30												
6A	13.0	T SP W/ O	SP		32												
7A	15.5	T SP	SP		29												

Remarks: ________________

Checked By: ________

Stantec Consulting Services Inc.

File Name: tmp_be_boring_log_v10_0.xlsm

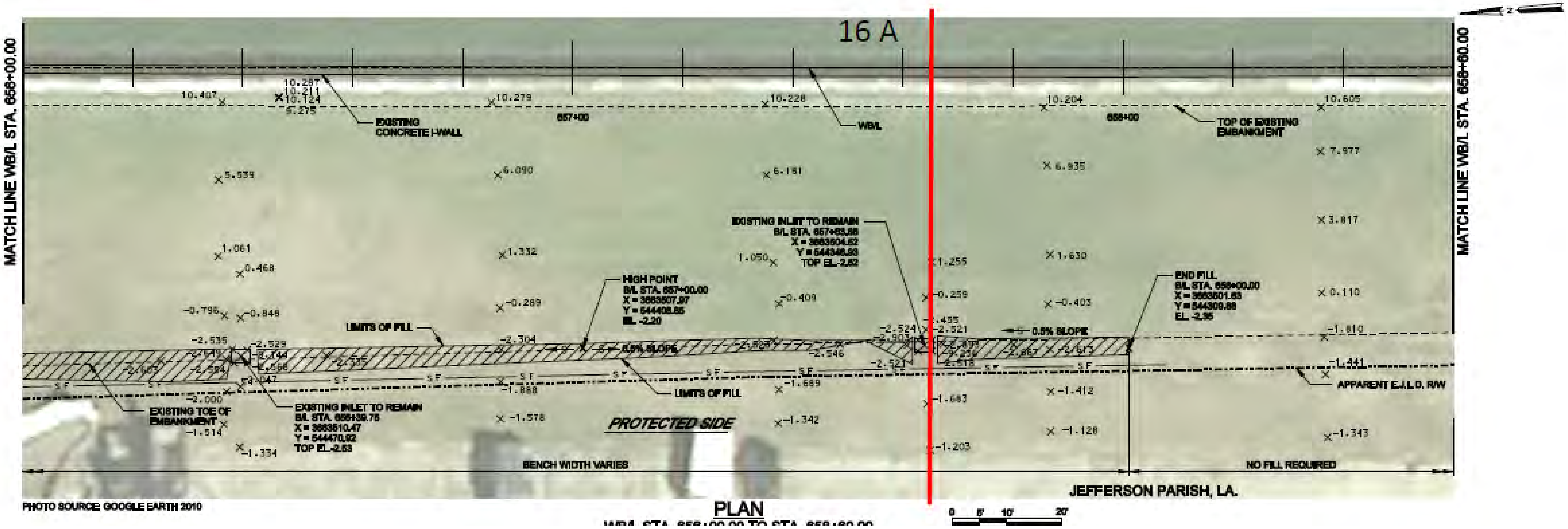


Figure 4 Reach 16A Plan View Cross Section Extent

Reach 16B

Below is a geological section (Figure 5) and the boring logs (figure 7) used to develop the statigraphy on Reach 16B (652+00 to 655+00), a table showing hydraulic properties used for the Seep/W (figure 6) analysis (Table 5), and a plan view cross section extent (figure 8). Two blanket soil materials are present in this reach at the lowest point inside the ditch, silty sand and marsh. The silty sand has a unit weight of 122 pcf and the marsh has a unit weight of 101 pcf. Assuming this stratigraphy is consistent through the subreach. The calculated average unit weight is 102 pcf.

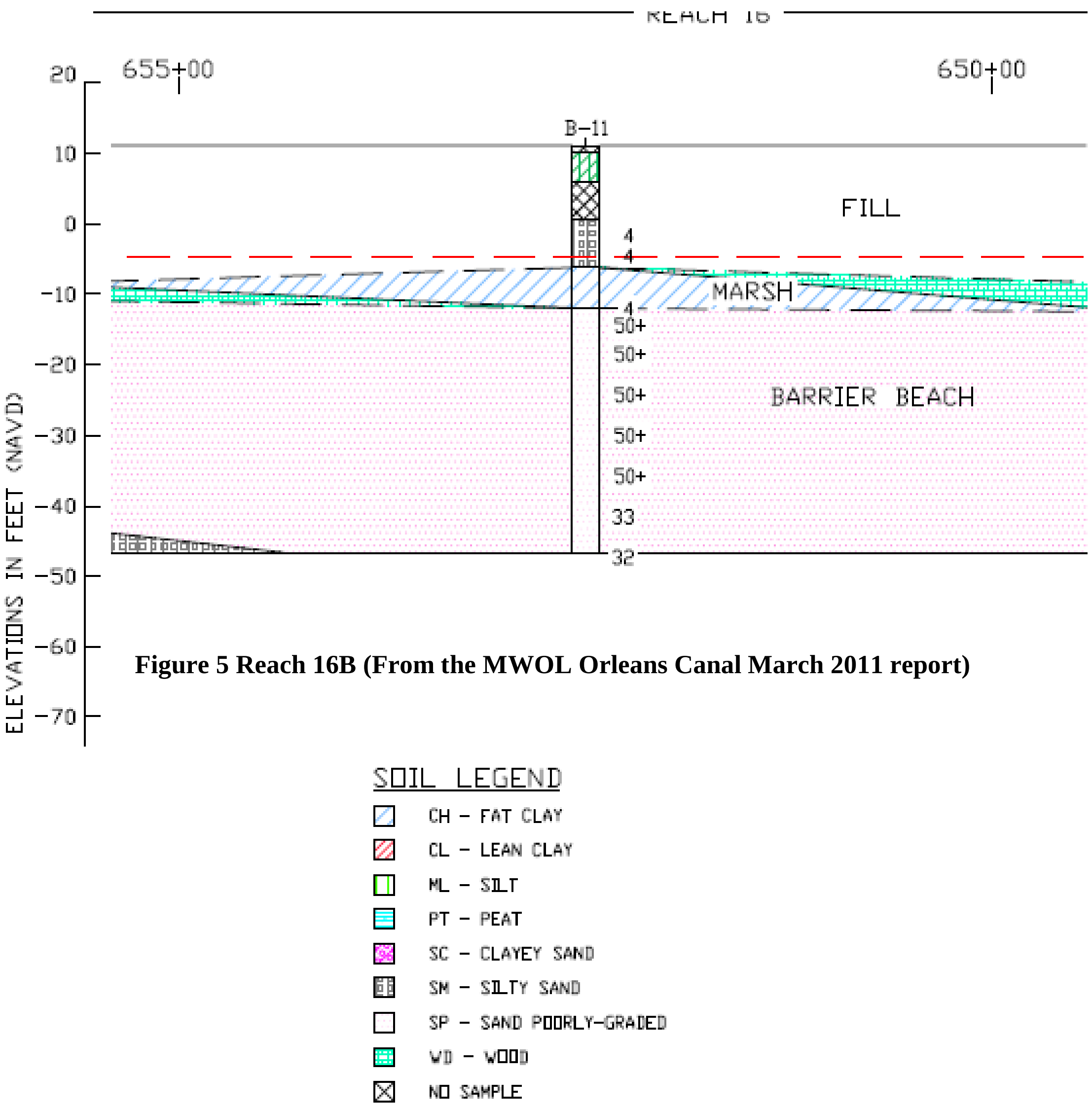
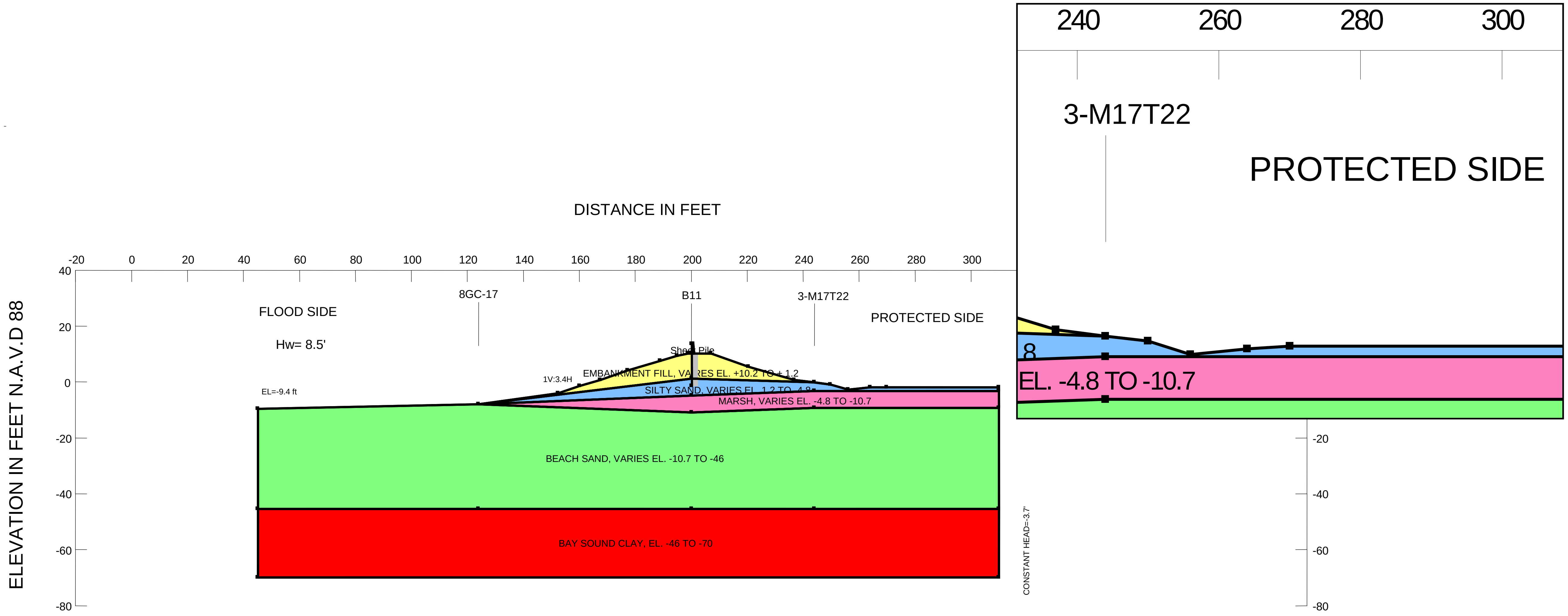


Figure 5 Reach 16B (From the MWOL Orleans Canal March 2011 report)

Table 5 Summary of Hydraulic Property Values for landside blanket for 16B(651+38 to 655+00)

Reach 16B Hydraulics Properties							
Unit	Classification (USCS) (Typical)	Saturated Permeability (Kx)	Permeability Ratio (Ky/ Kx)	Top Elevation of Blanket (ft)	Bottom Elevation of Blanket (ft)	Thickness of Blanket (ft)	Unit Weight (pcf)
Levee Embankment CL	CH, CL	9.8e-006 ft/sec	1	N/A	N/A	N/A	N/A
Silty Sand w/ Clay Layers	SM	3.28e-005 ft/sec	1	-2.92	-3.2	0.28	122
Marsh	CHO	1.31e-005 ft/sec	1	-3.2	-9.2	6	101



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Name: BEACH SAND, VARIES EL. -10.7 TO -46 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -46 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SILTY SAND, VARIES EL. 1.2 TO -4.8 Model: Saturated Only K-Sat: 3.28e-005 ft/sec K-Ratio: 1
Name: MARSH, VARIES EL. -4.8 TO -10.7 Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALSWERE ASSUMED TO VARY LINEARLY BETWEENTHE VALUES INDICATED FOR THESE LOCATIONS.

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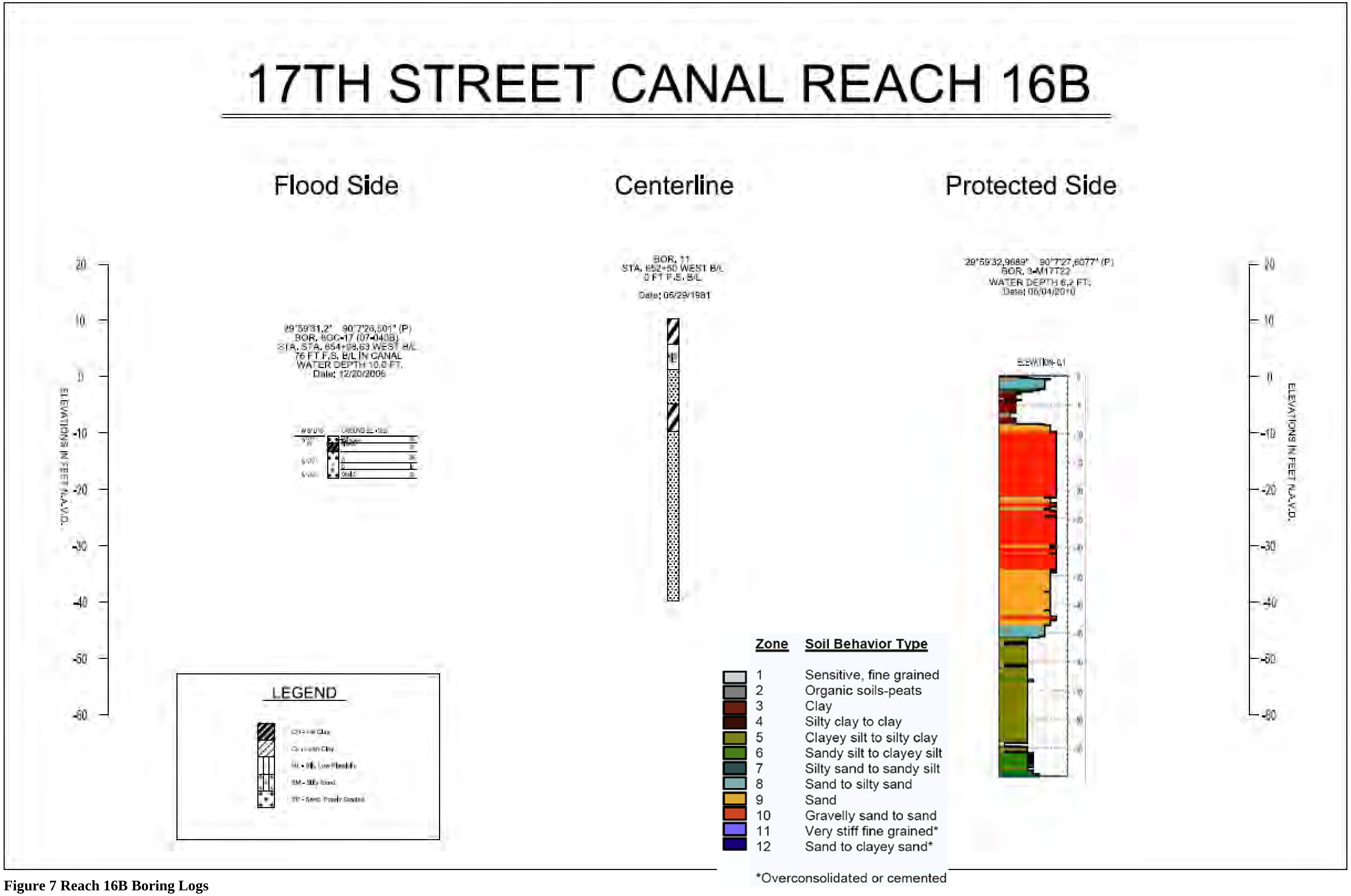
Last Edited By: Rosario-gonzalez, Pedro MVS

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16B,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 653+37 WEST
ORLEANS PARISH, LOUISIANA

Figure 6 SLOPE/W Model Plot with Screen Shot of Drainage Inlet



Zone	**Soil Behavior Type**
1	Sensitive, fine grained
2	Organic soils-peats
3	Clay
4	Silty clay to clay
5	Clayey silt to silty clay
6	Sandy silt to clayey silt
7	Silty sand to sandy silt
8	Sand to silty sand
9	Sand
10	Gravelly sand to sand
11	Very stiff fine grained*
12	Sand to clayey sand*

*Overconsolidated or cemented

Figure 7 Reach 16B Boring Logs

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Assigned By: ______

Project Number: 12-017136

Boring: 17MVS-07PU

Current Date: 11/27/2012

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR SM W/ ARS CH, O, SIF, G	SM		16												
1B	1.0	ST BR CL4 W/ LYS & ARS SP, G, SIF	CL4		20												
1C	2.0	T SP W/ ARS CH, O, RT	SP		16												
2A	4.0	T SP W/ ARS CH, RT	SP		18												
3A	6.5	T SP W/ WD	SP		20												
4A	9.0	T SP W/ O, G	SP		20												
5A	11.5	T SP W/ RT	SP		20												
6A	14.0	T SP W/ ARS CH	SP		22												

Remarks: ______

Checked By: ______

Stantec Consulting Services Inc.

File Name: 17MVS-07PU_be_boring_log_v10_0.

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Assigned By: ______

Project Number: 12-017136

Boring: 17MVS-06PU

Current Date: 11/27/2012

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR & T SM W/ ARS CH, G, RT	SM		10												
1B	1.0	T SP W/ RT, O	SP		2												
1C	2.0	T SP W/ RT	SP		2												
2A	4.0	T SP W/ RT	SP		25												
3A	6.5	T SP W/ RT	SP		26												
4A	9.0	T SP	SP		21												
5A	11.5	T SP W/ G	SP		20												
6A	14.0	T SP W/ G	SP		16												

Remarks: ______

Stantec Consulting Services Inc.

Checked By: ______

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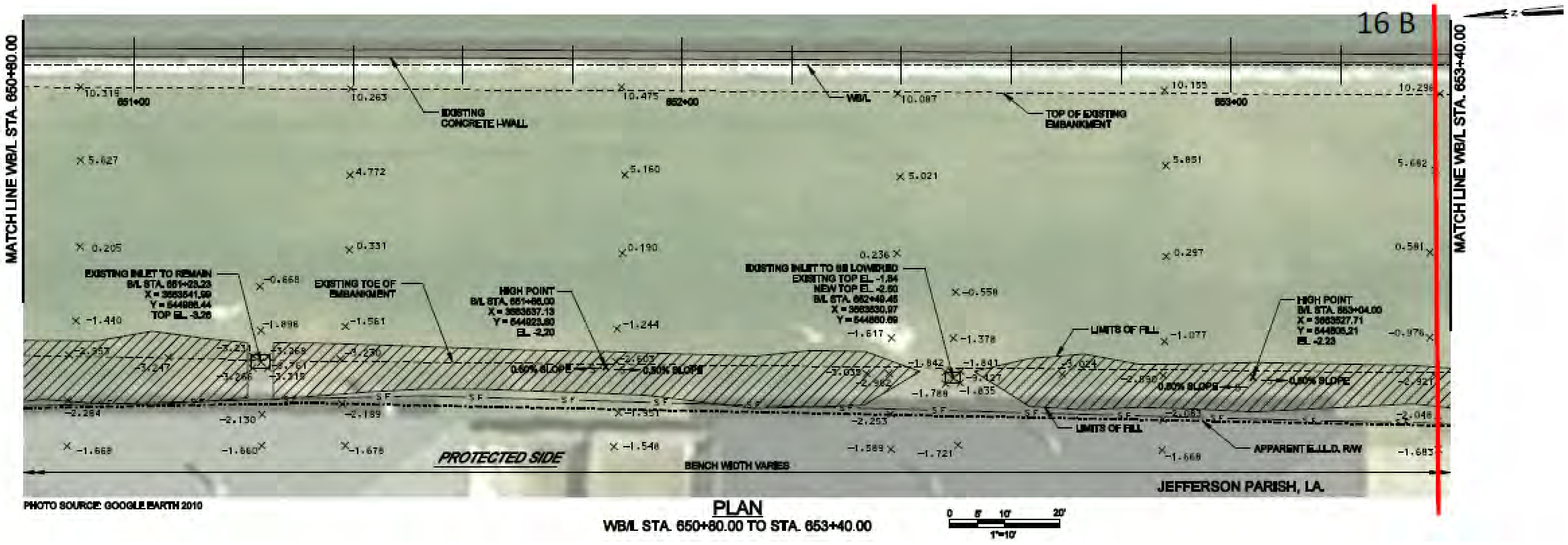


Figure 8 Reach 16B Plan View Cross Section Extent

Reach 16C

Below is a geological section (Figure 9) and the boring logs (figure 11) used to develop the statigraphy on Reach 16C (646+41 to 652+00), a table showing hydraulic properties used for the Seep/W (figure 10) analysis (Table 6), and a plan view cross section extent (figure 12). Three blanket soil materials are present in this reach at the lowest point inside the ditch, embankment fill, sand and marsh. The embankment fill has a unit weight of 114 pcf, the sand has a unit weight of 122 pcf and the marsh has a unit weight of 101 pcf. Assuming this stratigraphy is consistent through the subreach. The calculated average unit weight is 106 pcf.

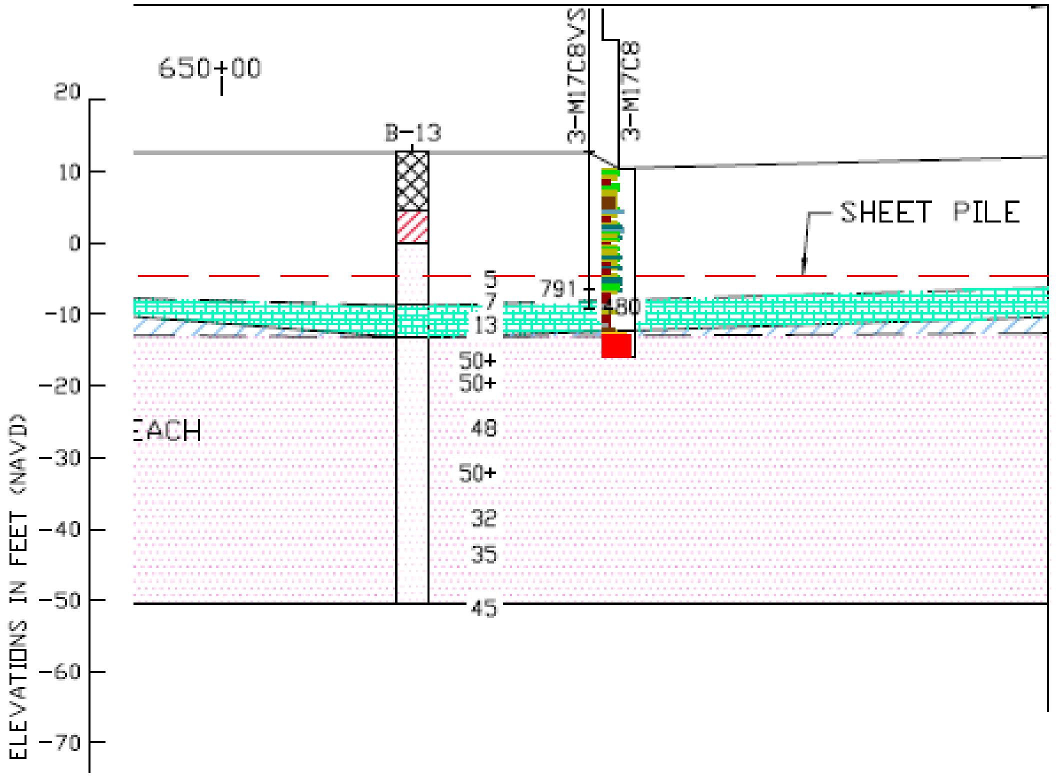
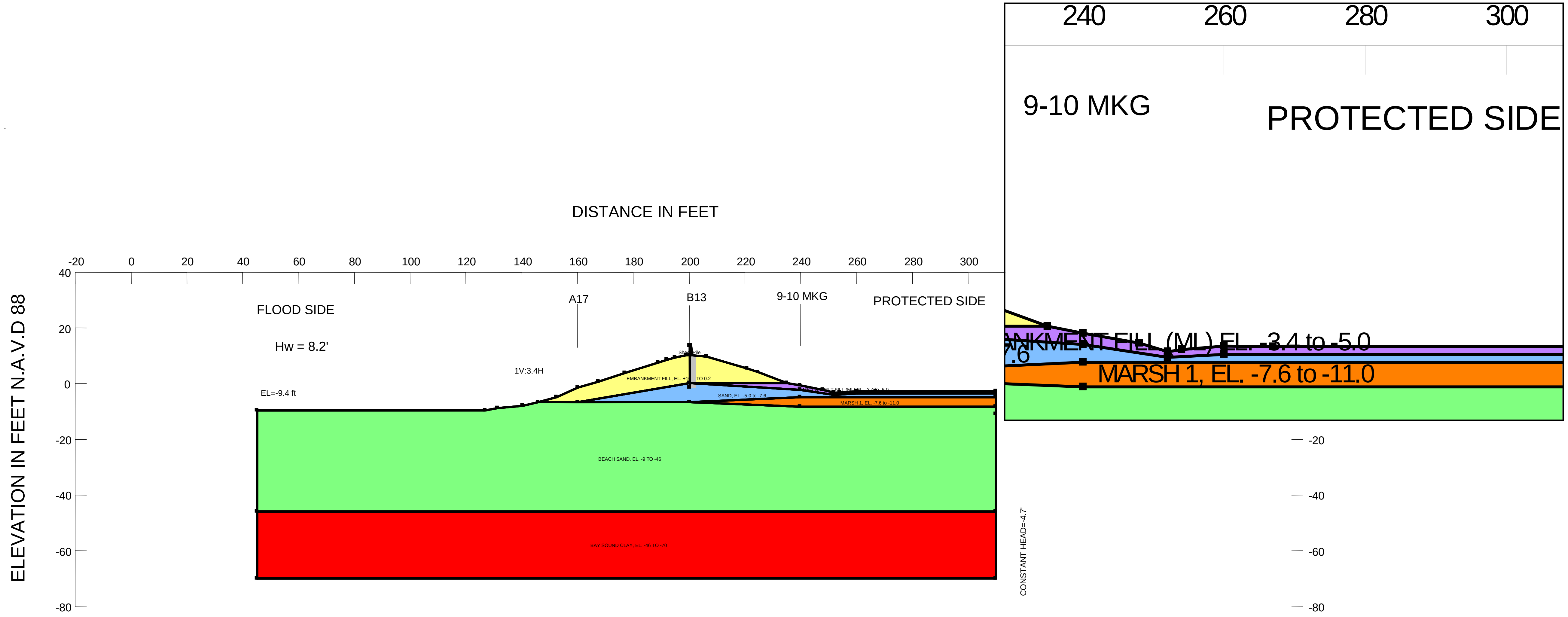


Figure 9 Reach 16C (From the MWOL Orleans Canal March 2011 report)

Table 6 Summary of Hydraulic Property Values for landside blanket for 16C (646+41 to 651+38)

Reach 16C Hydraulics Properties							
Unit	Classification (USCS) (Typical)	Saturated Permeability (Kx)	Permeability Ratio (Ky/ Kx)	Top Elevation of Blanket (ft)	Bottom Elevation of Blanket (ft)	Thickness of Blanket (ft)	Unit Weight (pcf)
Levee Embankment CL	CH, CL	9.8e-006 ft/sec	1	N/A	N/A	N/A	N/A
Levee Embankment PS	ML	1.64e-005 ft/sec	1	-3.4	-4.2	0.8	114
Sand	SP	0.00049 ft/sec	1	-4.2	-4.9	0.7	122
Marsh	CHO	1.31e-005 ft/sec	1	-4.9	-8.4	3.5	101



Name: EMBANKMENT FILL, EL. +10.2 TO 0.2 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: MARSH 1, EL. -7.6 to -11.0 Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BEACH SAND, EL. -9 TO -46 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -46 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SAND, EL. -5.0 to -7.6 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: EMBANKMENT FILL (ML) EL. -3.4 to -5.0 Model: Saturated Only K-Sat: 1.64e-005 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALSWERE ASSUMED TO VARY LINEARLY BETWEENTHE VALUES INDICATED FOR THESE LOCATIONS.

Name: Seepage Analysis
File Name: R16C.gsz Directory: Z:\OfficePrivateShares\ED-G\PRO Work\17th Street Canal\report B&V\Appendix E\calculations\SeepW R16_&_R30\R16C\
Last Edited By: Rosario-gonzalez, Pedro MVS

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16C,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 648+89 WEST
ORLEANS PARISH, LOUISIANA

Figure 10 SLOPE/W Model Plot with Screen Shot of Drainage Inlet

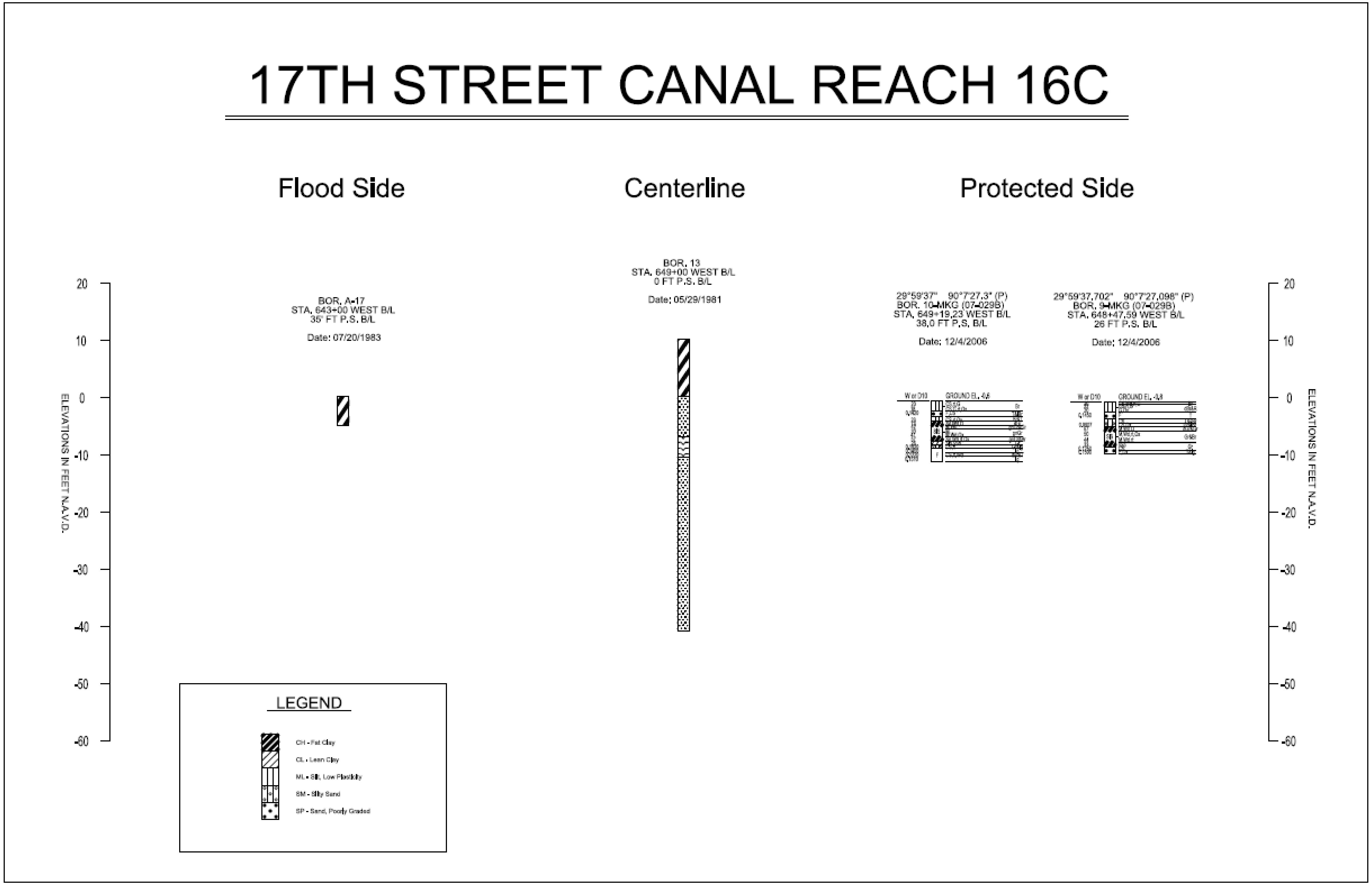


Figure 11 Reach 16C Boring Logs

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ______

Project Number: 12-017136

Boring: 17MVS-06PU

Current Date: 11/27/2012

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR & T SM W/ ARS CH, G, RT	SM		10												
1B	1.0	T SP W/ RT, O	SP		2												
1C	2.0	T SP W/ RT	SP		2												
2A	4.0	T SP W/ RT	SP		25												
3A	6.5	T SP W/ RT	SP		26												
4A	9.0	T SP	SP		21												
5A	11.5	T SP W/ G	SP		20												
6A	14.0	T SP W/ G	SP		16												

Remarks: ______

Stantec Consulting Services Inc.

Checked By: ______

File Name: 17MVS-06PU_be_boring_log_v10_0.

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 12-017136
Boring: 17MVS-05PU

Current Date: 11/27/2012

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	ST BR CH2 W/ ARS & LYS SM, O	CH2		28												
1B	1.0	BR ML W/ ARS SP, ARS CH, G, O	ML		39												
2A	2.0	ST BR CH3 W/ ARS SP, ARS ML, O, RT	CH3		38												
2B	3.0	ST BR & T CH3 W/ ARS SP, O	CH3		41												
3A	4.0	BR & T SP W/ LYS CH, G, RT	SP		15												
3B	5.0	T SP W/ ARS CH	SP		9												
4A	8.0	T SP W/ RT	SP		12												
4B	9.0	T SP	SP		9												
4C	10.0	T SP	SP		20												
5A	12.0	LGR SP	SP		23												
6A	14.5	LGR SP	SP		23												
7A	17.0	LGR SP	SP		27												
8A	19.5	LGR SP W/ SIF, G	SP		26												
9A	22.0	LGR SP W/ SIF	SP		23												
10A	24.5	LGR SP W/ SIF	SP		36												
11A	27.0	LGR SP W/ SIF, RT	SP		35												
12A	29.5	LGR SP W/ SIF	SP		31												
13A	32.0	LGR SP W/ SIF	SP		28												
14A	34.5	LGR SP W/ SIF	SP		29												
15A	37.0	LGR SP W/ SIF	SP		28												
16A	39.5	LGR SP	SP		27												
17A	42.0	LGR SP W/ SIF	SP		28												
18A	44.5	LGR SP W/ SIF	SP		29												
19A	47.0	LGR SP W/ SIF	SP		28												
20A	49.5	LGR SP W/ SIF	SP		25												
21A	52.0	LGR SP W/ SIF	SP		34												
22A	54.5	LGR SP W/ SIF	SP		31												
23A	57.0	LGR SP W/ SIF	SP		25												
24A	59.5	LGR SP W/ SIF, G	SP		30												

Remarks: ____________________

Checked By: ________

Stantec Consulting Services Inc.

File Name: tmp_be_boring_log_v10_0.xlsm

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 12-017136 **Current Date:** 11/27/2012
Boring: 17MVS-04PU

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR SM W/ ARS & LYS CH, G, RT	SM		16												
1B	1.0	LGR SP W/ LYS CH, G	SP		4												
1C	2.0	LGR SP W/ G, RT	SP		1												
1D	3.0	LGR SP W/ RT, O	SP		2												
2A	4.0	T SP W/ ARS CH, WD, RT	SP		18												
3A	6.5	T SP W/ O, RT	SP		23												
4A	9.0	T SP W/ G, O	SP		20												
5A	11.5	T SP W/ G, O, RT	SP		21												
6A	14.0	T SP W/ RT	SP		26												

Remarks: ________________ **Checked By:** ________

Stantec Consulting Services Inc. File Name: tmp_be_boring_log_v10_0.xlsm

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 12-017136 **Current Date:** 11/27/2012
Boring: 17MVS-03PU

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR SM W/ ARS CH, G, RT	SM		9												
1B	1.0	BR SM W/ ARS CH, G, RT	SM		8												
1C	2.0	BR SP W/ LYS CH, RT, G	SP		3												
1D	3.0	BR SP W/ ARS CH, RT	SP		7												
2A	4.0	LGR SP W/ ARS CH, G	SP		19												
3A	6.5	LGR SP W/ ARS CH, G	SP		18												
4A	9.0	LGR SP W/ ARS CH, G	SP		23												
5A	11.5	LGR SP W/ G, WD	SP		31												
6A	14.0	LGR SP W/ ARS CH, RT, O	SP		30												

Remarks: ______________________ Checked By: ________

Stantec Consulting Services Inc. File Name: 17MVS-03PU_be_boring_log_v10_0.

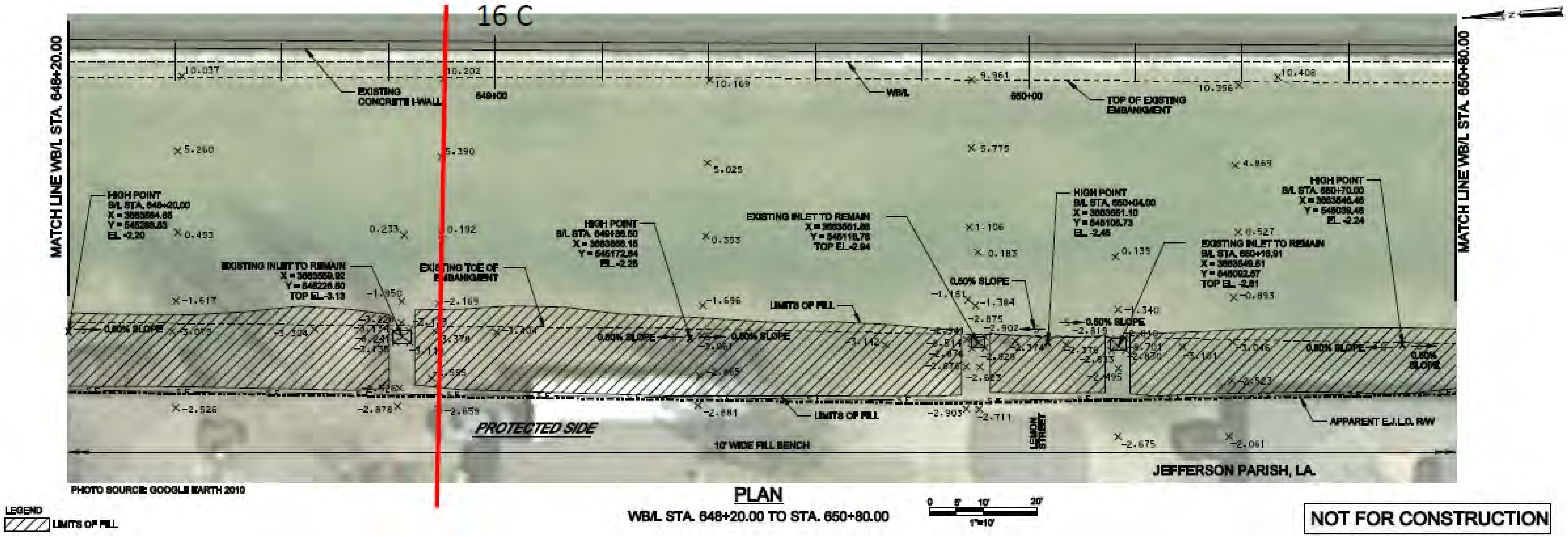


Figure 12 Reach 16C Plan View Cross Section Extent

Reach 16D

Below is a geological section (Figure 13) and the boring logs (figure 15) used to develop the statigraphy on Reach 16D (642+65 to 646+41), a table showing hydraulic properties used for the Seep/W (figure 14) analysis (Table 7), and a plan view cross section extent (figure 16). Three blanket soil materials are present in this reach at the lowest point inside the ditch, embankment fill, sand and marsh. The embankment fill has a unit weight of 114 pcf, the sand has a unit weight of 122 pcf and the marsh has a unit weight of 101 pcf. Assuming this stratigraphy is consistent through the subreach. The calculated average unit weight is 111 pcf.

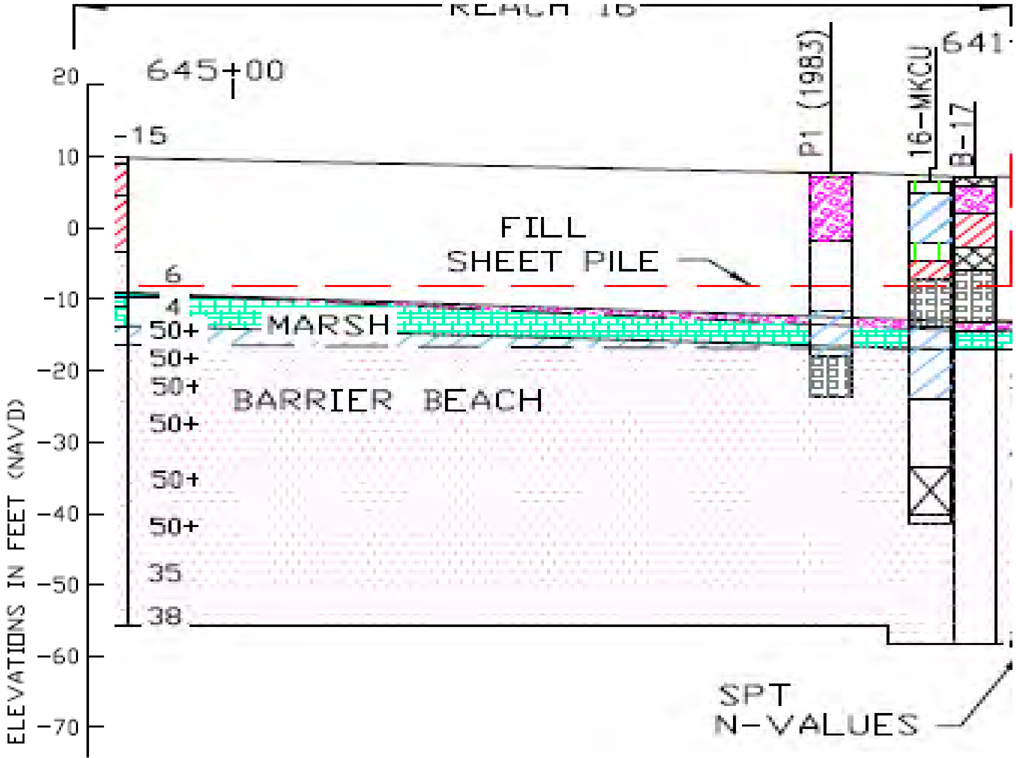


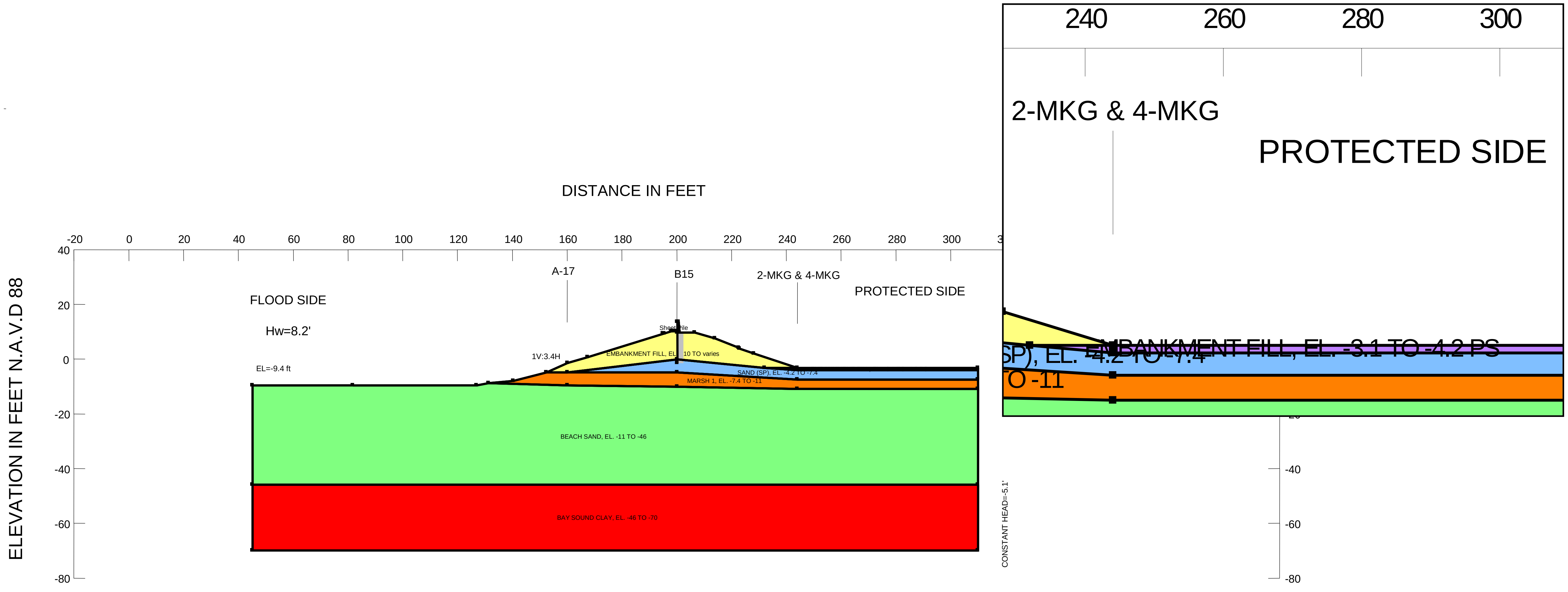
Figure 13 Reach 16D (From the MWOL Orleans Canal March 2011 report)

SOIL LEGEND

- ▨ CH - FAT CLAY
- ▨ CL - LEAN CLAY
- ◫ ML - SILT
- ▤ PT - PEAT
- ▩ SC - CLAYEY SAND
- ▦ SM - SILTY SAND
- ☐ SP - SAND POORLY-GRADED
- ▦ WD - WOOD
- ☒ NO SAMPLE

Table 7 Summary of Hydraulic Property Values for landside blanket for R16D (642+65 to 646+41)

Reach 16D Hydraulic Properties							
Unit	Classification (USCS) (Typical)	Saturated Permeability (Kx)	Permeability Ratio (Ky/ Kx)	Top Elevation of Blanket (ft)	Bottom Elevation of Blanket (ft)	Thickness of Blanket (ft)	Unit Weight (pcf)
Levee Embankment CL	CH, CL	2.62e-007 ft/sec	1	N/A	N/A	N/A	N/A
Levee Embankment PS	CH, CL	1.31e-005 ft/sec	1	-3.1	-4.2	1.1	114
Sand	SP	0.00049 ft/sec	1	-4.2	-7.4	3.2	122
Marsh	CHO	1.31e-005 ft/sec	1	-7.4	-11	3.6	101



Name: EMBANKMENT FILL, EL. +10 TO varies Model: Saturated Only K-Sat: 2.62e-007 ft/sec K-Ratio: 1
Name: MARSH 1, EL. -7.4 TO -11 Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BEACH SAND, EL. -11 TO -46 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -46 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SAND (SP), EL. -4.2 TO -7.4 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: EMBANKMENT FILL, EL. -3.1 TO -4.2 PS Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALSWERE ASSUMED TO VARY LINEARLY BETWEENTHE VALUES INDICATED FOR THESE LOCATIONS.

Name: Seepage Analysis
File Name: R16D.gsz Directory: Z:\OfficePrivateShares\ED-G\PRO Work\17th Street Canal\report B&V\Appendix E\calculations\SeepW R16_&_R30\R16D\
Last Edited By: Rosario-gonzalez, Pedro MVS

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16D,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 645+10 WEST
ORLEANS PARISH, LOUISIANA

Figure 14 SLOPE/W Model Plot with Screen Shot of Drainage Inlet

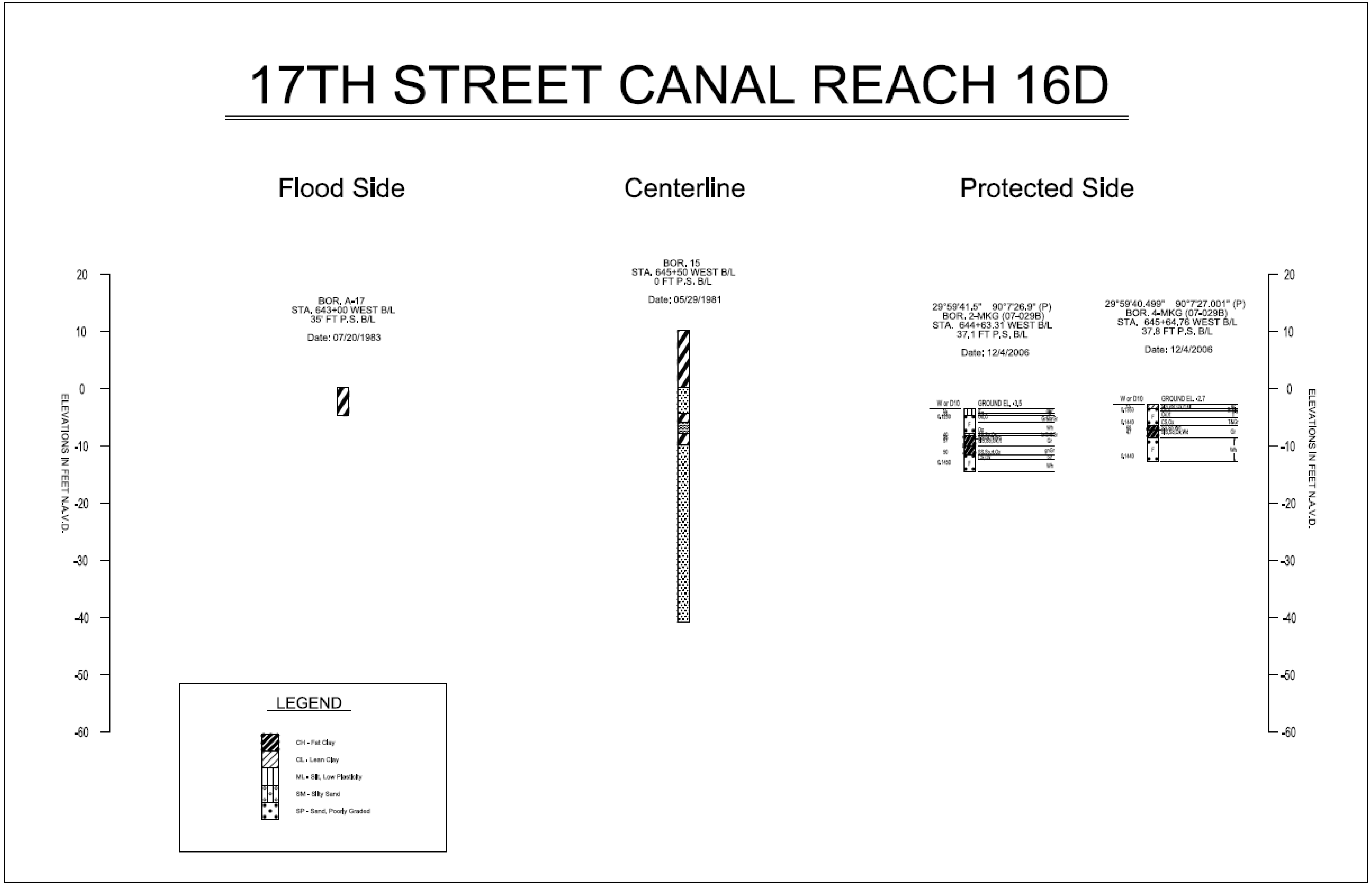


Figure 15 Reach 16D Boring Logs

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street Assigned By: ______

Project Number: 12-017136
Boring: 17MVS-02PU

Current Date: 11/27/2012

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	BR ML W/ ARS CH	ML		16												
1B	1.0	BR ML W/ ARS CH, G	ML		11												
1C1	2.0	BR ML W/ ARS CH, G	ML		14												
1C2	2.7	M BR CH4 W/ ARS ML, O, G	CH4		54												
2A1	4.0	ST BR CH2 W/ LYS SM, O, G, RT	CH2		29												
2A2	4.5	BR SP W/ RT	SP		19												
3A	6.0	BR SP	SP		19												
4A	8.5	BR SP	SP		18												
5A	11.0	BR SP	SP		21												
6A	13.5	BR SP	SP		21												
7A	16.0	BR SP W/ O, G	SP		20												

Remarks: ______

Checked By: ______

Stantec Consulting Services Inc.

File Name: tmp_be_boring_log_v10_0.xlsm

SUMMARY OF LABORATORY TEST RESULTS

Project: Lake Pontchartrain & Vicinity Hurricane Protection Project 17th Street **Assigned By:** ________

Project Number: 12-017136 **Current Date:** 11/27/2012
Boring: 17MVS-01PU

Sample Number	Depth	Visual Classification	USCS	E(f)	W%	Dry Dens (pcf)	Wet Dens (pcf)	Sat %	Shear Test Type	Angle	Cohesion (psf)	Unconf. Comp. Str.	LL	PL	PI	Torvane (tsf)	Other Tests
1A	0.0	ST BR CL4 W/ LYS ML, LYS SM, G	CL4		24												
1B	1.0	BK & LGR SM W/ O, RT, G	SM		8												
1C	2.0	LGR SM W/ O, G	SM		6												
2A	4.0	M LGR CH4 W/ ARS SP, WD	CH4		60												
3A1	6.5	M LGR CH2 W/ ARS O	CH2		33												
3A2	7.2	M LGR CH4 W/ ARS SM, CC	CH4		51												
3B	7.5	M LGR CH4 W/ LYS & ARS SP, RT	CH4		46												
3C1	8.5	VSO LGR CL4	CL4		36												
3C2	9.2	SO LGR CL4 W/ S, ARS CH, RT	CL4		27												
4A	10.5	LGR SP W/ ARS CH, RT	SP		24												
5A	13.0	LGR SP W/ ARS CH, O, WD	SP		28												
6A	15.5	LGR SP W/ O, ARS CH	SP		22												

Remarks: ________ Checked By: ________

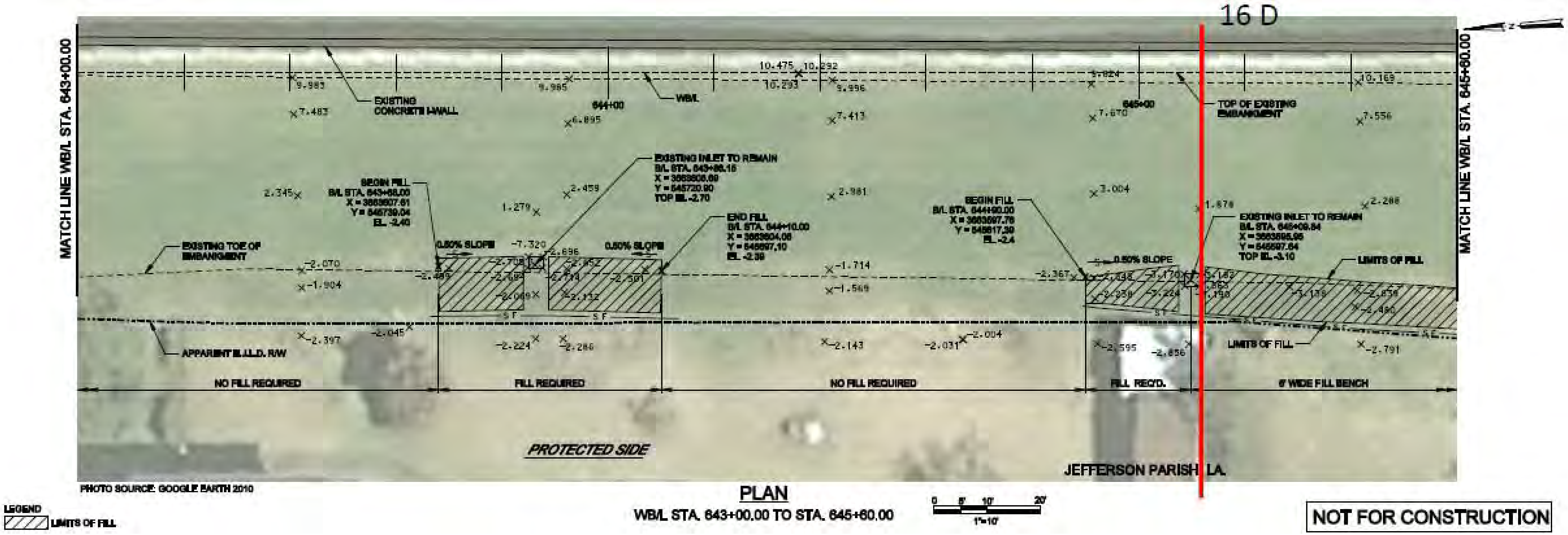


Figure 16 Reach 16C Plan View Cross Section Extent

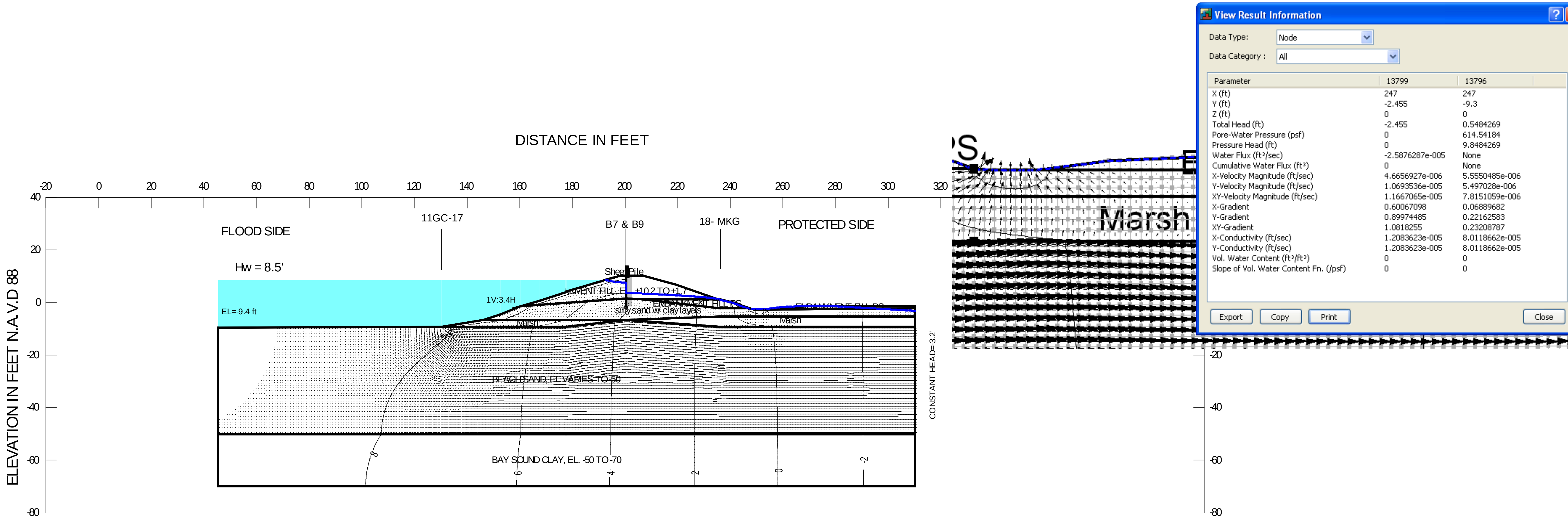
Results

The following tables (8-11) and figures (17-20) provide detail of the results of the seepage analyses conducted for the selected sub-reaches on Reach 16. Results presented in these figures are for the critical locations for each sub-reach cross section.

Reach 16A

Table 8 R16A Seep/W outputs

				Weighted Unit weight		109													
				Critical gradient		0.747													
offset levee toe (ft)	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
0	13799	247	-2.455	0	-2.455	0	0	-2.59E-05	0	4.67E-06	1.07E-05	1.17E-05	6.01E-01	9.00E-01	1.08E+00	1.21E-05	1.21E-05	0	0
	13796	247	-9.3	0	0.54843	614.54184	9.848427	None	None	5.56E-06	5.50E-06	7.82E-06	0.0688968	2.22E-01	0.23208787	8.01E-05	8.01E-05	0	0
		6.845			3.00343														
			exit gradient	0.439		FS	1.70												
6	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
	14205	253	-2.518	0	-2.518	0	0	-1.66E-05	0	1.72E-06	1.00E-05	1.02E-05	-2.95E-01	1.20E+00	1.24E+00	1.21E-05	1.21E-05	0	0
	14203	253	-9.3	0	0.16098	590.36537	9.460984	None	None	4.91E-06	5.50E-06	7.37E-06	0.0604252	2.21E-01	0.22893296	8.01E-05	8.01E-05	0	0
		6.782			2.67898														
			exit gradient	0.395		FS	1.89												
19	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
	15115	266	-1.395	0	-1.395	0	0	-5.35E-07	0	1.26E-07	5.37E-07	5.52E-07	-6.37E-02	3.27E-01	3.33E-01	1.64E-06	1.64E-06	0	0
	15112	266	-9.3	0	-0.5869	543.69982	8.713138	None	None	4.61E-06	1.28E-06	4.78E-06	0.0573764	4.92E-02	0.07560206	8.01E-05	8.01E-05	0	0
		7.905			0.80814														
			exit gradient	0.102		FS	7.30												



Data Type: Node

Data Category : All

Parameter	13799	13796
X (ft)	247	247
Y (ft)	-2.455	-9.3
Z (ft)	0	0
Total Head (ft)	-2.455	0.5484269
Pore-Water Pressure (psf)	0	614.54184
Pressure Head (ft)	0	9.8484269
Water Flux (ft³/sec)	-2.5876287e-005	None
Cumulative Water Flux (ft³)	0	None
X-Velocity Magnitude (ft/sec)	4.6656927e-006	5.5550485e-006
Y-Velocity Magnitude (ft/sec)	1.0693536e-005	5.497028e-006
XY-Velocity Magnitude (ft/sec)	1.1667065e-005	7.8151059e-006
X-Gradient	0.60067098	0.06889682
Y-Gradient	0.89974485	0.22162583
XY-Gradient	1.0818255	0.23208787
X-Conductivity (ft/sec)	1.2083623e-005	8.0118662e-005
Y-Conductivity (ft/sec)	1.2083623e-005	8.0118662e-005
Vol. Water Content (ft³/ft³)	0	0
Slope of Vol. Water Content Fn. (/psf)	0	0

Name: EMBANKMENT FILL, EL. +10.2 TO +1.7 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: BEACH SAND, EL VARIES TO -50 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -50 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: Marsh Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: silty sand w/ clay layers Model: Saturated Only K-Sat: 3.28e-005 ft/sec K-Ratio: 1
Name: EMBANKMENT FILL PS Model: Saturated Only K-Sat: 1.64e-006 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALSWERE ASSUMED TO VARY LINEARLY BETWEENTHE VALUES INDICATED FOR THESE LOCATIONS.

Name: Seepage Analysis
File Name: R16A - Final.gsz Directory: Z:\OfficePrivateShares\ED-G\PRO Work\17th Street Canal\report B&V\Appendix E\calculations\SeepW R16_&_R30\R16A\
Last Edited By: Rosario-gonzalez, Pedro MVS

US Army Corps of Engineers®
Saint Louis District

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LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

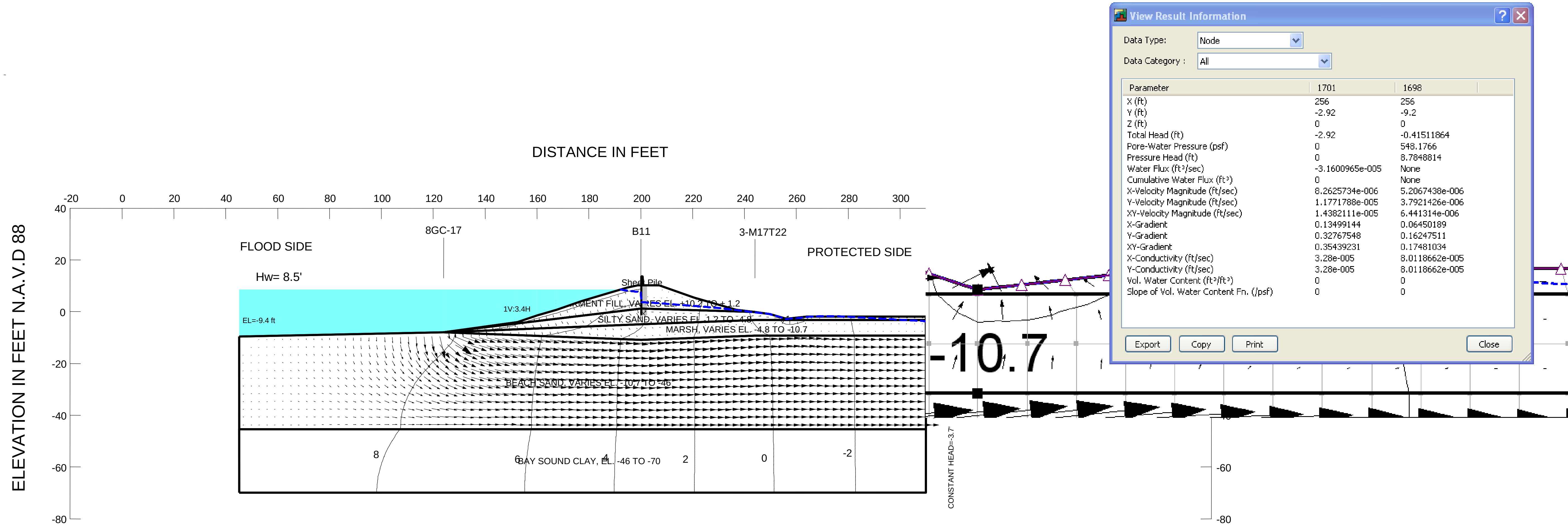
17th STREET OUTFALL CANAL, REACH 16A,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 657+65 WEST
ORLEANS PARISH, LOUISIANA

Figure 17 R16A SEEP/W Model Plot with Screen Shot of Drainage Inlet

Reach 16B

Table 9 R16B Seep/W outputs

				Weighted Unit weight		102													
				Critical gradient		0.635													
offset levee toe (ft)	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft^3/sec)	Cumulative Water Flux (ft^3)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft^3/ft^3)	Slope of Vol. Water Content Fn. (/psf)
0	1604	244	-0.255	0	-0.255	0	0	-4.56E-06	0	2.80E-06	1.04E-06	2.98E-06	1.28E-01	5.27E-02	1.38E-01	2.19E-05	2.19E-05	0	0
	1602	244	-9.2	0	0.3895	598.38494	9.5895	None	None	5.35E-06	1.49E-06	5.56E-06	0.0663101	4.89E-02	0.08238681	8.01E-05	8.01E-05	0	0
		8.945			0.6445														
			exit gradient	0.072		FS	8.81												
12	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft^3/sec)	Cumulative Water Flux (ft^3)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft^3/ft^3)	Slope of Vol. Water Content Fn. (/psf)
	1701	256	-2.92	0	-2.92	0	0	-3.16E-05	0	8.26E-06	1.18E-05	1.44E-05	1.35E-01	3.28E-01	3.54E-01	3.28E-05	3.28E-05	0	0
	1698	256	-9.2	0	-0.4151	548.1766	8.78488	None	None	5.21E-06	3.79E-06	6.44E-06	0.0645019	1.62E-01	0.17481034	8.01E-05	8.01E-05	0	0
		6.28			2.50488														
			exit gradient	0.399		FS	1.59												
17	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft^3/sec)	Cumulative Water Flux (ft^3)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft^3/ft^3)	Slope of Vol. Water Content Fn. (/psf)
	1726	261.3333	-2.3386667	0	-2.3387	0	0	-9.30E-06	0	3.92E-06	3.29E-06	5.12E-06	-1.19E-01	9.33E-02	1.51E-01	3.28E-05	3.28E-05	0	0
	1747	262	-9.2	0	-0.7879	524.91816	8.41215	None	None	6.21E-06	2.96E-06	6.87E-06	0.0603019	1.21E-01	0.1350725	8.01E-05	8.01E-05	0	0
		6.893645			1.55082														
			exit gradient	0.225		FS	2.82												



View Result Information

Data Type: Node

Data Category : All

Parameter	1701	1698
X (ft)	256	256
Y (ft)	-2.92	-9.2
Z (ft)	0	0
Total Head (ft)	-2.92	-0.41511864
Pore-Water Pressure (psf)	0	548.1766
Pressure Head (ft)	0	8.7848814
Water Flux (ft³/sec)	-3.1600965e-005	None
Cumulative Water Flux (ft³)	0	None
X-Velocity Magnitude (ft/sec)	8.2625734e-006	5.2067438e-006
Y-Velocity Magnitude (ft/sec)	1.1771788e-005	3.7921426e-006
XY-Velocity Magnitude (ft/sec)	1.4382111e-005	6.441314e-006
X-Gradient	0.13499144	0.06450189
Y-Gradient	0.32767548	0.16247511
XY-Gradient	0.35439231	0.17481034
X-Conductivity (ft/sec)	3.28e-005	8.0118662e-005
Y-Conductivity (ft/sec)	3.28e-005	8.0118662e-005
Vol. Water Content (ft³/ft³)	0	0
Slope of Vol. Water Content Fn. (/psf)	0	0

Name: EMBANKMENT FILL, VAIRES EL. +10.2 TO + 1.2 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: BEACH SAND, VARIES EL. -10.7 TO -46 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -46 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SILTY SAND, VARIES EL. 1.2 TO -4.8 Model: Saturated Only K-Sat: 3.28e-005 ft/sec K-Ratio: 1
Name: MARSH, VARIES EL. -4.8 TO -10.7 Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS AND CPT DATA. SEE BOTH BORING AND CPT DATA PLATES.

WHERE INDICATED, SHEAR STRENGTHS BETWEEN VERTICALSWERE ASSUMED TO VARY LINEARLY BETWEENTHE VALUES INDICATED FOR THESE LOCATIONS.

Name: Seepage Analysis
File Name: R16B_updated - FINAL.gsz Directory: Z:\OfficePrivateShares\ED-G\PRO Work\17th Street Canal\report B&V\Appendix E\calculations\SeepW R16_&_R30\R16B\
Last Edited By: Rosario-gonzalez, Pedro MVS

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

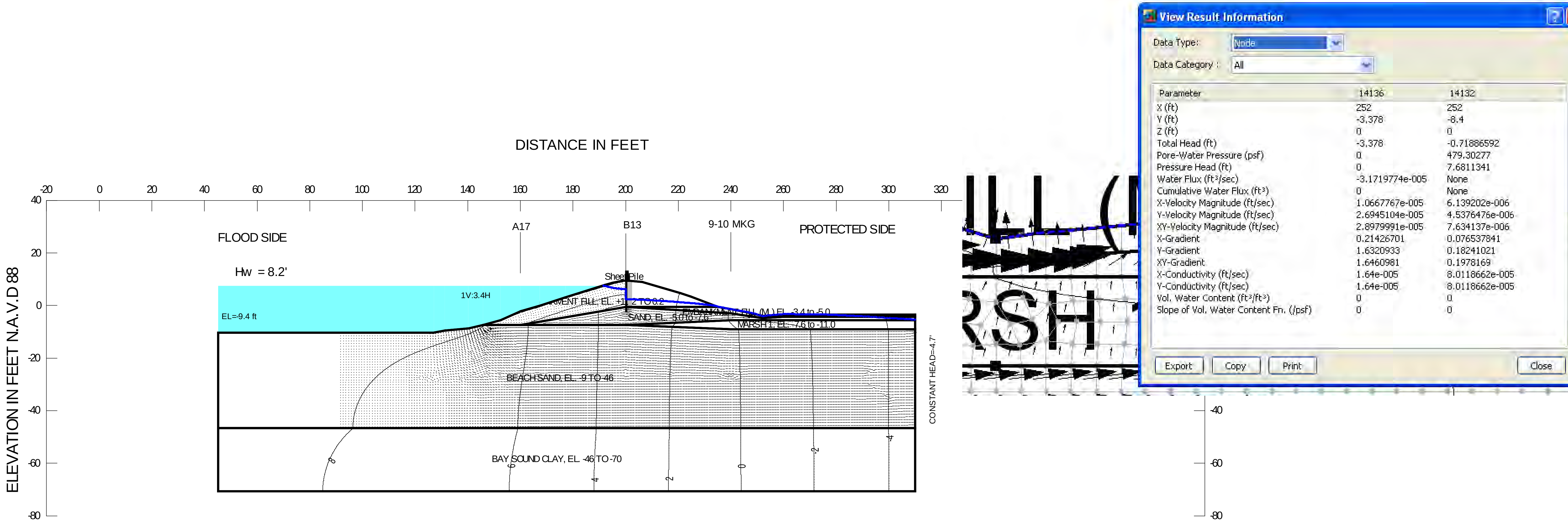
17th STREET OUTFALL CANAL, REACH 16B,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 653+37 WEST
ORLEANS PARISH, LOUISIANA

Figure 18 R16B SEEP/W Model Plot with Screen Shot of Drainage Inlet

Reach 16C

Table 10 R16C Seep/W outputs

				Weighted Unit weight		106													
				Critical gradient		0.699													
offset levee toe (ft)	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
0	12950	235	0.192	0	0.192	0	0	-3.59E-06	0	3.88E-06	1.73E-06	4.25E-06	2.85E-01	6.92E-02	2.93E-01	1.38E-05	1.38E-05	0	0
	12947	235	-8.2	0	0.64502	551.92898	8.845016	None	None	6.48E-06	7.25E-07	6.52E-06	0.08081	2.47E-02	0.084508196	8.01E-05	8.01E-05	0	0
		8.392			0.45302														
			exit gradient	0.054		FS	12.94												
17	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
	14136	252	-3.378	0	-3.378	0	0	-3.17E-05	0	1.07E-05	2.69E-05	2.90E-05	2.14E-01	1.63E+00	1.65E+00	1.64E-05	1.64E-05	0	0
	14132	252	-8.4	0	-0.7189	479.30277	7.681134	None	None	6.14E-06	4.54E-06	7.63E-06	0.076538	1.82E-01	0.1978169	8.01E-05	8.01E-05	0	0
		5.022			2.65913														
			exit gradient	0.529		FS	1.32												
25	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
	14684	260	-2.595	0	-2.595	0	0	-2.43E-06	0	6.07E-07	2.89E-06	2.95E-06	-4.41E-02	1.75E-01	1.80E-01	1.64E-05	1.64E-05	0	0
	14681	260	-8.4	0	-1.3026	442.87583	7.097369	None	None	5.62E-06	4.02E-06	6.91E-06	0.070036	1.60E-01	0.17484208	8.01E-05	8.01E-05	0	0
		5.805			1.29237														
			exit gradient	0.223		FS	3.14												



View Result Information

Data Type: Node

Data Category : All

Parameter	14136	14132
X (ft)	252	252
Y (ft)	-3.378	-8.4
Z (ft)	0	0
Total Head (ft)	-3.378	-0.71886592
Pore-Water Pressure (psf)	0	479.30277
Pressure Head (ft)	0	7.6811341
Water Flux (ft³/sec)	-3.1719774e-005	None
Cumulative Water Flux (ft³)	0	None
X-Velocity Magnitude (ft/sec)	1.0667767e-005	6.139202e-006
Y-Velocity Magnitude (ft/sec)	2.6945104e-005	4.5376476e-006
XY-Velocity Magnitude (ft/sec)	2.8979991e-005	7.634137e-006
X-Gradient	0.21426701	0.076537841
Y-Gradient	1.6320933	0.18241021
XY-Gradient	1.6460981	0.1978169
X-Conductivity (ft/sec)	1.64e-005	8.0118662e-005
Y-Conductivity (ft/sec)	1.64e-005	8.0118662e-005
Vol. Water Content (ft³/ft³)	0	0
Slope of Vol. Water Content Fn. (/psf)	0	0

Name: EMBANKMENT FILL, EL. +10.2 TO 0.2 Model: Saturated Only K-Sat: 9.8e-006 ft/sec K-Ratio: 1
Name: MARSH 1, EL. -7.6 to -11.0 Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BEACH SAND, EL. -9 TO -46 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -46 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SAND, EL. -5.0 to -7.6 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: EMBANKMENT FILL (ML) EL. -3.4 to -5.0 Model: Saturated Only K-Sat: 1.64e-005 ft/sec K-Ratio: 1

GENERAL NOTES

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Name: Seepage Analysis
File Name: R16C.gsz Directory: Z:\OfficePrivateShares\ED-G\PRO Work\17th Street Canal\report B&V\Appendix E\calculations\SeepW R16_&_R30\R16C\
Last Edited By: Rosario-gonzalez, Pedro MVS

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LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

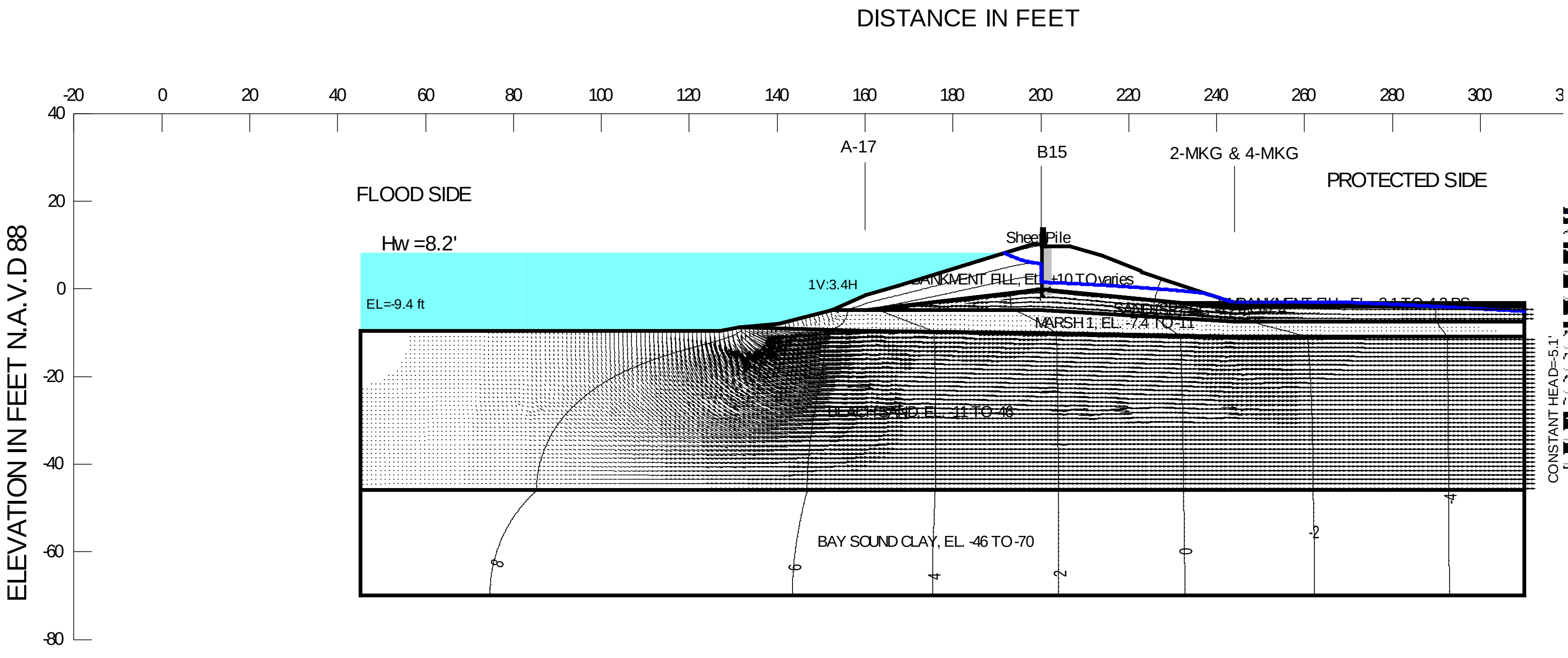
17th STREET OUTFALL CANAL, REACH 16C,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 648+89 WEST
ORLEANS PARISH, LOUISIANA

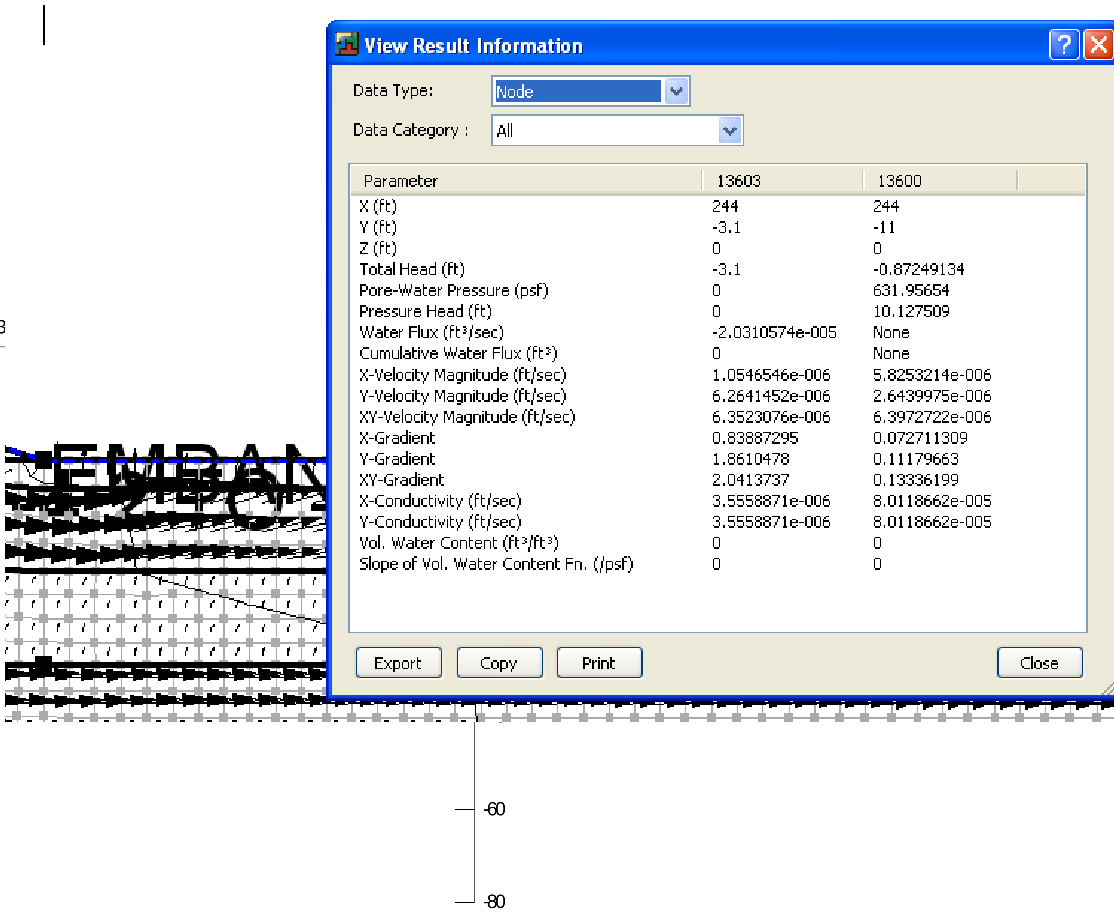
Figure 19 R16C SEEP/W Model Plot with Screen Shot of Drainage Inlet

Reach 16D

Table 11 R16D Seep/W outputs

				Weighted Unit weight		111													
				Critical gradient		0.779													
offset levee toe (ft)	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
0	13603	244	-3.1	0	-3.1	0	0	-2.03E-05	0	1.05E-06	6.26E-06	6.35E-06	8.39E-01	1.86E+00	2.04E+00	3.56E-06	3.56E-06	0	0
	13600	244	-11	0	-0.8725	631.95654	10.12751	None	None	5.83E-06	2.64E-06	6.40E-06	0.0727113	1.12E-01	0.13336199	8.01E-05	8.01E-05	0	0
		7.9			2.22751														
			exit gradient	0.282		FS	2.76												
23	Node	X (ft)	Y (ft)	Z (ft)	Total Head (ft)	Pore-Water Pressure (psf)	Pressure Head (ft)	Water Flux (ft³/sec)	Cumulative Water Flux (ft³)	X-Velocity Magnitude (ft/sec)	Y-Velocity Magnitude (ft/sec)	XY-Velocity Magnitude (ft/sec)	X-Gradient	Y-Gradient	XY-Gradient	X-Conductivity (ft/sec)	Y-Conductivity (ft/sec)	Vol. Water Content (ft³/ft³)	Slope of Vol. Water Content Fn. (/psf)
	15161	267	-3.1	0	-3.1	0	0	-1.54E-06	0	6.15E-08	1.55E-06	1.55E-06	-5.53E-11	1.17E-01	1.17E-01	1.31E-05	1.31E-05	0	0
	15158	267	-11	0	-2.4046	536.35282	8.595398	None	None	5.09E-06	2.00E-06	5.47E-06	0.0635446	7.91E-02	0.10145344	8.01E-05	8.01E-05	0	0
		7.9			0.6954														
			exit gradient	0.088		FS	8.85												





Data Type: Node

Data Category : All

Parameter	13603	13600
X (ft)	244	244
Y (ft)	-3.1	-11
Z (ft)	0	0
Total Head (ft)	-3.1	-0.87249134
Pore-Water Pressure (psf)	0	631.95654
Pressure Head (ft)	0	10.127509
Water Flux (ft³/sec)	-2.0310574e-005	None
Cumulative Water Flux (ft³)	0	None
X-Velocity Magnitude (ft/sec)	1.0546546e-006	5.8253214e-006
Y-Velocity Magnitude (ft/sec)	6.2641452e-006	2.6439975e-006
XY-Velocity Magnitude (ft/sec)	6.3523076e-006	6.3972722e-006
X-Gradient	0.83887295	0.072711309
Y-Gradient	1.8610478	0.11179663
XY-Gradient	2.0413737	0.13336199
X-Conductivity (ft/sec)	3.5558871e-006	8.0118662e-005
Y-Conductivity (ft/sec)	3.5558871e-006	8.0118662e-005
Vol. Water Content (ft³/ft³)	0	0
Slope of Vol. Water Content Fn. (/psf)	0	0

Name: EMBANKMENT FILL, EL. +10 TO varies Model: Saturated Only K-Sat: 2.62e-007 ft/sec K-Ratio: 1
Name: MARSH 1, EL. -7.4 TO -11 Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1
Name: BEACH SAND, EL. -11 TO -46 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: BAY SOUND CLAY, EL. -46 TO -70 Model: Saturated Only K-Sat: 3.28e-008 ft/sec K-Ratio: 1
Name: Sheet Pile Model: Saturated Only K-Sat: 1e-010 ft/sec K-Ratio: 1
Name: SAND (SP), EL. -4.2 TO -7.4 Model: Saturated Only K-Sat: 0.00049 ft/sec K-Ratio: 1
Name: EMBANKMENT FILL, EL. -3.1 TO -4.2 PS Model: Saturated Only K-Sat: 1.31e-005 ft/sec K-Ratio: 1

GENERAL NOTES

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Name: Seepage Analysis
File Name: R16D.gsz Directory: Z:\OfficePrivateShares\ED-G\PRO Work\17th Street Canal\report B&V\Appendix E\calculations\SeepW R16_&_R30\R16D\
Last Edited By: Rosario-gonzalez, Pedro MVS

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LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT

17th STREET OUTFALL CANAL, REACH 16D,
PROTECTED SIDE STABILITY ANALYSIS,
CASE: Seepage Analysis
STA. 645+10 WEST
ORLEANS PARISH, LOUISIANA

Figure 20 R16A SEEP/W Model Plot with Screen Shot of Drainage Inlet

Hand Calculations example R16C:

Step 1

Obtained Hydraulic Grade Line graph from SEEP/W analysis.

Step2

Average gradients are defined as the change in total head across a layer of soil (Equation 1).

Equation 1:

$$i = \frac{(h_1 - h_2)}{(z_1 - \ z_2)}$$

$$i = Average\ Gradient$$
$$h_1 = Head\ at\ Top\ of\ Aquifer, ft$$
$$h_2 = Head\ at\ Bottom\ of\ Aquifer, ft$$
$$z_1 = Elevation\ at\ Top\ of\ Aquifer, ft$$
$$z_2 = Elevation\ at\ Bottom\ of\ Aquifer, f$$

Equation 2:

$$\gamma_{AVG} = \frac{(z_1 * \gamma_1 + z_2 * \gamma_2 \ldots)}{(z_1 + z_2 \ldots)} = \frac{(0.8 * 114 + 0.7 * 122 + 101 * 3.5)}{(0.8 + 0.7 + 3.5)} = 106\, pcf$$

$$z_{1,2} = thickness\ of\ Soil\ Strata, ft$$
$$\gamma_{1,2} = Unit\ Weight\ of\ Soil\ Strata, pcf$$

Equation 3:

$$i_c = \frac{(\gamma_{AVG} - \gamma_{WATER})}{(\gamma_{WATER})} = \frac{(106 - 62.4)}{62.4} = 0.699$$

$$i_c = Critical\ Gradient\ for\ Soil$$
$$\gamma_{AVG} = Average\ Unit\ Weight\ of\ Blanket, pcf$$
$$\gamma_{WATER} = Unit\ Weight\ of\ Water, 62.4\, pcf$$

Conclusion

Reach 16B and 16C were the only two reaches out of the four analyzed by MVS with a seepage FoS less than 1.6. In both deficiencies reaches there is a continuous inlet drainage ditch on the protected side of the levee. The Seep/W models shown the velocity vectors concentrate at the ditch, resulting in high pore pressures and exit gradients. While the URS seepage FoS are somewhat higher than the ones calculated by MVS, their analyses does not account for the variation in elevations on the protected side caused by the inlet ditch. Also, the stratigraphy used by URS and prepared by B&V to run seep/w was conservatively created for slope stability analysis and not for seepage analyses. Table 12 points out the differences between URS and MVS seepage analysis

Table 12 Differences between URS and MVS seepage analysis

	URS	MVS
No. Reach Analyzed on Seep/W	1	4
SWL (ft)	10 approximately 2000 ft after pump station 6	8.5 approximately 2000 ft after pump station 6
	8	8.2
Blanket Distribution	Maintained constant (Clay fill and Marsh)	Sand and Marsh
		Sand and Marsh
		Silt, Sand and Marsh
		Clay, Sand and Marsh
Blanket Thickness (ft)	5.9	6.8
		6.3
		5.0
		7.9
Drainage Inlet Model on Seep/W	No	Yes
Hydraulic Permeability	Maintained previously from Black & Veatch	Obtained from DIVR 1110-1-400

Appendix D: Soil Stratification by Sub-reach

Boring name	depth		elev		layer thickness	USCS	Fine content %
14-MKG	0	0.7	-2.1	-2.8	1.7	SM	7.6
	0.7	1.7	-2.8	-3.8		CH	
	1.7	2.3	-3.8	-4.4	0.6	SM	8.4
	2.3	5	-4.4	-7.1	4.3	CH	
	5	6.3	-7.1	-8.4		CH	
	6.3	6.6	-8.4	-8.7		CL	
	6.6	7	-8.7	-9.1	0.4	SP	

MKG-15,17,18

		avg. thicknes (ft)
🟩	Blanket	2.1
⬜	SP	1.3
🟥	MARSH	4.3
🟦	AQU	x

Boring name	depth		elev		layer thickness	USCS	Fine content %
15-MKG	0	0.6	-0.9	-1.5	1	CH	
	0.6	1	-1.5	-1.9		CL	
	1	1.6	-1.9	-2.5	0.6	SM	7
	1.6	3	-2.5	-3.9	5	CH	
	3	3.7	-3.9	-4.6		SM	13.3
	3.7	5	-4.6	-5.9		CH	
	5	6.1	-5.9	-7		CH	
	6.1	6.6	-7	-7.5		SM	19
	6.6	7	-7.5	-7.9	0.4	SP	

MKG-14,16 & PU- 07,08 Borings

		avg. thicknes (ft)
🟩	Blanket	2.7
⬜	SP	1.03
🟥	MARSH	2.8
🟦	AQU	x

Boring name	depth		elev		layer thickness	USCS	Fine content %
16-MKG	0	1.6	-0.8	-2.4	2.2	ML	
	1.6	2	-2.4	-2.8		CL	
	2	4	-2.8	-4.8		ML	
	4	6.4	-4.8	-7.2	3	CH	
	6.4	7	-7.2	-7.8		CL	
	7	9.5	-7.8	-10.3	2.5	SP	

Boring name	depth		elev		layer thickness	USCS	Fine content %
17-MKG	0	0.4	-0.2	-0.6	3.6	ML	
	0.4	1	-0.6	-1.2		CL	
	1	2.2	-1.2	-2.4		CH	
	2.2	2.9	-2.4	-3.1		ML	
	2.9	3.6	-3.1	-3.8		CL	
	3.6	4.1	-3.8	-4.3	0.5	SM	10
	4.1	7	-4.3	-7.2	3.6	CH	
	7	7.7	-7.2	-7.9		CH	
	7.7	10	-7.9	-10.2	2.3	SP	

Boring name	depth		elev		layer thickness	USCS	Fine content %
18-MKG	0	0.7	0.1	-0.6	1.8	CL	
	0.7	1.4	-0.6	-1.3		CH	
	1.4	1.8	-1.3	-1.7		ML	
	1.8	4.5	-1.7	-4.4	2.7	SM	5.7
	4.5	4.9	-4.4	-4.8	4.2	CL	
	4.9	7	-4.8	-6.9		CH	
	7	8.7	-6.9	-8.6		CH	
	8.7	10.4	-8.6	-10.3	1.7	SP	

Boring name	depth		elev		layer thickness	USCS	Fine content %
07-PU	0	1	-1.3	-2.3	4	ML	
	1	2	-2.3	-3.3		CL	
	2	4	-3.3	-5.3		SM	22.8
	4	6.5	-5.3	-7.8	2.5	SP	
	6.5	9	-7.8	-10.3	2.5	SM	9.9
	9	11.5	-10.3	-12.8	2.5	SM	8.7
	11.5	14	-12.8	-15.3	2.5	SM	
	14	16	-15.3	-17.3	2	SM	

Boring name	depth		elev		layer thickness	USCS	Fine content %
08-PU	0	1	-2	-3	3	ML	
	1	2	-3	-4		ML	
	2	3	-4	-5		ML	
	3	4	-5	-6	1	SM	
	4	5	-6	-7	4	CH	
	5	8	-7	-10		CH	
	8	10.5	-10	-12.5	2.5	SM	5.1
	10.5	13	-12.5	-15	2.5	SM	6.5
	13	15.5	-15	-17.5	2.5	SM	6
	15.5	17	-17.5	-19	1.5	SM	

Boring name	depth		elev		layer thickness	USCS	Fine content %
13-MKG	0	1	-1.2	-2.2	2.5	CL	
	1	2.5	-2.2	-3.7		ML	
	2.5	3.6	-3.7	-4.8	5.3	CL	
	3.6	7.5	-4.8	-8.7		CH	
	7.5	7.8	-8.7	-9		CL	
	7.8	9.7	-9	-10.9	1.9	SP	
	blanket thicknes				7.8		

MKG-Borings

		avg. thicknes (ft)	AVG aqu top elev.
🟩	Blanket	2.5	
⬜	SP	0.0	x
🟥	MARSH	5.3	
🟦	AQU	x	-9.0

avg blanket thicknes= 7.8

PU-Borings

		avg. thicknes (ft)	AVG aqu top elev.
🟩	Blanket	4.0	
⬜	SP	0.00	x
🟥	MARSH	0.0	
🟦	AQU	x	-6.4

avg blanket thicknes= 4.0

06-PU	0	1	-2.4	-3.4	4	ML	63.2
	1	2	-3.4	-4.4		SM	
	2	4	-4.4	-6.4		SM	16.1
	4	6.5	-6.4	-8.9	2.5	SP	
	6.5	9	-8.9	-11.4	2.5	SP	
	9	11.5	-11.4	-13.9	2.5	SP	
	11.5	14	-13.9	-16.4	2.5	SP	
	14	16	-16.4	-18.4	2	SP	
	blanket thicknes				4		

Boring name	depth		elev		layer thickness	USCS	Fine content %
6-MKG	0	0.6	-2	-2.6	1.5	CH	
	0.6	1.5	-2.6	-3.5		ML	
	1.5	2.1	-3.5	-4.1	0.6	SP	
	2.1	7.9	-4.1	-9.9	5.8	CH	
	7.9	9.7	-9.9	-11.7		SP	
	blanket thicknes				7.9		
7-MKG	0	0.5	-1.6	-2.1	1.4	CL	
	0.5	1.4	-2.1	-3		ML	
	1.4	2.4	-3	-4	1	SM	9.8
	2.4	3.1	-4	-4.7	7.1	CH	
	3.1	3.7	-4.7	-5.3		CH	
	3.7	9.5	-5.3	-11.1		CH	
	9.5	12	-11.1	-13.6	2.5	SP	
	blanket thicknes				9.5		
8-MKG	0	0.4	-2.6	-3	1.4	CL	
	0.4	1.4	-3	-4		ML	
	1.4	3.6	-4	-6.2	2.2	SM	5.9
	3.6	4.3	-6.2	-6.9	3.9	CL	
	4.3	5.5	-6.9	-8.1		CH	
	5.5	6.5	-8.1	-9.1		ML	
	6.5	7.5	-9.1	-10.1		CH	
	7.5	8.5	-10.1	-11.1	1	SP	
	blanket thicknes				7.5		
9-MKG	0	1.7	-0.8	-2.5	1.7	ML	
	1.7	2.9	-2.5	-3.7	2.5	SP	
	2.9	4.2	-3.7	-5		SM	9.2
	4.2	7.7	-5	-8.5	3.5	CH	
	7.7	8.9	-8.5	-9.7	1.2	SP	
	blanket thicknes				7.7		
10-MKG	0	1.7	-0.6	-2.3	1.7	ML	
	1.7	2.7	-2.3	-3.3	1	SP	
	2.7	3.5	-3.3	-4.1	4.9	ML	
	3.5	7	-4.1	-7.6		CH	
	7	7.6	-7.6	-8.2		CL	
	7.6	8.2	-8.2	-8.8	0.6	SM	5.1
	8.2	10.5	-8.8	-11.1	2.3	SP	
	blanket thicknes				7.6		
11-MKG	0	0.5	0.4	-0.1	3.3	CL	
	0.5	3.3	-0.1	-2.9		ML	
	3.3	4.1	-2.9	-3.7	0.8	SP	
	4.1	7.9	-3.7	-7.5	3.8	CH	
	7.9	9.5	-7.5	-9.1	1.6	SP	
	blanket thicknes				7.9		
12-MKG	0	0.4	0.8	0.4	1.5	ML	
	0.4	1.5	0.4	-0.7		CH	
	1.5	2.2	-0.7	-1.4	0.7	SI	
	2.2	3.3	-1.4	-2.5	4	ML	
	3.3	3.8	-2.5	-3		SM	8.8
	3.8	4.8	-3	-4		CH	
	4.8	6.2	-4	-5.4		CL	
	6.2	7	-5.4	-6.2	0.8	SP	
	blanket thicknes				6.2		
03-PU	0	1	-2.4	-3.4	1	SM	49.1
	1	2	-3.4	-4.4	3	SM	3.5
	2	3	-4.4	-5.4		SP	
	3	4	-5.4	-6.4		SP	
	4	6.5	-6.4	-8.9	2.5	SM	17.8
	6.5	9	-8.9	-11.4	2.5	SM	5
	9	11.5	-11.4	-13.9	2.5	SP	
	11.5	14	-13.9	-16.4	2.5	SP	
	14	16	-16.4	-18.4	2	SP	
	blanket thicknes				6.5		
04-PU	0	1	-2.7	-3.7	3	ML	
	1	2	-3.7	-4.7		SM	42.4
	2	3	-4.7	-5.7		SM	
	3	4	-5.7	-6.7	1	SP	
	4	6.5	-6.7	-9.2	2.5	SM	14.4
	6.5	9	-9.2	-11.7	2.5	SP	
	9	11.5	-11.7	-14.2	2.5	SM	6.2
	11.5	14	-14.2	-16.7	2.5	SM	
	14	16	-16.7	-18.7	2	SM	
	blanket thicknes				6.5		
05-PU	0	1	-1.9	-2.9	4	CL	
	1	2	-2.9	-3.9		MH	
	2	3	-3.9	-4.9		CH	
	3	4	-4.9	-5.9		CH	
	4	5	-5.9	-6.9	1	SP	3
	5	8	-6.9	-9.9	4	SM	16.2
	8	9	-9.9	-10.9		SM	
	9	10	-10.9	-11.9	1	SP	
	10	12	-11.9	-13.9	2	SP	
	12	14.5	-13.9	-16.4	2.5	SM	
	14.5	17	-16.4	-18.9	2.5	SM	
	17	19.5	-18.9	-21.4	2.5	SP	
	19.5	22	-21.4	-23.9	2.5	SM	
	22	24.5	-23.9	-26.4	2.5	SP	
	24.5	27	-26.4	-28.9	2.5	SP	
	27	29.5	-28.9	-31.4	2.5	SP	
	29.5	32	-31.4	-33.9	2.5	SP	
	32	34.5	-33.9	-36.4	2.5	SP	
	34.5	37	-36.4	-38.9	2.5	SP	
	37	39.5	-38.9	-41.4	2.5	SP	
	39.5	42	-41.4	-43.9	2.5	SP	
	42	44.5	-43.9	-46.4	2.5	SP	
	44.5	47	-46.4	-48.9	2.5	SP	
	47	49.5	-48.9	-51.4	2.5	SP	
	49.5	52	-51.4	-53.9	2.5	SP	
	52	54.5	-53.9	-56.4	2.5	SP	
	54.5	57	-56.4	-58.9	2.5	SP	
	57	59.5	-58.9	-61.4	2.5	SP	
	59.5	61	-61.4	-62.9	1.5	SP	
	blanket thicknes				9		

MKG-Borings

		avg. thicknes (ft)	AVG aqu top elev.
🟩	Blanket	1.8	
⬜	SP	1.3	x
🟥	MARSH	4.7	
🟦	AQU	x	-8.7

PU-Borings

		avg. thicknes (ft)	AVG aqu top elev.
🟩	Blanket	2.7	
⬜	SP	1.67	x
🟥	MARSH	3.0	
🟦	AQU	x	-9.7

avg blanket thicknes= 7.6

Boring name	depth		elev		layer thickness	USCS	Fine content %
1-MKG	0	1	-3.5	-4.5	1	ML	
	1	3.4	-4.5	-6.9	2.4	SP	
	3.4	5.7	-6.9	-9.2	4.9	CH	
	5.7	7.6	-9.2	-11.1		CH	
	7.6	8.3	-11.1	-11.8		CL	
	8.3	9.5	-11.8	-13	1.2	SP	
	blanket thicknes				8.3		
2-MKG	0	1.1	-3.5	-4.6	1.1	ML	
	1.1	4.3	-4.6	-7.8	**3.2**	SP	
	4.3	4.7	-7.8	-8.2	3.7	CL	
	4.7	6.4	-8.2	-9.9		CH	
	6.4	8	-9.9	-11.5		CH	
	8	11	-11.5	-14.5	3	SP	
	blanket thicknes				8		
3-MKG	0	1	-3.5	-4.5	2.9	SM	
	1	2.1	-4.5	-5.6		SP	
	2.1	2.9	-5.6	-6.4		SM	3.3
	2.9	5.3	-6.4	-8.8	2.4	CH	
	5.3	9.9	-8.8	-13.4	4.6	SP	
	blanket thicknes				5.3		
4-MKG	0	0.7	-2.7	-3.4	0.7	CL	
	0.7	3.7	-3.4	-6.4	3	SP	
	3.7	4.5	-6.4	-7.2	2.1	CH	
	4.5	5.8	-7.2	-8.5		CH	
	5.8	10	-8.5	-12.7	4.2	SP	
	blanket thicknes				5.8		
5-MKG	0	0.5	-1.8	-2.3	1	CH	
	0.5	1	-2.3	-2.8		ML	
	1	2.5	-2.8	-4.3	2.5	SM	7.6
	2.5	3.5	-4.3	-5.3		SP	
	3.5	5.6	-5.3	-7.4	4.1	CH	
	5.6	7.3	-7.4	-9.1		CH	
	7.3	7.6	-9.1	-9.4		CL	
	7.6	10	-9.4	-11.8	2.4	SP	
	blanket thicknes				7.6		
17MVS-01PU	0	1	-0.1	-1.1	4	CH	
	1	4	-1.1	-4.1		SM	36.5
	4	8.5	-4.1	-8.6	9	CH	
	8.5	10.5	-8.6	-10.6		CL	
	10.5	13	-10.6	-13.1		SM	36.3
	13	15.5	-13.1	-15.6	2.5	SP	
	blanket thicknes				13		
17MVS-02PU	0	1	-2.7	-3.7	6	CL	
	1	2.7	-3.7	-5.4		ML	
	2.7	4.5	-5.4	-7.2		CH	
	4.5	6	-7.2	-8.7		ML	
	6	8.5	-8.7	-11.2	2.5	SP	
	blanket thicknes				6		

PU/MKG-Borings

		avg. thicknes (ft)
🟩	Blanket	1.1
⬜	SP	2.0
🟥	MARSH	4.6
🟦	AQU	x
		7.7

avg blanket thicknes=