LOUISIANA COASTAL PROTECTION AND RESTORATION
FINAL TECHNICAL REPORT

ENGINEERING APPENDIX

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U. S. Army Corps of Engineers
New Orleans District
Mississippi Valley Division

LOUISIANA COASTAL PROTECTION AND RESTORATION
ENGINEERING APPENDIX

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LOUISIANA COASTAL PROTECTION AND RESTORATION ENGINEERING APPENDIX

PURPOSE

The Louisiana Coastal Protection and Restoration (LACPR) Technical Report has been developed by the United States Army Corps of Engineers (USACE) in response to Public Laws 109-103 and 109-148. Under these laws, Congress and the President directed the Secretary of the Army, acting through the Chief of Engineers, to:

- Conduct a comprehensive hurricane protection analysis and design in close coordination with the State of Louisiana and its appropriate agencies;
- Develop and present a full range of flood control, coastal restoration, and hurricane protection measures exclusive of normal policy considerations for South Louisiana;
- Consider providing protection for a storm surge equivalent to a Category 5 hurricane; and
- Submit preliminary and final technical reports.

This Engineering Appendix outlines the engineering and design work done to support the preparation of the Louisiana Coastal Protection and Restoration (LACPR) Technical Report. It includes geotechnical investigations, levee design, structural design, coastal restoration features and cost estimates. Figure 1 shows the general planning area.

Figure 1 - LACPR Planning Area

STRUCTURAL ALIGNMENTS

Alternative alignments were developed in conjunction with other federal, state and local representatives and through extensive public involvement. Details on how these alignments were developed can be found in the Main Report and the Structural Plan Component Appendix.

The alignments were used to develop cost estimates used to compare the structural alternatives through the Risk-Informed Decision Framework (RIDF)/Multi-Criteria Decision Analysis (MCDA) process. More information on this process can be found in the RIDF Appendix. These proposed alignments do not represent exact construction alignments. It is expected that a more thorough analysis will be conducted during the detailed design phase to determine modification of alignments that could possibly represent significant improvements to the schedule, budget, and overall effectiveness of any future projects.

Confirmation of or amendments to the final construction alignment will be made with due deliberation and consideration of many significant factors, including the costs and benefits to the level of protection, the environment, constructability, schedule, hydraulics, economic and cultural resources, and other general and local issues. Innovative engineering will also be a key component in the alternative alignment analysis.

REACHES

Planning Units

The planning area was divided into different Planning Units (PU) based on hydrologic boundaries (see figure 2). These Planning Units extend as follows:

1. Lake Pontchartrain Basin, or the area east of the Mississippi River (PU1)
2. Barataria Basin, or the area from the Mississippi River west to Bayou Lafourche (PU2)

3a. Eastern Terrebonne Basin, or the area west of Bayou Lafourche to Bayou de West (PU3a)

3b. Atchafalalya Influence Area, or the area west of Bayou de West to Freshwater Bayou (PU3b)

4. Chenier Plain, or the area west of Freshwater Bayou to the Sabine River (PU4)

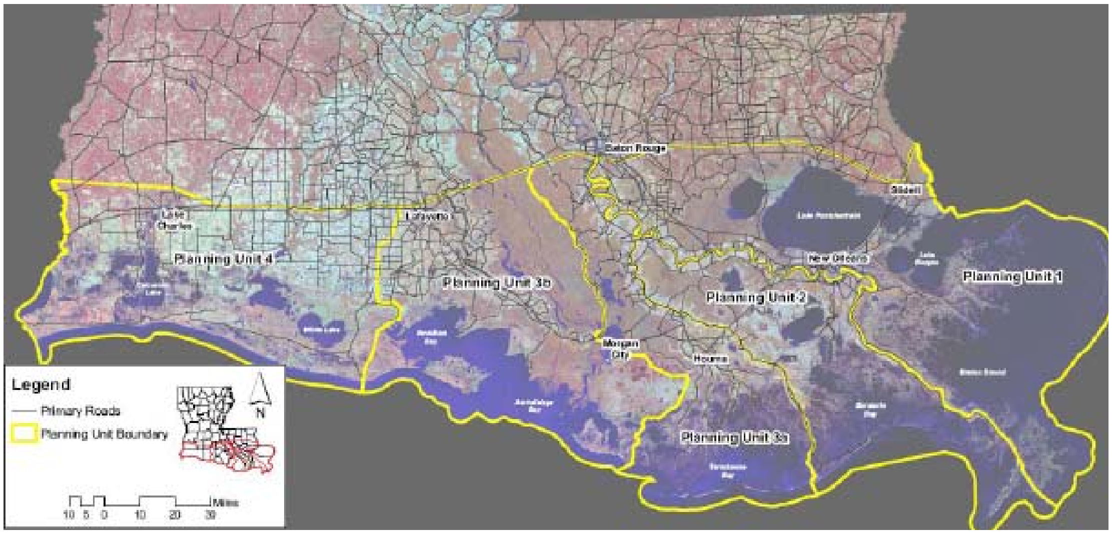


Figure 2 - Planning Units

Reaches and Sections

For design purposes the planning area was broken down into four reaches based on areas that have similar geotechnical conditions (areas where the stratigraphy remains relatively consistent). Alternative alignments in each reach were further broken down into sections for ease in developing cost estimates. Plates 1 thru 4 show the locations of the geotechnical reaches and alignment sections as well as the lengths of those sections in feet and miles.

HYDRODYNAMIC MODELING AND DESIGN

USACE/FEMA JOINT SURGE STUDY

The Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE) collaborated on the USACE/FEMA Joint Surge Study (JSS) for Southeastern Louisiana The project modeled hurricane storm surge throughout coastal Southeastern Louisiana to provide output for various planning and design uses within the two federal agencies. FEMA intends to use the output of this modeling effort as input for the development of new Digital Flood Insurance Rate Maps (DFIRMS) and other uses, while USACE is using the output of this study in the evaluation and design of hurricane protection systems including the LACPR effort. Details of the methodology and results of this study are included in the Hydraulics And Hydrology (H&H) Appendix.

ANALYSIS AND DESIGN

In the framework of LACPR the hydraulic analysis plays a key role in the cost-benefit analysis of the alternatives in the various planning units. Each levee alternative affects the propagation of the surge and the waves during a storm in a different way. The differences in storm surge and wave characteristics result in varying levee designs, overtopping volumes and interior stage frequency curves.

The hydraulic analysis of each alternative in LACPR consisted of the following consecutive steps:

1. Numerical computations of surge levels and wave characteristics
2. Frequency analysis
3. Determination of the levee heights and overtopping volumes
4. Determination of the interior stages including rainfall

To provide a range of alternatives for evaluation and to enable the economic evaluation it was decided to evaluate each levee alternative for different design levels and event frequencies. A levee design was made for three different levels of risk reduction (100-year, 400-year, 1000-year). A more detailed description of the design methodology and results of this effort are included in the H&H Appendix.

Planning Units 1 and 2

Levee design height results were provided for base conditions and east model grids A and B for different hydraulic reaches for two different modeling conditions with friction and without friction[1]. These model grids are described below and in more detail in the H&H Appendix. Details of the with and without friction conditions can also be found in the H&H Appendix along with maps showing the location of the hydraulic reaches.

Model Grid A: This grid includes non-overtopping barriers across the eastern edge of Lake Pontchartrain and along the GIWW in Barataria Basin (PU2).

Model Grid B: This grid includes overtopping barriers across the eastern edge of Lake Pontchartrain and along the GIWW in Barataria Basin.

A determination was made as to which of the previously described levee sections fell into each hydraulic reach. Based on preliminary analysis it was determined that non-overtopping barrier alternatives would be removed from further consideration because of their higher cost in relation to benefits over those provided by the overtopping barrier alternatives. Details of this preliminary analysis can be found in the Structural Plan Component Appendix. Since only barrier alternatives with overtopping barriers were considered in detail these are the only design results shown. Tables 1 to 4 below show the design levee heights for the base condition grid and grid B for with and without friction cases.

With and without friction cases differ in that STWAVE, a near shore wave generation and transformation model which was used as part of the hydraulic analysis done for this project, has an option to include calculation of wave dissipation due to bottom roughness or vegetation. STWAVE simulations were executed both with and without activating the frictional dissipation in the model. Simulations with friction will have lower wave heights in shallow, submerged wetland areas than the without friction simulations. Although, in areas strongly forced by the winds, frictional dissipation can be balanced by wind input.

[1] All elevations in this report are to NAVD88(2004.65).

The issue of the "with friction" or "without friction" STWAVE results was resolved for the LACPR project when the ongoing effort for designing the 100-year protection system settled on the "without friction case" as being the one used to design the reconstructed levee system. The team doing this work employed an ITR and EPR review process. The judgment of the EPR Team was that the with friction STWAVE results appeared to be unrealistic and not conservative enough, given the potential consequences of overtopping and the lack of wave data to support the friction factors used in the STWAVE simulations. It was decided that the LACPR methodology employ the same methodology used in the restoration effort since that effort when completed would be the base condition 2010 case for LACPR.

Without friction case elevations were used to develop costs used for running the MCDA. Estimates developed using the with friction case elevations were used in performing a sensitivity analysis to determine if using the with friction vs. without friction cases would affect project ranking (see Structural Plan Component Appendix). This analysis determined that the choice of with and without friction would not on balance affect the ranking of any plan.

Table 1
Design Elevations For Base Conditions (without friction) Planning Unit 1 and Planning Unit 2

Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plate 1)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
BS-0005	1	6	26.5	32.5	35.5
BS-0007	1	7	26	34	38
BS-0009	1	Plaq EB (8)	29	38.5	42.5
BS-0026	1	1005c	18.5	20	23.5
BS-0032	1	1005a	16	21	23.5
BS-0037	2	403b,403c	11	14	18
BS-0040	1	1005f	18	23.5	26
BS-0048	1	5b,1004a,1004b	28.5	35	38
BS-0058	1	1005d	15	18	21
BS-0074	2	14b,1008	18	25	28.5
BS-0075	2	14a	17	21.5	23.5
BS-0092	1	1005b	16.5	19.5	21.5
BS-0093	1	1005e	18	19	21.5
BS-0094	1	1002b(1)	16.5	23	26
BS-0101	2	403d,403e	11	14	16
BS-0110	2	409	7.5	10.5	12.5
BS-0111	2	404c(1)	8	11.5	13
BS-0112	2	403f	8.5	12	13.5
BS-0130	2	1016,403a	11	17	20
BS-0136	1	1000c	16	20	22
BS-0137	1	1000b	15	19	21.5
BS-0138	1	1000a	15	20	22.5
BS-0139	1	1001a,1001b,1001c,1002a	16	21.5	24
BS-0157	1	1018	10	14	16.5
BS-0158	1	1015,1017	10	15	17.5

Table 1 Design Elevations For Base Conditions (without friction) Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plate 1)	Design Level		
BS-0175	1	1003,1002b(2)	22.5	30.5	34.5
BS-0176	1	1006	13.5	18.5	21
BS-0177	1	1a(1),1b	20	28	32
BS-0205	2	13,109	12	14	16.5

Table 2 Design Elevations For Grid B (without friction) Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plate 1)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
EB-0007	1	7	28	37.5	40.5
EB-0009	1	Plaq EB (8)	33	42.5	45.5
EB-0026	1	1005c	18.5	18.5	18.5
EB-0032	1	1005a,16	13	18.5	21.5
EB-0058	1	1005d	15	15	15
EB-0074	2	109,14b, 1008	18.5	26.5	30.5
EB-0075	2	13, 14a	17.5	23	26
EB-0092	1	1005b	16.5	16.5	18.5
EB-0093	1	1005e	18	18	18
EB-0094	1	1002b,1003	13	21	24.5
EB-0101	2	403a,403b,403c,403d, 403e, 1016b	11	11	11
EB-0110	2	409	6	8.5	10
EB-0112	2	403f,404c(1)	6.5	9	10.5
EB-0129	1	6,1004a, 1004b,5b	26.5	33.5	37
EB-0130	2	1016 (a)	16	22	25
EB-0136	1	1000c	11	15.5	17.5
EB-0137	1	1000b	9.5	13.5	16
EB-0138	1	1000a	9.5	14.5	17.5
EB-0139	1	1001a,1001b,1001c, 1002a	11	17.5	21
EB-0147	1	1005f	15	16.5	20.5
EB-0175	1	2,3	24.5	32	36
EB-0176	1	1006	9	14.5	18
EB-0177	1	1b,1a(1),1a(2)	26	35	39

Table 3 Design Elevations For Base Conditions (with friction) Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plate 1)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
BS-0005	1	6	24	29.5	32
BS-0007	1	7	21.5	28	31.5
BS-0009	1	Plaq EB (8)	24	31	35
BS-0026	1	1005c	18.5	20	23.5
BS-0032	1	1005a	14.5	19.5	21.5
BS-0037	2	403b,403c	11	12.5	16
BS-0040	1	1005f	17.5	23	26
BS-0048	1	5b,1004a,1004b	24	30	32
BS-0058	1	1005d	15	18	21
BS-0074	2	14b,1008	15.5	21.5	25
BS-0075	2	14a	16	20.5	22.5
BS-0092	1	1005b	16.5	19.5	21.5
BS-0093	1	1005e	18	19	21.5
BS-0094	1	1002b(1)	16.5	23	26
BS-0101	2	403d,403e	11	14	16
BS-0110	2	409	7	10	12
BS-0111	2	404c(1)	8	11.5	13
BS-0112	2	403f	8	11	13
BS-0130	2	1016,403a	11	15	17
BS-0136	1	1000c	16	20	22
BS-0137	1	1000b	15	19	21.5
BS-0138	1	1000a	15	20	22.5
BS-0139	1	1001a,1001b,1001c, 1002a	16	21.5	24
BS-0157	2	1018	10	14	16
BS-0158	1	1015,1017	10	15	17.5
BS-0175	1	1003,1002b(2)	19	25.5	29
BS-0176	1	1006	12.5	17	19
BS-0177	1	1a(1),1b	17.5	23.5	26.5
BS-0205	2	13,109	11	14	16.5

Table 4 Design Elevations For Grid B (with friction) Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plate 1)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
EB-0007	1	7	23	30.5	35
EB-0009	1	Plaq EB (8)	25.5	34.5	40
EB-0026	1	1005c	18.5	18.5	18.5
EB-0032	1	1005a,16	13	17	19.5
EB-0058	1	1005d	15	15	15
EB-0074	2	109,14b,1008	15.5	22	25.5
EB-0075	2	13,14a	16.5	22	24.5
EB-0092	1	1005b	16.5	16.5	18.5
EB-0093	1	1005e	18	18	18
EB-0094	1	1002b,1003	12.5	20.5	24.5
EB-0101	2	403a,403b,403c,403d, 403e, 1016b	11	11	11
EB-0110	2	409	5.5	8	9.5
EB-0112	2	403f,404c(1)	6	9	10
EB-0129	1	6,1004a,1004b,5b	26.5	33.5	37
EB-0130	2	1016 (a)	14	19	22
EB-0136	1	1000c	11	15.5	17.5
EB-0137	1	1000b	9.5	13.5	16
EB-0138	1	1000a	9.5	14.5	17.5
EB-0139	1	1001a,1001b,1001c, 1002a	11	17.5	21
EB-0147	1	1005f	15	16.5	20
EB-0175	1	2,3	21.5	27.5	30.5
EB-0176	1	1006	8	13	16
EB-0177	1	1b,1a(1),1a(2)	20.5	27	30

New North Shore Alignments

Levee alignments along the north shore of Lake Pontchartrain were reanalyzed in an effort to provide a better line of protection for existing development. These new alignments are shown on Plate 5. New design elevations were developed for these levees and are shown in Tables 5 and 6. Design elevations and costs were developed only for the without friction case for the new north shore alignments.

Table 5
Design Elevations For Base Conditions (without friction) New North Shore Alignments

PU	Levee Section (see plate 5)	Design Level		
		100-YR (ft)	400-YR (ft)	1000-YR (ft)
1	NNS0	16	20	22
1	NNS1	15	19	22
1	NNS2	15	19	22
1	NNS3	15	20	23
1	NNS4	15	20	23
2	NNS5	20	28	32
2	NNS6a	20	28	32
1	NNS6b	23	31	35
1	NNS6c	17	23	26
1	NNS6d	16	22	24
2	NNS7	16	20	22
2	NNS8	16	20	22
2	NNS9	16	20	22

Table 6
Design Elevations For Grid B (without friction) New North Shore Alignments

PU	Levee Section (see plate 5)	Design Level		
		100-YR (ft)	400-YR (ft)	1000-YR (ft)
1	NNS0	11	16	18
1	NNS1	10	14	16
1	NNS2	10	14	16
1	NNS3	10	15	18
1	NNS4	10	15	18
2	NNS5	26	35	39
2	NNS6a	26	35	39
1	NNS6b	13	21	25
1	NNS6c	13	21	25
1	NNS6d	11	18	21
2	NNS7	11	16	18
2	NNS8	11	16	18
2	NNS9	11	16	18

Planning Units 3a, 3b and 4

Three hyrdo modeling grids were run to develop the levee design heights for alternatives for PU3a, PU3b and PU4 for two different modeling conditions with friction and without friction. These model grids are described below and in more detail in the H&H Appendix.

West Model Grid A: This grid includes the Morganza to the Gulf alignment and then follows the GIWW to just east of the state line.

West Model Grid B: This grid includes the Morganza to the Gulf alignment and includes a back ring levee around the Houma area, ring levees for Morgan City and Patterson, a levee along the wetland interface from Patterson to Abbeville and ring levees around Kaplan, Gueydan and a larger ring levee around Lake Charles.

West Model Grid C: The grid incorporates features of both levee grids.

A determination was made as to which of the previously described levee sections fell into each hydraulic reach. Tables 7 to 8 below show the design levee heights for with and without friction cases. Without friction case elevations were used to develop costs used for running the MCDA. Estimates were also developed using the with friction case elevations for use in performing a sensitivity analysis.

Table 7
Design Elevations For Planning Unit 3a, Planning Unit 3b and Planning Unit 4 (without friction)

Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
WA-W0017	3a	14b	21	29.5	34.5
WA-W0025	3a	15, 16	22	30.5	35.5
WA-W0026	3a	17, 18, 19, 20a	28	36.5	41
WA-W0035	3a	20b	23	31	35.5
WA-W0045	3a	21	15	24	29
WA-W0050	3a	1022, 22, 23b(1), 5000	12	19.5	23.5
WA-W0056	3a, 3b	23b(2), 23a(1), 24a	16.5	23	27
WA-W0063	3b	2007b	20	27.5	32.5
WA-W0073	4	807b	16	24	28.5
WA-W0079	3b	801b, 2007a, 2802	20.5	28	32.5
WA-W0082	4	807a	14	20.5	24.5
WA-W00103	4	803, 804, 805a	21.5	28	31.5
WA-W00119	4	807c, 807d	13.5	21.5	26
WA-W00124	4	806	12	19.5	24
WB-W0056		23a	18	25	28.5
WB-W0060	3b	301a, 801b	16.5	23.5	27.5
WB-W0075	3b	2302a	20	27	31
WB-W0085	3b	302b, 2302b	17	26	31.5

Table 7 Design Elevations For Planning Unit 3a, Planning Unit 3b and Planning Unit 4 (without friction)					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
WB-W0089	3b	301c	19	26.5	30.5
WB-W0090	3b	2006	18	24.5	28.5
WB-W0094	3b	301b, 301b(2), 3001	16.5	25	30
WC-W0169	3a	110,111,112		9.5	24
WT-W0104	3b	3002	14.5	22	26.5
WT-W0110	3b	3005	12.5	20.5	25
WT-W0111	3b	3003, 3004	17.5	25	29
WT-W0127	4	3009, 3010	11	15.5	17.5
WT-W0135	4	3006	9	15.5	18.5
WT-W0153	4	3007	9	15.5	18.5
WT-WPATT	3a	23a(2), 1023a, 24b, 801a	13.5	20	24
WT-W0999	4	3008	13.5	17	19.5

Table 8 Design Elevations For Planning Unit 3a, Planning Unit 3b and Planning Unit 4 (with friction)					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
WA-W0017	3a	14b	17.5	24	28
WA-W0025	3a	15, 16	18.5	25.5	29.5
WA-W0026	3a	17, 18, 19, 20a	21	29.5	34
WA-W0035	3a	20b	19	25	28.5
WA-W0045	3a	21	13.5	19.5	23
WA-W0050	3a	1022, 22, 23b(1), 5000	10.5	15.5	18
WA-W0056	3a, 3b	23b(2), 23a(1), 24a	12.5	17.5	20.5
WA-W0063	3b	2007b	18.5	25	29
WA-W0073	4	807b	13.5	19	22.5
WA-W0079	3b	801b (GIWW), 2007a, 2802	19.5	26.5	31
WA-W0082	4	807a	12.5	18.5	21.5
WA-W00103	4	803, 804, 805a	15.5	20.5	23.5
WA-W00119	4	807c, 807d	12.5	19	22.5
WA-W00124	4	806	11	17	20.5
WB-W0060	3b	301a, 801b	12	17.5	20
WB-W0075	3b	2302a	16	21.5	25
WB-W0085	3b	302b, 2302b	15.5	22	26
WB-W0089	3b	301c	14.5	21	25
WB-W0090	3b	2006	13.5	18.5	21
WB-W0094	3b	301b, 301b(2), 3001	12.5	18.5	22
WC-W0169	3a	110,111,112			

Table 8 Design Elevations For Planning Unit 3a, Planning Unit 3b and Planning Unit 4 (with friction)					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
WT-W0104	3b	3002	12	17	20.5
WT-W0110	3b	3005	12	17.5	20.5
WT-W0111	3b	3003, 3004	14	19	22.5
WT-W0127	4	3009, 3010	11	15.5	17.5
WT-W0135	4	3006	6.5	11.5	15
WT-W0153	4	3007	8.5	14	17
WT-WPATT	3a	23a(2), 1023a, 24b, 801a	9.5	14.5	17.5
WT-WLAKC	4	3008	10.5	13	15

FUTURE CONDITIONS

Degraded Coastline

An additional modeling grid was developed to determine the effects of a degraded coastline on surge and wave heights. Details on how this grid was developed (how the degraded coastline was estimated) can be found in the H&H Appendix. New levee elevations necessary to provide the desired protection under these conditions were developed. These levee elevations (for the without friction case) are shown in Tables 9 thru 10 for high level and barrier plans. High level plans are those alternatives which consist of raising existing levees and constructing new levees. Barrier plans are those alternatives which include building a barrier across Lake Pontchartrain in PU1 and along the GIWW in PU2 along with raising the existing levees and constructing new levees.

Table 9 Design Elevations For Degraded Coastline Condition High Level Plans - Without Friction Case Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
BS-0005	1	6	28.5	36.5	41
BS-0007	1	7	27	36.5	40
BS-0009	1	Plaq EB (8)	32.5	42.5	45
BS-0026	1	1005c	18.5	20	23.5
BS-0032	1	1005a	17	23	26
BS-0037	2	403b,403c	12	18	21.5
BS-0040	1	1005f	19	25	29
BS-0048	1	5b,1004a,1004b	32	40.5	43.5
BS-0058	1	1005d	15	19	21.5
BS-0074	2	14b,1008	18	25	28.5
BS-0075	2	14a	17	21.5	23.5

Table 9 Design Elevations For Degraded Coastline Condition High Level Plans - Without Friction Case Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR (ft)	400-YR (ft)	1000-YR (ft)
BS-0092	1	1005b	16.5	19.5	21.5
BS-0093	1	1005e	18	20	23
BS-0094	1	1002b(1)	17.5	24	27.5
BS-0101	2	403d,403e	12	17.5	20
BS-0110	2	409	10	14	16.5
BS-0111	2	404c(1)	10.5	14.5	17
BS-0112	2	403f	11	15.5	18.5
BS-0130	2	1016,403a	14	19.5	23
BS-0136	1	1000c	16	20	22
BS-0137	1	1000b	15	19	21.5
BS-0138	1	1000a	15	20	23
BS-0139	1	1001a,1001b,1001c,1002a	16	22	25
BS-0157	2	1018	11.5	16	18.5
BS-0158	2	1015,1017	11.5	17	20
BS-0175	1	1003,1002b(2)	24	33	37.5
BS-0176	1	1006	14	19	22.5
BS-0177	1	1a(1),1b	23	32	36.5
BS-0205	2	13,109	14	18	19.5

Table 10 Design Elevations For Degraded Coastline Condition Barrier Plans - Without Friction Case Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR	400-YR	1000-YR
EB-0007	1	7	29	40	42.5
EB-0009	1	Plaq EB (8)	36.5	46.5	48
EB-0026	1	1005c	18.5	18.5	18.5
EB-0032	1	1005a,16	14	20.5	24
EB-0058	1	1005d	15	16	15.5
EB-0074	2	109,14b, 1008	18.5	26.5	30.5
EB-0075	2	13, 14a	17.5	23	26
EB-0092	1	1005b	16.5	16.5	18.5
EB-0093	1	1005e	18	19	19.5
EB-0094	1	1002b,1003	14	22	26
EB-0110	2	403a,403b,403c,403d, 403e, 1016b	12	14.5	15
EB-0111	2	409	8.5	12	14

Table 10 Design Elevations For Degraded Coastline Condition Barrier Plans - Without Friction Case Planning Unit 1 and Planning Unit 2					
Hydraulic Reach (see H&H Appendix)	PU	Levee Section (see plates 2-4)	Design Level		
			100-YR	400-YR	1000-YR
EB-0112	2	403f,404c(1)	9	12.5	15.5
EB-0129	1	6,1004a, 1004b,5b	28.5	37.5	42.5
EB-0130	2	1016 (a)	19	24.5	28
EB-0136	1	1000c	11	15.5	17.5
EB-0137	1	1000b	9.5	13.5	16
EB-0138	1	1000a	9.5	14.5	18
EB-0139	1	1001a,1001b,1001c, 1002a	11	18	22
EB-0147	1	1005f	16	18	23.5
EB-0175	1	2,3	26	34.5	39
EB-0176	1	1006	9.5	15	19.5
EB-0177	1	1b,1a(1),1a(2)	29	39	43.5

Relative Sea Level Rise

Two estimates of future relative sea level rise (RSLR) were developed. These estimates vary among the planning units. These estimates are shown below.

	Planning Unit 1	Planning Unit 2
RSLR Estimate 1	1.3 feet	1.9 feet
RSLR Estimate 2	2.6 feet	3.2 feet

	Planning Unit 3a, 3b	Planning Unit 4
RSLR Estimate 1	1.9 feet	1.3 feet
RSLR Estimate 2	3.2 feet	2.6 feet

Information on how these estimates were developed can be found in the H&H Appendix.

ANALYSIS OF LAKE PONTCHARTRAIN AND BARRIER STRUCTURE SIZING

The University of New Orleans performed a study to determine the required size of the structures at the Rigolets and Chef Passes to avoid adversely affecting the tidal prism. These would be gated structures allowing tidal exchange during non-storm conditions. This preliminary study determined that the structure at the Rigolets would need to be 1900 feet wide and the structure at the Chef would need to be 750 feet wide. Details of this study are included as an attachment to the H&H. Further study will be necessary during detailed design to determine the exact size and configuration of these structures.

INTERCEPTED DRAINAGE

Because results from the detailed interior drainage modeling work are not available at this time, estimates of additional pumping that would be required for new levee alignments were made using a simplified method. Details of this methodology can be found in the H&H Appendix. Pumping requirements for North Shore levees are shown in Figure 3.

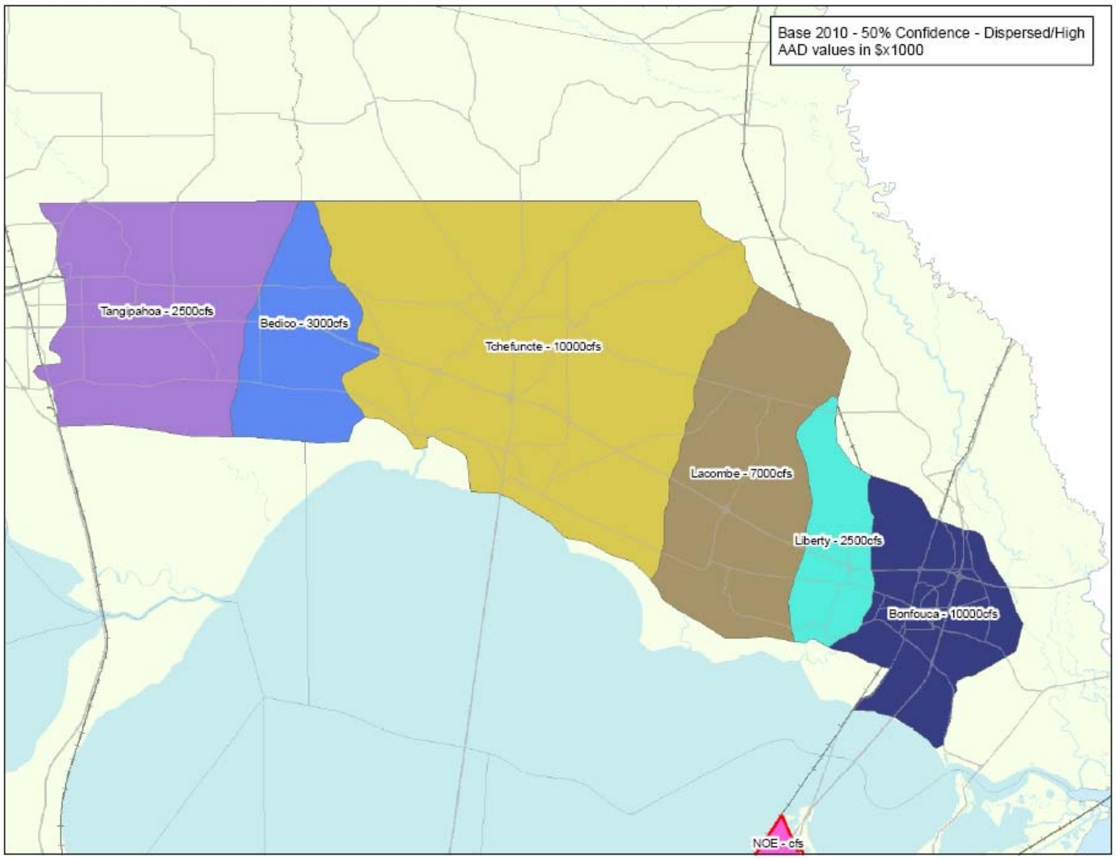


Figure 3 - Estimated Pumping Capacity For Northshore Leveed Areas

Estimates were also made for pumping requirements for leveed areas in PU2. New requirements are 15,000 cfs for the area on the east side of PU2 and 2500 cfs for the area on the west side of PU2. These estimates will be refined as more detailed modeling information becomes available.

Pumping requirements were also developed for the new north shore levees. These requirements are shown below.

Area	Required Pumping Capacity
Madisonville	5,000 cfs
South Covington	1,600 cfs
Madisonville to Madisonville	5,600 cfs
Mandeville	5,200 cfs

West Lacombe	2,400 cfs
East Lacombe	5,000 cfs
Slidell	54,000 cfs

INCREASED SURGE LEVEL ON PLAQUEMINES PARISH LEVEES

Estimates of the additional levee elevations needed to prevent induced damages to areas in Plaquemines Parish affected by construction of barriers in PU1 and PU2 were developed. These estimates are shown below. Details of how these values were determined are shown in the H&H Appendix. Figure 4 shows the location of the areas described below.

Ollie - increase levee heights by 2.6ft to accommodate the max change at 100year.
Bellevue - increase levee heights by 0.6ft to accommodate a reasonably constant increase in level.
Pointe ala Hache - increase levee heights by 0.3ft to accommodate a reasonably constant increase in level.
Diamond - Mississippi Levee - increase levee heights by 0.3ft to accommodate a reasonably constant increase in level.
Gainard Woods - Mississippi Levee - increase levee heights by 0.2ft to accommodate a reasonably constant increase in level.

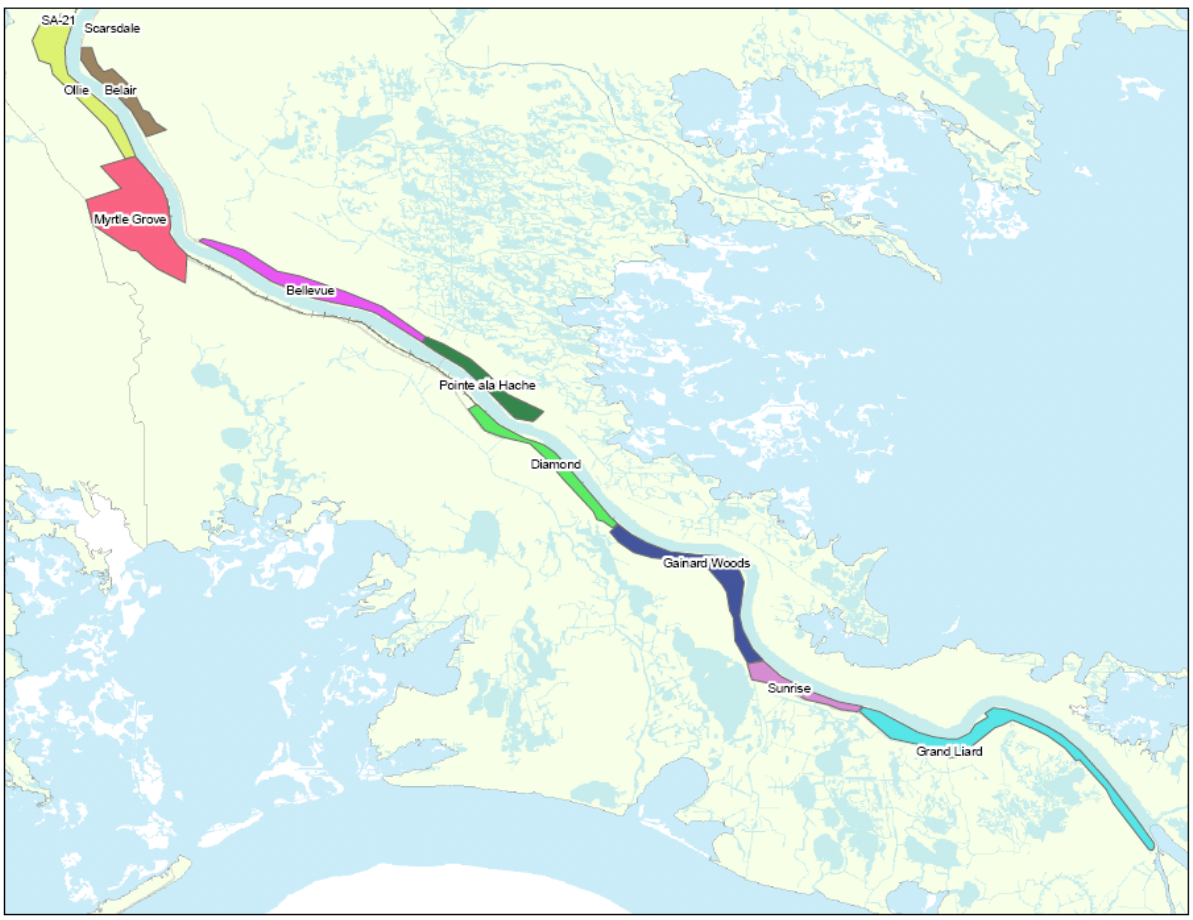


Figure 4 - Areas Subject to Additional Surge by Construction of Barrier Plans

GEOTECHNICAL

GEOLOGY

Geologic Formations

The history of the planning area is dominated by deltaic growth. The Mississippi River deltaic plain is composed of two active and several inactive deltaic complexes extending some 180 miles across southeast Louisiana. Several major deltaic complexes that have formed during the last 7,000 years have been identified in coastal Louisiana. These complexes reflect changes in the course of the Mississippi River. From oldest to youngest, the abandoned delta complexes are the Maringouin, Teche, St. Bernard, Lafourche, and Plaquemine. The active complexes include the Atchafalaya and Modern deltas. The relative ages of these complexes are well established, but the absolute ages are less accurate. Ages were derived from radiocarbon data published in previous studies (Frazier, 1967 and McFarlan, 1961) as well as archeological evidence (McIntire, 1958).

Progradation of these deltas is responsible for the formation of two distinct geomorphic regions; the deltaic plain in the central and southeastern portions of coastal Louisiana and the chenier plain in the southwestern part of the state (see Figure 5). Progradation of the present and former Mississippi River courses and deltas are responsible for creating the recent alluvial valley and deltaic plain of southeastern Louisiana. Each time the Mississippi River has built a major delta lobe seaward, it has subsequently been abandoned in favor of a shorter, more direct route to the sea. These meander belt changes in the alluvial valley and accompanying shifts in centers of deposition have resulted in the distribution of deltaic sediments along the coast of central and southeast Louisiana. Soon after a delta lobe is abandoned, marine transgression caused by compaction and subsidence of deltaic sediments begins. The end result of this long period of deltaic sedimentation has been the formation of a vast expanse of marsh and swamp separated by abandoned courses and distributaries.

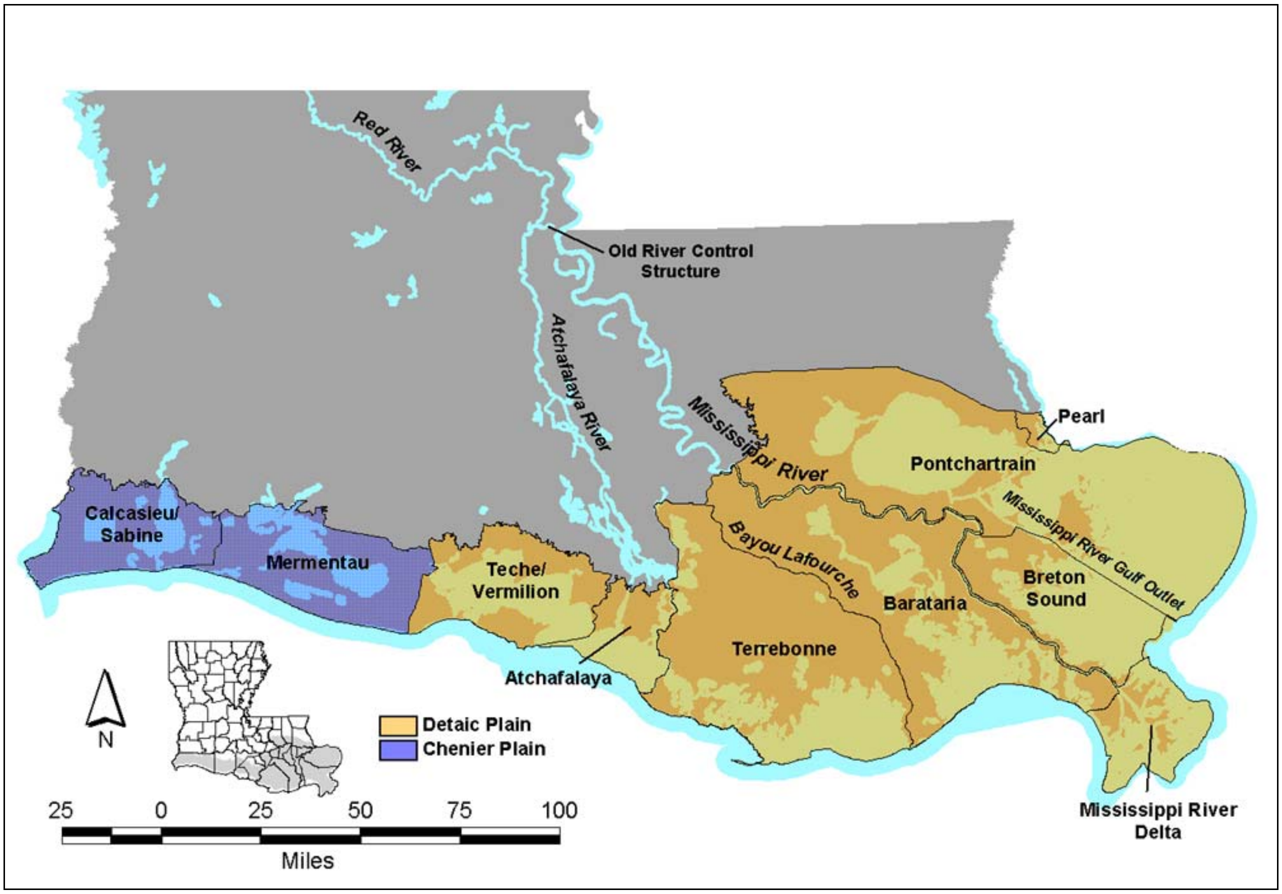


Figure 5 - Location of Chenier and Deltaic Plains

The deltaic plain is generally composed of a characteristic suite of depositional environments which include marsh, swamp, natural levee, interdistributary, prodelta, and Pleistocene. At the surface and shallow subsurface, marsh, swamp, and natural levee deposits make up the majority of the depositional environments. Marsh deposits range from 1 to 20 feet thick and are generally composed of very soft, organic clays and peat, with high water content and low strengths. Swamp deposits vary widely in thickness, water content, and strength, and are characterized by soft to stiff clays with some silt, wood, and organics. Natural levee deposits border the hundreds of abandoned distributaries and courses located throughout the deltaic plain. They reach a maximum of 30 feet in thickness and are generally composed of oxidized, medium to stiff, clays and silty clays having relatively low water content and high strength. Located beneath marsh, swamp, and natural levee deposits are interdistributary deposits. Interdistributary deposits are up to 200 feet thick and are characterized by very soft to soft clays with some silt and shells. Interdistributary deposits have relatively high water content and low strength. Prodelta deposits are generally found beneath interdistributary deposits. They are composed of medium clay with relatively low water content and moderate strengths. Prodelta deposits are up to 120 feet thick in the deltaic plain. Prodelta clays sit stratigraphically above Pleistocene deposits. Pleistocene deposits represent the best foundation material in coastal Louisiana. They typically consist of interbedded, highly oxidized, stiff to very stiff, clay, silt, silty sand, and sand. These deposits have low water content and high strengths. In the central portion of the deltaic plain, where the ancestral

Mississippi River entrenchment is located, substratum sands are located beneath prodelta deposits. A cross section showing an example of deltaic plain geology is shown in figure 6.

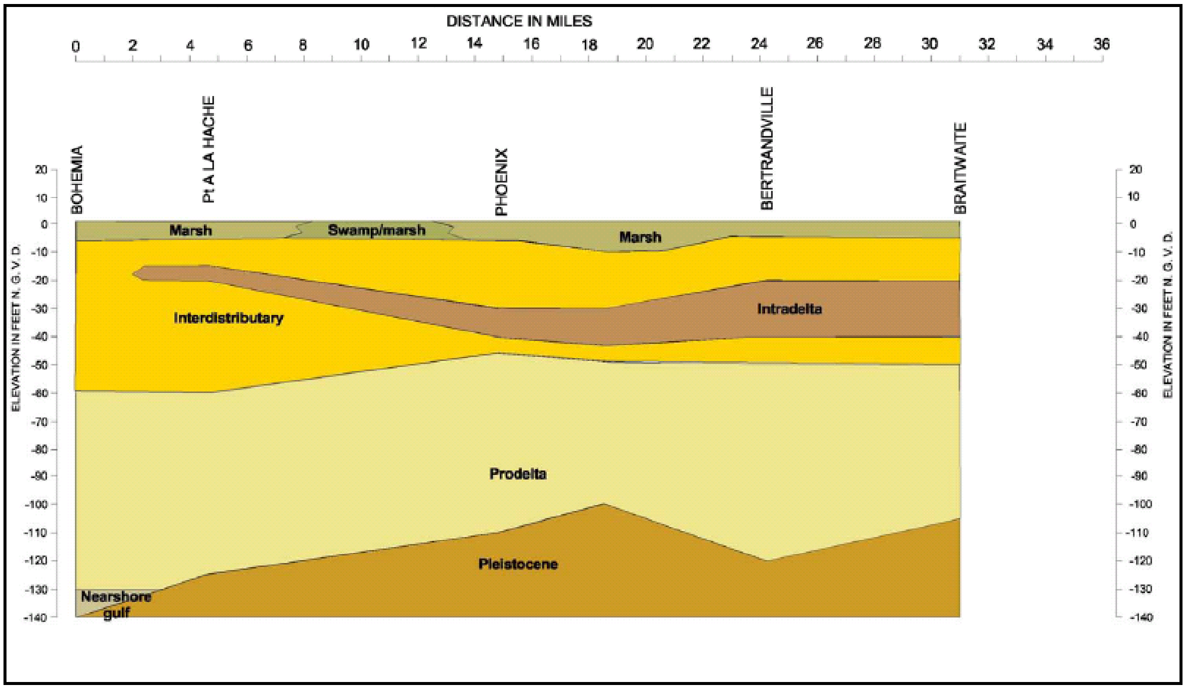


Figure 6 - Deltaic Plain

In contrast to the deltaic plain, the chenier plain formed by longshore transport of fine-grained Mississippi River sediments that were deposited to the west of the deltaic plain. These sediments, transported by westward flowing nearshore currents, were eventually deposited along the existing shoreline as mudflats. When deposition ceased or declined due to shifting Mississippi River courses, these deposits were reworked by coastal processes, concentrating the coarse grained sediments, and forming shore-parallel ridges called “cheniers” (Gould and McFarlan, 1959; Byrne et al, 1959). Introduction of new sediment by westward shifts of the Mississippi River delta resulted in the isolation of these ridges by accretion of new material on the existing shoreline. Numerous cycles of deposition and erosion have been responsible for creating the alternating ridges separated by marshlands, which are characteristic of the chenier plain. The Atchafalaya River is currently supplying the chenier plain with fine sediments via westward flowing longshore currents.
In the northern portion of the chenier plain, marsh deposits up to 10 feet in thickness overly Pleistocene deposits. In the southern half, chenier ridges up to 10 feet thick, composed of sand and shell material separated by marsh deposits approximately 5 feet thick, overly approximately 20 feet of lacustrine, tidal flat, and Gulf bottom clays. These clays are generally soft with relatively high water contents and low strengths. These clays sit directly on Pleistocene deposits. A cross section showing an example of chenier plain geology is shown in figure 7.

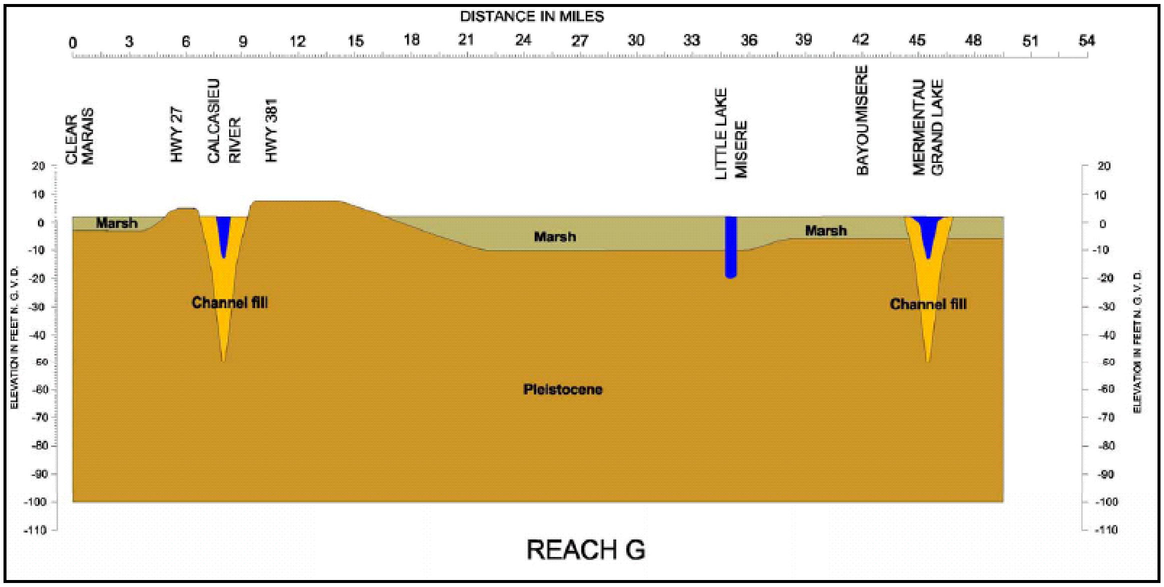


Figure 7 - Chenier Plain

Groundwater

Groundwater is at or near the surface throughout most of the coastal zone. The silt and sand rich depositional environments such as point bar, intradelta, natural levee, beach, and nearshore gulf are generally connected hydraulically to the adjacent water body (i.e. river, lake, distributary channel) and the groundwater level in these deposits generally reflects the level/stage of the adjacent water body. This is especially true in deposits adjacent to the Mississippi and Atchafalaya Rivers.

Numerous deep regional aquifers exist in South Louisiana. The coastal lowlands aquifer system of Louisiana consists of alternating beds of sand, gravel, silt, and clay deposited under fluvial, deltaic, and marine conditions. The aquifer system is comprised of sediment from late Oligocene age to Holocene that thicken and dip toward the Gulf Coast. The sediments are highly heterogeneous with sand beds that are not traceable for more than a few miles. The Chicot aquifer underlies most of southwestern Louisiana and extends from central southwestern Louisiana to the Gulf of Mexico and from Sabine Lake to St. Mary Parish. The Chicot aquifer is up to 800 feet thick at its most northern extent and extends to an unknown depth beneath the Gulf of Mexico. The Southeastern Louisiana aquifer system, also known as the Southern Hills aquifer system, consists of about 30 named aquifers. The Southeastern aquifer extends approximately from the Mississippi River to the Pearl River in Louisiana. The aquifers range in thickness from 50 to 1100 feet with thickness increasing toward the south.

Relative Subsidence

The entire coastal zone is experiencing relative subsidence. Relative subsidence is defined here as the net effect of numerous processes that result in the downward displacement of the land surface relative to sea level. Relative subsidence is controlled by several factors which include eustatic sea level, geosynclinal downwarping, compaction of Holocene deposits, and faulting. Recent studies have shown that subsurface fluid withdrawal (oil, gas, water) may also be a major contributor to relative subsidence and resulting wetland loss (Morton et al, 2002). An important man-made contributor to relative subsidence is drainage for agriculture, flood protection, and development.

Eustatic sea level refers to the global fluctuations in sea level primarily due to changes in the volume of major ice caps and glaciers, and expansion or contraction of seawater in response to temperature changes. Recent studies have predicted an increase in the rate of eustatic rise due to global warming (IPCC, 2001).

Downwarping of the Gulf Coast Geosyncline accounts for a small percentage of the observed relative subsidence in coastal Louisiana (Kolb and Van Lopik, 1958). For millions of years, fine sediments have been deposited along the continental margin downwarping the basement and creating a gradually subsiding trough. The downwarping continues as new sediments are added to the basin.

Compaction of Holocene deposits has been considered the primary contributor to relative subsidence in the coastal plain. The three major components of Holocene sediment compaction include: 1) primary consolidation, 2) secondary compression, and 3) oxidation of organic matter (Terzaghi, 1943; Roberts, 1985). Primary consolidation occurs as the volume of the soil mass is reduced due to dewatering under a sustained load. Secondary compression results from a decrease in soil volume due to rearrangement of the internal soil structure. Oxidation of organic matter through chemical reactions reduces the soil volume.

Compaction of Holocene sediments varies widely throughout the coastal zone and is closely linked to the thickness and age of deposits. Fine-grained deposits with high water contents characterize the coastal zone. Where the thicker deposits are found, there is more interstitial water available for removal, which leads to high rates of relative subsidence as they compact. Older deposits have already undergone most of the primary consolidation and secondary compression and therefore exhibit lower relative subsidence rates than recently deposited sediments. The age, thickness, and to some extent the type of deposits are responsible for much of the variability in relative subsidence rates across the coast.

Movement on the downthrown side of deep-seated fault blocks is a well documented process in coastal Louisiana. However, their effects on the shallow subsurface and surface are poorly understood. Recent investigations (Gagliano, 2005) have identified likely areas of fault-induced subsidence but the magnitude and spatial extent of their impact are still being investigated. The Baton Rouge fault is probably the best known example of an active fault that has caused some structural damage. This fault crosses the PU1 barrier alignment approximately 6 miles south of Slidell. Most fault planes in coastal Louisiana generally trend east-west and may contribute to increased maintenance at the location where they intersect the alternatives. A minor amount of movement along fault planes can have significant impacts on wetlands where marsh accretion barely exceeds relative subsidence. Figure 8 shows the location of major fault trends of south Louisiana. A more detailed analysis of faulting and the potential for other seismic activity will be conducted during the next design phase of the project.

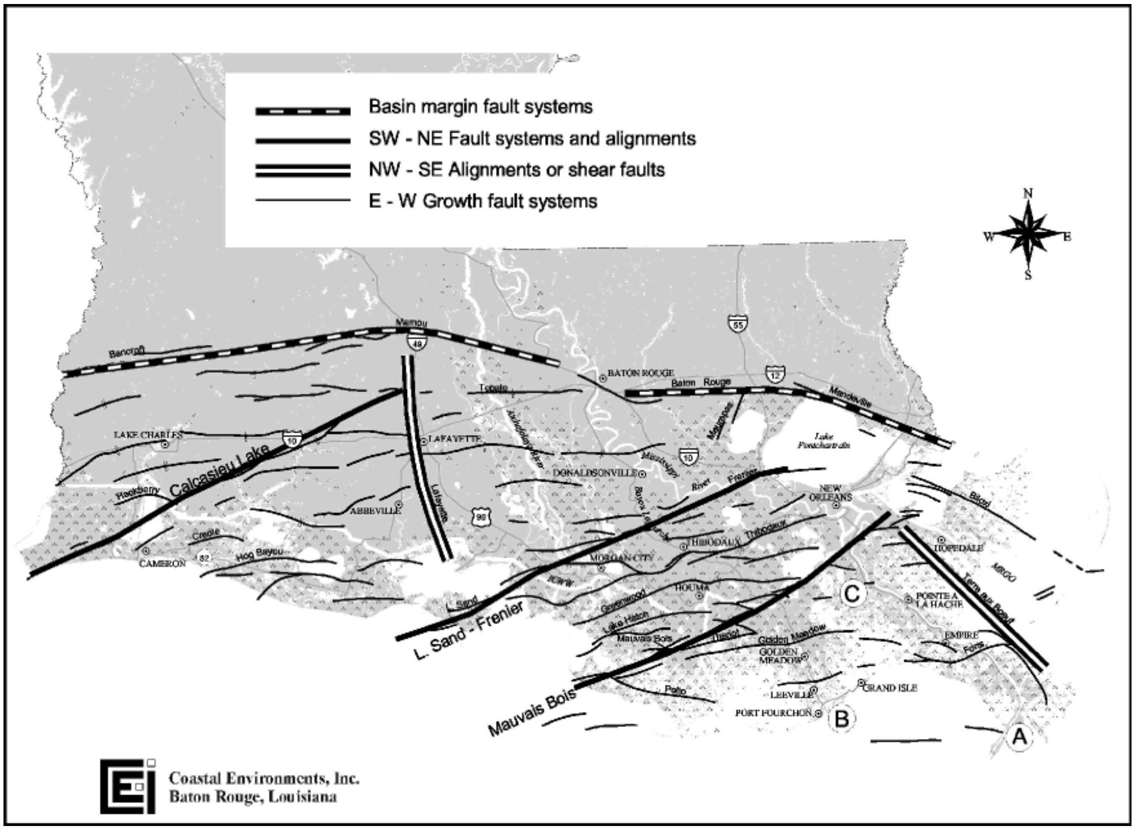


Figure 8 - Major Fault Trends Of South Louisiana

Forced drainage of wetlands results in lowering of the water table resulting in accelerated compaction and oxidation of organic material. Areas under forced drainage can be found throughout coastal Louisiana.

Relative subsidence rates vary considerably across coastal Louisiana. In general, natural rates of relative subsidence are highest near the coast and at the mouth of the Mississippi River where young thick sediments are present. Reported rates range from less than 0.5 feet to over 5.0 feet per century. Relative subsidence rates of several feet have been documented in developed areas of Jefferson and Orleans parishes due mainly to forced drainage. In addition, large areas of coastal land loss are found associated with failed land reclamation projects. Currently, no coastwide system for quantifying and predicting relative subsidence on a regional scale has been established. Therefore, relative subsidence rates are generally estimated using a combination of benchmark leveling, tide gauge measurements, and radiometric dating of buried marsh horizons.

Borrow Sources

Large volumes of clay, silt, and sand will be required for construction of the LACPR alternatives. Because the planning area extends across the entire State, numerous borrow sources will be required. Portions of the levee material will be available adjacent to the new levees but some may need to be hauled from distances of up to 60 miles away. Potential silt and sand sources include the Mississippi, Atchafalaya, and Vermilion Rivers, as well as tidal deltas and offshore shoals in the Gulf of Mexico. Sources of silt and clay include natural levee deposits of past and present Mississippi River courses and Pleistocene terrace deposits.

GEOTECHNICAL DESIGN

General

The large scope of work (from Sabine River to the Pearl River) necessitated a generalized assessment of the geologic foundation conditions in the planning area. The alignment was divided into four similar reaches or areas where the soil layering (stratigraphy) remains relatively consistent (see plates 1 and 2 for the location of these reaches). Soil unit weights and shear strengths of the strata were assigned to each of the four reaches based upon geotechnical engineering experience in the region with various projects in the vicinity. The objective to provide comparisons for three different levels of hurricane risk reduction levees and two different methods of levee design was achieved. Certainly, more detailed designs based upon site-specific foundation conditions will result in cost advantages in some reaches and cost disadvantages in others; however, the level of geotechnical reliability will be greatly enhanced. These site-specific investigations and designs will be conducted during the next phases.

Foundation Design Reaches

The three levels of risk reduction analyzed were for El. +25, +30, and +40. These elevations were selected based on preliminary modeling available at the start of design. It was assumed that the range of elevations covered by these designs (25' to 40') would include most elevations needed for the hurricane risk reduction alternatives. These designs were used to develop costs which were interpolated/extrapolated to determine costs for individual portions of project alternatives depending on the required levee design elevation. Existing ground for all reaches was assumed to be zero for all alternatives for the purpose of foundation design. Reach 1 extended from the Lake Pontchartrain south shore at the Rigolets through Orleans, St. Bernard, Plaquemine, Jefferson, and Lafourche Parishes to Larose, Louisiana and consisted of a 30-foot Marsh deposit and a 30-foot Interdistributary deposit overlying a 60-foot Prodelta deposit and then Pleistocene clay. This reach consisted of the worst soils with regards to shear strength and settlement potential. Reach 2 extended from Larose through Terrebone Parish to Gibson, Louisiana and consisted of a 10-foot Marsh deposit, a 20-foot Interdistributary deposit, a 90-foot swamp deposit and then substratum sands. Reach 2 was considered to be slightly better soils than Reach 1 with regards to shear strength and settlement potential. Reach 3 extended from Gibson through St. Mary and Iberia Parishes to the Cote Blanche Salt Dome and consisted of a 15-foot Marsh deposit and then an 85-foot swamp deposit overlying substratum sands. Reach 3 was considered to be slightly better soils that Reach 2 with regards to shear strength and settlement potential. Reach 4 extended from Cote Blanche through Vermilion, Cameron, and Calcasieu Parishes to the Sabine River and consisted of a 10-foot Marsh deposit overlying Pleistocene clay. Reach 4 also was assumed to encompass from the north shore of Lake Pontchartrain to the Pearl River near Slidell, Louisiana due to similar foundation conditions as in southwest Louisiana. Reach 4 consisted of the best soils with regards to shear strength and settlement potential.

Typical Design Sections

The two methods of levee design considered for each reach were soil-cement columns and geotextile-reinforced embankment. See figures 9 and 10 and plates L-1 thru L-24 for typical sections for each reach. Each of these methods produces reduced berms and less levee footprint than a levee without these improvements. While the geotextile-reinforced embankment produces reduced berms and footprints by reinforcing the embankment, the soil-cement columns actually improve the foundation soils below the levee footprint by the deep mixing of cement in a series of “columns” and drastically improves the shear strength and compressibility of the clay soils.

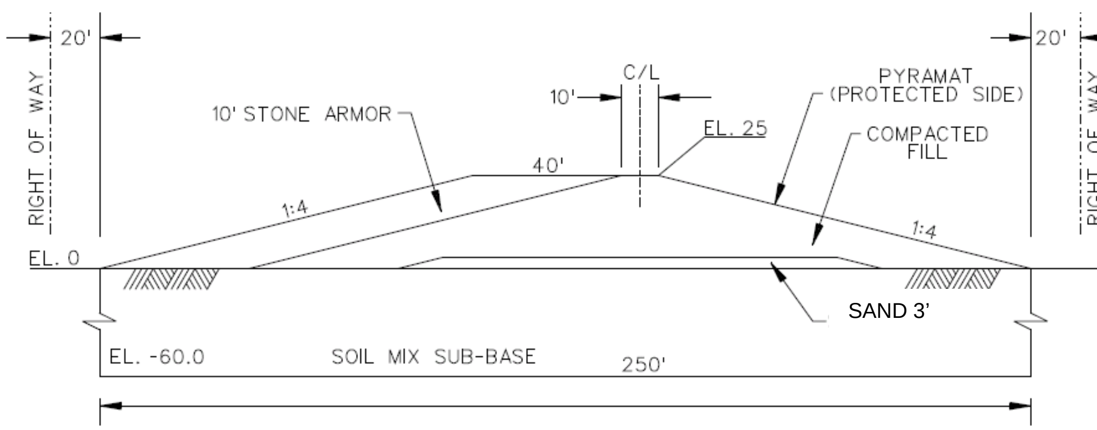


Figure 9 - Typical Soil Cement Section (Clay Fill)

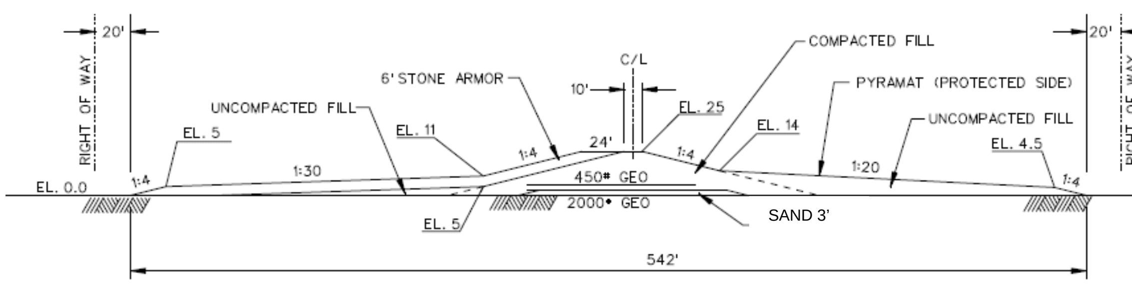


Figure 10 - Typical Geotextile-Reinforced Embankment Section (Clay Fill)

Deep Mixing Technology would be used to inject a binder mixture into the upper soft to very soft soils. In all reaches except Reach 4, a 60-foot depth column was used, while in Reach 4 the depth was reduced to 10-feet due to the presence of shallow Pleistocene clays at this depth. In this case, Type I Portland cement would be used as the binder, although some additives, such as fly ash or lime, could be considered.

Two Deep Mixing processes are commonly used. In the Dry Mix process, the binder mixture is injected into the soil pneumatically through the mixing tool. The natural moisture content of the soil is used in this process to hydrate the cement, which gives the improved foundation its more competent characteristics. In the Wet Mix process, the end result is the same, but the method of mixing the binder with the soil is somewhat different. The binder is first mixed with water and then injected hydraulically. This creates a slurry column, which cures in a way similar to that from the Dry Mix process. Each method has advantages and disadvantages, but either would work for this application.

The costs are approximately the same for the two methods. The dry method requires a much lighter rig, but is limited in depth to approximately 75-feet. The wet method requires less torque, can improve the foundation to depths of approximately 150-feet, and is much quicker, but produces about 20% of the column volume as excess material on the site.

For all reaches and levels of levee embankment, 30% of the foundation soil would be replaced with soil cement columns. The columns would be approximately 2.6-feet in diameter and would be placed in an overlapping pattern in rows 7-feet on center. The rows would extend from the protected-side levee toe to the flood-side toe of the armored rock. Where berms are present and extend beyond the toe, the soil-cement rows would not continue past where the main levee slope on the protected-side or the armored rock slope on the flood-side would have intersected the natural ground if no berms were present. The columns would be installed perpendicular to the levee centerline to serve as hard clay shear walls, and would achieve shear strength of approximately 6,000-psf. The equivalent shear strength of the soil-column matrix beneath the levee would be 2,000-psf for a 30% replacement ratio.

Immediately after the soil cement columns are installed, the compacted earthen levee could be constructed by conventional means. Construction lifts would have to be sequenced during the initial 28 days curing time to prevent overloading the columns before they reach their full design strength. This would be dictated by the site-specific in-situ foundation conditions. After 28 days curing time, the levee could be raised to its full height. A layer of geotextile varying in strength from 1460 to 1640 pounds-per-inch at 5% strain (depending upon the reach) is required for internal stability within the levee embankment only for the El. +40 alternative.

Flood-side slope protection was designed by the Coastal Structures Group of ERDC and consisted of varying thicknesses of rock from the levee crown down to the levee or berm toe. Details of this design can be found in Annex 4 of the Engineering Investigations enclosure to the LACPR Preliminary Technical Report. The rock thickness, since it was considerable, was taken into account for all stability analyses. Although its thickness added to the active loading near the levee crown, it helped the levee stability in the flood-side berms. Therefore, construction of the levee will be staged, such that the levee embankment will be limited to a certain elevation (to be determined during detailed design) until the rock is placed in the flood-side berm, then levee embankment will be allowed to proceed to the final levee grade. Thickness of rock varied from 6- to 7-feet for the geotextile-reinforced levee alternative to 8- to 10-feet for the soil-cement levee alternative. The amount of rock cover is dependent upon the levee and berm slopes; the flatter the slope, the smaller the amount of rock required for protection due the wave-breaking effects of the longer slope. A separator fabric is also recommended between the rock armoring and the levee fill to prevent migration of rock into the fill material and loss of embankment material from wave action. Overtopping protection would also be provided on the crown and protected-side levee slope but was not considered significant enough to include in the stability analyses due to its limited height and extent over the levee. Armoring requirements are being reanalyzed as part of the ongoing Hurricane and Storm Damage Risk Reduction System work and designs will be revised during the next phase of design based on the results of this work.

For both alternative levee designs for all reaches, a three-foot sand base was included to provide a base for construction activities. The sand base was limited in extent such that 10-feet of clay cover would be provided above the sand due to seepage concerns. Compacted clay fill was assumed for all levee and berm material. This will provide the necessary strength for the levee embankment height and for the berm to support the rock armoring protection layer.

The length of geotextile required for each section varied from 75- to 320-feet for the geotextile-reinforced alternative. The required strength at 5% strain of this geotextile varied from 200- to 2,020-pounds-per-inch. In some sections for both geotextile-reinforced levees and soil-cement columns, geotextile reinforcement is required to stabilize the flood-side berm. The length of geotextile required for some sections of the soil-cement alternative varied from 40- to 190-feet, and the required strength at 5% strain of this geotextile varied from 200- to 1,700-pounds-per-inch. This geotextile reinforcement was required for only the internal stability within the levee embankment for only the El. +40 alternative and for the flood-side berm.

All slope stability analyses were performed using the Method of Planes. The flood-side designs provided for a minimum design factor of safety of 1.3. The protected-side designs were evaluated for two water loadings. For the extreme case of water to the levee crown, a minimum design factor of safety of 1.2 was required. For the “operating” case with the water level 10-feet below the levee crown, a minimum design factor of safety of 1.3 was required. The stability analyses for the geotextile alternative are shown on plates G1 to G16 and the stability analyses for the soil-cement alternative are shown on plates G17 to G40 for each of the four reaches and each of the three levee elevations. Only the controlling water load case is shown for the protected-side stability plates.

The Tables 11 to 13 show the required levee footprint for each of the three levee crowns considered. These footprint distances do not include any adjacent borrow pit requirements that may be utilized in areas where feasible and economical. The geotextile-reinforced alternative was not considered practical for the levee El. +40 in Reaches 1 and 2, given the excessive levee footprint of ~1,300-feet required in Reach 3. For levee crown El. +40, the levee required footprints range from 1,040- to 1,280-feet for the geotextile-reinforced alternative and range from 450- to 800-feet for the soil-cement alternative. The required levee footprints for the geotextile-reinforced alternative are 2.3 times larger than the soil-cement alternative.

Table 11
Levee Footprints El. +40

Crown El. +40 / Reach	Geotextile Reinforced Levee Footprint ft.	Soil-Cement Column Levee Footprint ft.
1	--	800
2	--	650
3	1280	550
4	1040	450

For levee crown El. +30, the required levee footprints range from 580- to 1180-feet for the geotextile-reinforced alternative and range from 290- to 440-feet for the soil-cement alternative. The required levee footprints for the geotextile-reinforced alternative range from 2 to 2.7 times larger than the soil-cement alternative.

Table 12
Levee Footprints El. +30

Crown El. +30 / Reach	Geotextile Reinforced Levee Footprint ft.	Soil-Cement Column Levee Footprint ft.
1	1180	440
2	760	340
3	720	290
4	580	290

For levee crown El. +25, the required levee footprints range from 440- to 830-feet for the geotextile-reinforced alternative and are 250-feet for each of the soil-cement alternatives. The required levee footprints for the geotextile-reinforced alternative range from 1.7 to 3.3 times larger than the soil-cement alternative.

Table 13 Levee Footprints El. +25		
Crown El. +25 Reach	Geotextile Reinforced Levee Footprint ft.	Soil-Cement Column Levee Footprint ft.
1	830	250
2	540	250
3	520	250
4	440	250

For all levee sections, both geotextile-reinforced and soil-cement alternatives, thru – levee seepage will not be an issue since levee embankment material will consist of acceptable clay material. When more site-specific geotechnical data are available, more detailed underseepage analyses will be conducted. These data include minimal areas where sand may exist at shallow levels underneath the proposed levee. In those areas where required, seepage berms or relief wells would be considered to provide adequate factors of safety.

Settlement

Foundation settlement is a key component of the estimated levee construction cost, particularly for the geotextile-reinforced levee alternative, which would require numerous lifts to construct to the project design grade. Consolidation and lateral spread of the soft clays in the foundation would produce substantial settlement of the levee foundation. The settlement analyses considered ultimate consolidation settlement based upon empirical values relating liquid limits to the compression index. Additionally, lateral spread was assumed to be 25% of the ultimate consolidation values for the geotextile alternative and 15% for the soil-cement column alternative. Shrinkage settlement was assumed to be 10% of the fill height. The sum of these three values provides an estimate of the ultimate settlement of the levee. For the soil-cement column levee alternative no settlement was assumed within the soil-cement columns themselves, however, settlement in the fill above the columns and the foundations soils below the columns is anticipated and estimated. Tables 14 to 16 summarize the estimated ultimate settlement of the proposed levee.

Table 14 Ultimate Settlement Estimate El. +40		
Crown El. +40 Reach	Geotextile Reinforced Levee ft.	Soil-Cement Column Levee ft.
1	------	10.6
2	------	11.6
3	19.7	7.3
4	9.3	5.0

Table 15 Ultimate Settlement Estimate El. +30		
Crown El. +30	Geotextile Reinforced Levee	Soil-Cement Column Levee
Reach	ft.	ft.
1	20.4	8.3
2	17.4	9.1
3	16.3	5.8
4	7.7	3.8

Table 16 Ultimate Settlement Estimate El. +25		
Crown El. +25	Geotextile Reinforced Levee	Soil-Cement Column Levee
Reach	ft.	ft.
1	17.8	7.2
2	14.7	7.8
3	14.3	5.0
4	6.8	3.2

The geotextile-reinforced alternative produced settlements ranging from 1.9 to 2.9 times larger than those produced with the soil-cement column alternative.

An empirical relationship relating liquid-limit values to coefficient of consolidation (U.S. Navy, 1971) was used to estimate a hypothetical lift construction schedule for the soil-cement alternative. Table 17 summarizes the results of this estimation:

Table 17 **Soil-Cement Column Alternative Settlement - Lift Requirements**			
Reach	El. +40	El. +30	El. +25
1	2 - 6' Lifts @ t= 6 & 20 yrs.	1 - 7' Lift @ t= 9 yrs.	1 -6' Lift @ t = 11 yrs.
2	2 - 6' Lifts @ t= 5 & 20 yrs.	1 - 7' Lift @ t= 6 yrs.	1 - 7' Lift @ t= 7 yrs.
3	1 - 7' Lift @ t= 7 yrs.	1 - 6' Lift @ t= 8 yrs.	1 - 5' Lift @ t= 12 yrs.
4	1 - 5' Lift @ t= 9 yrs.	1 - 4' Lift @ t= 12 yrs.	1 - 3' Lift @ t= 12 yrs.

Reaches 1 and 2 with crown El. +40 are the only ones that require two subsequent lifts. All other reaches and elevations would only require one subsequent lift. Lift heights vary from 3-feet in Reach 4 (El. +25) to 7-feet for Reaches 1 thru 3 at various elevations. The time to first lift varies from 5-years for Reach 2 (El. +40) to 12-years for Reaches 3 and 4 at various elevations.

Tables 18 and 19 show the hypothetical lift construction schedule for the geotextile alternative.

Table 18
Geotextile Reinforced Levee Alternative Settlement - Lift Requirements

Reach	El. +40	El. +30	El. +25
1	N/A	1 - 6' Lift @ t= 1/2 yrs. 2 - 7' Lifts @ t= 3.5 & 14 yrs 1 - 5' Lift @ t= 39 yrs.	1 - 6' Lift @ t= 2 yrs. 2 - 7' Lifts @ t= 8 & 34 yrs.
2	N/A	1 - 6' Lift @ t= 2 yrs. 2 - 7' Lifts @ t= 8 & 34 yrs.	2 - 6' Lift @ t= 2 & 19 yrs. 1 - 5' Lift @ t= 38 yrs.
3	1 - 6' Lift @ t= 1/2 yrs. 2 - 7' Lifts @ t= 3.5 & 16 yrs 1 - 4' Lift @ t= 40 yrs.	1 - 6' Lift @ t= 1 yrs. 2 - 7' Lifts @ t= 8 & 34 yrs	2 - 6' Lift @ t= 4 & 14 yrs. 1 - 5' Lift @ t= 35 yrs
4	1 - 6' Lift @ t= 2 yrs. 1 - 7' Lift @ t= 19 yrs.	1 - 6' Lift @ t= 3 yrs. 1 - 3' Lift @ t= 25 yrs.	1 - 5' Lift @ t= 6 yrs. 1 - 3' Lift @ t= 27 yrs.

Table 19
Geotextile Reinforced Levee Alternative Settlement - Lift Requirements

Reach	El. +20	El. +15
1	1 – 5' Lift @ t= 3 yrs. 2 – 7' Lifts @ t= 15 & 35 yrs.	1 - 5' Lift @ t= 4 yrs. 1 - 6' Lift @ t= 15 yrs 1 - 5' Lift @ t= 35 yrs.
2	1 – 4' Lift @ t= 4 yrs. 2 – 5' Lifts @ t= 18 & 36 yrs.	1 - 4' Lift @ t= 4 yrs. 2 – 3.5' Lifts @ t= 18 & 36 yrs.

In areas where a straddle enlargement of an existing levee and berm is possible, the settlement is overestimated since it is based on zero initial ground surface elevation. Therefore, the number of lifts and the quantity of levee fill material described in this report is overestimated for those areas.

Overtopping Weir Section

An additional section was developed for the overtopping weir in PU1 and PU2. This section is shown on plate L-25 and described under the levee design section of this appendix.

Hollow Concrete Levee

As part of the ongoing hurricane protection work, as well as the LACPR effort, an evaluation of a hollow concrete levee concept was undertaken. A description of this effort is given in the Innovative Designs Section of this report.

Additional Investigations

The following additional work will be done during detailed design : 1) increase geotechnical reliability with additional borings and CPTs along the proposed alignment, 2) study utilizing higher replacement ratio for soil-cement columns to alleviate berms for all reaches for El. +40 and for Reaches 1 and 2 for El. +30, 3) study the feasibility of adjacent borrow for more economical levee construction and effects upon the levee footprint, 4) perform underseepage analyses in areas where shallow sands may exist to determine if seepage berms, relief wells or other measures are required to reduce seepage concerns, 5) reevaluate settlement for areas where the proposed levee will straddle an existing levee of substantial grade, 6) reevaluate settlement to investigate whether soil-cement levee sections could be economically overbuilt to avoid lift construction, and 7) further investigate different methods of levee construction including investigating the use of different fill materials, investigating the use of aggregate filter stone and performing a more detailed analysis of the concrete levee concept . Costs for these efforts have been included in the E&D portion of the cost estimates.

LEVEE DESIGN

GENERAL

The five planning units were broken down into reaches and sections for ease in comparing alternatives. These sections are shown on plates 1 and 2. Existing LIDAR information was used to develop quantities for both the typical geotextile-reinforced and soil-cement column improvement sections for each reach. Quantities were developed for elevation 25 ft, 30 ft and 40 ft levees.

FLOOD PROTECTION ALTERNATIVES

For this effort, two typical levee sections were considered. The first is a conventional earthen levee utilizing geotextile layers for load distribution and reinforcement for stability. The second is also an earthen levee design, but built upon an improved foundation of soil-cement mix columns. Plates L-1 thru L-24 show typical sections for each reach and elevation.

Geotextile Alternative

The first alternative is a clay levee with geotextile reinforcement located in the center just above the base in two layers. The design levee section has 1V on 4H side slopes and a 10' wide crown. The design heights are 25', 30' and 40'. Floodside and landside stability berms are required to provide stability due to the soft foundation. The floodside slope and berm are protected from wave action by an 6' - 7' thick stone blanket. The levee crown, landside slope and the landside berm are protected from erosion with a high performance turf reinforcement mat anchored to the levee and berm designed to hold up under over topping conditions. For preliminary design purposes, the proprietary product Pyramat® was selected as representative of the required quality and performance characteristics. In the reaches where the levee is being constructed over wetlands a 3' sand base is placed down the center of the levee to provide a construction platform. Under the poorest foundation conditions the footprint widths for the 25', 30' and 40' high levees are approximately 830', 1180' and 1280' respectively. This alternative at the 40' design height is not practical to build in soils Reaches 1 and 2 due to severe settlement that would be experienced in the compressible soils.

Soil Mix Alternative

The second design alternative is a clay levee supported by cement soil columns. The columns would be approximately 2.6-feet in diameter and would be placed in an overlapping pattern in rows 7-feet on center. The depth of the columns for the best soils condition is 10' and in the poor soils it is 60'. The columns extend between the levee toes for levees without stability berms. Where there are stability berms the soil columns extend approximately 40' past the levee toes. The design section is also 1V on 4H with a 10' wide crown and the design heights are 25', 30' and 40'. On the poorest foundations stability berms are required for the 40' and 30' levees but for the 25' levee stability berms are not required. On the best foundation conditions stability berms are required for only the 40' levee and only on the protected side. The use of geotextile reinforcement is limited to a single layer located in the center just above the base of the levee and only for the 40' high levee. The flood side levee slopes and berm are protected by an 8' – 10' thick blanket of stone. On levees without flood side stability berms the stone blanket is increased to 10'. Under the poorest foundation conditions (reach 1) the footprint widths for the 25', 30' and 40' high levee are approximately 250', 440' and 800'. The levee crown, landside slope and the landside berm are also protected from over topping with a high performance turf reinforcement mat.

The levee alignment along the south shore of Lake Pontchartrain in Jefferson and Orleans Parish requires the levee foot print and flood side berms to extend out over the water. In such conditions only sand is used in the berms under the rock armor. In addition a sand working platform is constructed to above the lake level under the levee.

Levee Design for Overflow and Overtopping

This levee alternative is another form of the geotextile alternative constructed to an elevation of 12.0' to facilitate overflow and overtopping by the storm surge and temporary retention of the storm surge. The geotextile reinforcement is still located in the center just above the sand base. The design levee section has 1V on 4H side slopes and a 10' wide crown. The floodside and landside stability berms are required to provide stability due to the soft foundation. The floodside levee slope is protected from wave action by a 7' thick stone blanket with a 5' thick rock berm extending 25' beyond the armor blanket. This rock berm serves as a combination stability and wave berm. The landside of the levee has a 5' thick rock berm extending 70 feet from its intersection with the levee landside slope. This berm also serves as a landside stability berm and as armor for the overflow and overtopping. The levee crown and landside levee slope above the landside rock is protected from erosion with a high performance turf reinforcement mat anchored to the levee designed to hold up under overflow and overtopping conditions. For preliminary design and cost purposes, the proprietary product Pyramat® was selected as representative of the required quality and performance characteristics. Investigations have been initiated as part of the current storm damage reduction system work to determine what is the best method for protection from overtopping and erosion. The results of these studies will be incorporated during detailed design. A typical section of this levee section is shown on plate L-25. This levee section will be used in two reaches. The first is across the opening between Lake Pontchartrain and Lake Borgne. The second reach extends along the south side of the GIWW between Larose and Belle Chasse.

CONSTRUCTION CONDITIONS

For this effort, the planning area is divided into four soils reaches with Reach 1 having the poorest foundation condition and improving through Reach 4, which has the best foundation condition. Foundation conditions generally improve from east to west across the coastal area of south Louisiana from the Mississippi River delta to the Sabine River. Soil conditions are generally better in southwest Louisiana, where the underlying, firmer Pleistocene soils are found closer to the surface.

Another factor influencing construction conditions is the location of levee design alignments between wetlands and land above sea level, either distributary ridges or the Pleistocene prairies that are found in Reach 4. The largest portion of proposed levee alignments falls in wetlands including parallel borrow pits. The second group of design alignments falls along the interface between wetlands and ridges or prairies, with the levee footprint falling in the wetlands and the parallel landside borrow areas falling on higher ground. For the final set of design alignments, both levee and borrow pits are on high ground.

Constructing levees completely founded in wetland requires a sand base along the levee centerline to serve as construction access and a dry working platform. This is typical of the levee alignments along the GIWW and south of the GIWW. In soils Reach 4 located west of New Iberia, the good foundation soils are close to the surface in the wetlands. For preliminary design, 80% of the required quantity of earthen levee material is assumed opposite cast with 20% hauled in from 30 miles away from the Pleistocene prairie. Proposed levees east of New Iberia (reach 3) located totally in wetlands have a lower percentage opposite cast: around 40% with 60% haul. East of Golden Meadow (reach 1) the percent goes to 20% opposite cast and 80% haul with haul distances of 50 to 60 miles round trip. Sand for construction access is assumed to be barged from the Atchafalaya River area or Mississippi River. Truck haul to construction sites from the barge to placement is short since waterways run alongside or near the levee alignments. Levee alignments east of Golden Meadow (reach 1) will use sand from the Mississippi River and those to the west (reach 2 and 3) from the Atchafalaya River area. Stone armor will be barged in from out of state and will follow for the most part the same access used for the sand levee base from the point of barge delivery.

Construction along the interface between wetland and highland has the levee located on wetland which requires the placement of a sand base for access and to provide a working platform. Most of the borrow falls alongside and parallel to the levee on the protected side which is dry. High percentages of opposite cast are assumed (80% to 90%). The balance required material is assumed truck hauled for a 20-mile round trip from the tributary ridges or Pleistocene prairie. Alignments in Plaquemines Parish (reach 1) have extremely limited local borrow sources resulting in an estimated round trip haul of 120 miles. The greatest portion of sand will be barged to the approximate area of the job site since few waterways are near these alignments. Truck haul from the barge drop off ranges from 20 to 80 miles round trip. Alignments near the Atchafalaya River (reach 3) and Mississippi River (reach 1) sand sources will use truck hauls with 10 to 20 mile rounds trips. Armor stone will be barged in from out of state utilizing access similar to sand, where the material is moved by barge to the approximate area of the construction site.

Levees constructed on Pleistocene soils found in Reach 4 have their alignments approximately following the 10' contour in the southwest part of the state. Favorable soil conditions classified as Reach 4 also occur at an additional short reach on the eastern end of the levee alignments on the north shore of Lake Pontchartrain. All of these levees will be constructed using 90% opposite cast and 10% truck haul with a round trip of 10 miles. Borrow pits are all located on Pleistocene soils. Sand is not required for construction access on these alignments. Armor stone for these alignments is truck hauled between 10 and 20 miles round trip from the nearest waterway which allows barge access.

AVAILABILITY OF BORROW

While assumptions have been made regarding the availability of local borrow for levee construction, this is a critical construction issue that warrants much closer analysis. The quantity of material required to build even the shortest of the proposed alignments will be in the hundreds of millions of cubic yards. Finding such a quantity of suitable material in south Louisiana would be difficult as well as environmentally undesirable. One alternative to reducing the need for clay borrow from wetlands is to reconfigure the levee design cross section to use more sand and at the same time maintaining a 10' to 15' clay cap over the sand to prevent wash out of the sand core. This will be further investigated during detailed designs.

STRUCTURES

GENERAL

No hurricane protection project could span coastal Louisiana without crossing dozens of navigable waterways, distributaries, urban drainage canals, and roadways. For the LACPR effort a set of typical structures were designed using a parametric approach to parallel the levee design effort. Details of these designs can be found in the report titled "Preliminary Technical Report for the Louisiana Coastal Protection and Restoration Study Structural Components" dated May 2006. With final grades unknown until hydraulic analyses were completed, the team developed schematic designs for the necessary structures to assumed elevations of 30, 35 and 45 feet. These elevations were selected based on the results of preliminary modeling, assuming that the structures would need to be higher than the surrounding levees because of hydrodynamic design conditions. Invert elevations were also assumed based on existing surveys and other existing data.

Structures designed for LACPR generally fall into the following categories: sluice gate structures, sector gated structures, roller/swing gate structures, tainter gated structures, butterfly gate structures, locks, box culvert structures, new pumping stations, and hardening and fronting protection for existing pumping stations. A description of each type of structure is shown below. Plates S1 – S23 show typical sections and other details. Table 20 shows the number and type of structures identified for the evaluated alternatives in each planning unit. This listing does not including existing and new pumping stations.

Table 20
Structures Identified By Planning Unit

Planning Unit	Structure Type	Number of Structures
1	56' Sector Gate	9
	Tainter Gate	2
	Butterfly Gate	1
	110' Sector Gate	4
	Sluice Gate[2]	3
	Road and Railroad Gates	17
2	56' Sector Gate	2
	Tainter Gate	2
	110' Sector Gate	4
	Road and Railroad Gates	8
	110' Lock	1
3a	56' Sector Gate	16
	Tainter Gate	2
	110' Sector Gate	4
	Sluice Gate	12
	250' Sector Gate	2
	110' Lock	2
3b	56' Sector Gate	3
	110' Sector Gate	14
	Sluice Gate	6
4	56' Sector Gate	7
	Tainter Gate	1
	110' Sector Gate	5
	Sluice Gate	9

[2] Number of sluice gates does not include environmental structures.

SLUICE GATE STRUCTURES

Drainage structures with sluice gates will provide drainage through the flood protection at various locations within the planning area (see plate S-7). Each structure will consist of a pile founded, reinforced concrete structure with trash screens, operating platforms, and provisions for dewatering. A 24-foot wide roadway will provide access across the structure. The sluice gate structures will connect into the existing flood protection on each side of the structure with a T-wall. The concept for these structures was taken from the 2003 Morganza to the Gulf of Mexico, Bayou Grand Caillou Alternative Study. The sluice gates will have the capability to be operated manually or will be mechanically actuated with portable motors.

Three different structures of this type are included. One will have 4 - 10' x 10' sluice gates, an invert of El. –12.0 and will be utilized at several locations along the alignment. A second structure of this type will have 4 or 5 – 8' x 10' gates and an invert at El. –8.0. This structure will be utilized at locations where the intersecting waterways that are smaller and shallower. These structures are also provided at locations where previous studies envisioned the use of multi-barreled box culverts. Given the levee sizes considered for LACPR, a pile founded, sluice gate structure appears to be much more practical and cost effective than long box culverts under wide and tall levees. A third type of sluice gate structure will be provided where only a few small openings are required to pass drainage flows. This structure will be a modified, inverted T-wall monolith with 5' x 5' surface mounted gates and an invert at El. –5.0. The number of gates at each site will be based on the flow requirements.

A detailed load analysis, considering both vertical and horizontal loads, was performed on each of the typical sluice gate structures for each of the three levels of risk reduction. For the T-type structure, the analysis considered an inverted T-wall structure with the top of the base at El. –5.0 and an increased wall depth to accommodate the gated openings at the base of the wall.

A foundation plan was developed for these structures using the USACE program CPGA (X0080) and the calculated vertical and horizontal loads. Typical pile capacities were assumed to be in excess of 100 tons per pile and were based on foundation capacities presented herein with a factor of safety of 3.0 for this level of analysis. Minor overstresses were allowed in the foundation piling.

SECTOR GATE STRUCTURES

Sector gated structures will provide flood protection (closure) during storm events while allowing normal navigation at many of the waterways intersecting the flood protection alignment (see plates S-8 to S-15). These structures were sized based on the apparent width of the existing waterway. The sill elevation at each location was selected based on the prevailing bottom elevation at the site and is typically either El. –9.0 or El. –15.0. Standard sector gate widths of either 56 feet or 110 feet were used. A special structure that is 250 feet wide with a deeper sill will be provided at the Houma Navigation Canal where larger vessels are anticipated. Each sector gate structure will be a pile founded, reinforced concrete structure at the required sill elevation and width to maintain navigation in the waterway. Double sector gates were provided at waterways with the highest levels of navigation and/or at major waterways where the number of vessels seeking safe harbor would be the highest (see plates S-16 to S-17). The double-gated structure will accommodate the higher traffic volume in either case. The structure will have emergency and/or maintenance stop logs and separate control houses on each wall. A timber guidewall with a protective cellular dolphin at the end will be provided on both sides of each approach channel to the structure.

A detailed load analysis, considering both vertical and horizontal loads, was performed on a typical interior monolith for several of the required sector gate structures. The detailed analyses considered two of the three levels of risk reduction. A foundation plan was developed for these structures using graphical methods and the calculated vertical and horizontal loads. Given the scope of LACPR, minor over-stresses were allowed in the foundation piling. Pile capacities were based on foundation capacities presented herein with a factor of safety of 3.0.

SPECIAL SECTOR GATE STRUCTURES

Special, 250-foot wide sector gated structures are assumed as part of the closure and flood protection at the Houma Navigation Canal (HNC) waterway to provide for the navigation needs in these waterways. The sill elevation was selected based on the prevailing bottom elevation at the site, El. –20.0 at the HNC. Each sector gate structure will be a pile founded, reinforced concrete structure at the required sill elevation with the appropriate width to maintain navigation in the waterway. The structure will have emergency and/or maintenance stop logs and separate control houses on each wall. Due to the nature of the navigation in these waterways, a cellular, concrete guidewall with protective dolphins at the end will be provided on both sides of each approach channel. These guidewalls will also be longer than those provided at the typical sector gated structure. At these locations, the overall depth of the structure will necessitate the use of adjacent, non-overflow sections until the channel slope becomes high enough to use conventional T-walls for the tie-in to the adjacent levees. At the deeper structures, with sill elevations at or below El. –20.0, the use of floodwalls is not adequate to “span” between the deep primary structure and the shallower foundation for the floodwall structure. Given their overall height, these structures must resist lateral loads nearly as high as the primary structure. The non–overflow monoliths are substantial structures with wide bases to bridge the deeper sections of the channel and/or excavation until the use of the standard floodwalls was deemed appropriate.

The main structure is envisioned as a single segment to be floated into position, however the adjacent non-overflow sections and the tie-in floodwalls were considered to be floated into position in separate phases after the navigation structure has been completed enough to allow for some minimal navigation. The basis for this method of construction is the construction plan for the Inner Harbor Navigation Canal (IHNC) Lock Replacement.

A detailed load analysis, considering both vertical and horizontal loads, was performed on the structure required for an El. 45.0 level of protection. A foundation plan was developed for these structures using graphical methods and the calculated vertical and horizontal loads.

Pile capacities were based on foundation capacities presented herein with a factor of safety of 3.0.

TAINTER GATE STRUCTURES

Tainter gated structures will be provided as part of the closure and flood protection at the larger waterways (see plate S-18). These structures were sized based on the available flow area in the existing waterway. The sill elevation at each location was selected based on the prevailing bottom elevation at the site. Tainter gate widths of either 50 feet or 63 feet were used in this study. The gate radius was determined using the required sill elevation at the anticipated location of the trunnion girder. The basic layout for the tainter gate structures will be similar to the Old River Auxiliary Control Structure and the Red River Waterway dams. Each tainter gated structure will be a pile founded, reinforced concrete structure at the required sill elevation with the appropriate number of steel tainter gates with post-tensioned anchorages to maintain the flow conditions in the waterway. A two-lane highway bridge will be incorporated into the structure for access and maintenance. The structure will have emergency and/or maintenance stop logs, an exposed cantilevered machinery platform and four cellular dolphins to serve as guardwalls for the structure. The location and size of the tainter gated structures are shown in Table 21.

TABLE 21
SUMMARY – TAINTER GATED STRUCTURES

STRUCTURE LOCATION	PLANNING UNIT	SILL ELEVATION	GATE WIDTH	NUMBER OF GATES
Bayou Grand Caillou	3a	-12.0	50 feet	4
Bayou Perot	2	-16.0	50 feet	16
Mermentau River	4	-12.0	50 feet	5
Vermillion River	3b	-12.0	50 feet	4
Calcasieu River	4	-25.0	63 feet	8
Chef Pass	1	-25.0	63 feet	12
Rigolets Pass	1	-30.0	63 feet	15

A detailed load analysis, considering both vertical and horizontal loads, was performed on a typical interior monolith for several of the required tainter gate structures. The detailed analyses considered two of the three levels of risk reduction. A foundation plan was developed for these structures using the USACE program CPGA (X0080) and the calculated vertical and horizontal loads. Minor over-stresses were allowed in the foundation piling. Typical pile capacities were assumed to be in excess of 110 tons per pile and were based on foundation capacities presented herein with a factor of safety of 3.0.

BUTTERFLY GATE STRUCTURE

A butterfly-gated structure will be provided at the Rigolets Pass as part of the closure complex for Lake Pontchartrain at this location (see plate S-19). This structure was sized based on the available flow area in the Rigolets and is presently deemed necessary to allow for flows through the Rigolets for as long as possible. The sill elevation at the Rigolets was selected based on the prevailing bottom elevation in the channel. Butterfly gates open and close on their own in response to head and flow conditions due to the offset pintle location. The butterfly gate design allows for the automatic operation of the gates in case of a reversal in the direction of flows through the pass thus allowing for continual uninterrupted flow through the Rigolets Pass.

The tainter and butterfly gated structures at this location will be constructed separately so as not to cutoff flow through the pass. The structure will be constructed in the dry with a series of sheet pile cells for the cofferdam. The assumed number of gates across the pass was based upon a rough calculation of the end area of the pass at the nearby U.S. Hwy 90 bridge as presented in the 1973 Lake Pontchartrain and Vicinity Barrier Plan, Rigolets Control Structure and Closure Plan DDM. The concept for the butterfly-gated structure will be similar to that presented in the 1989 Lake Pontchartrain & Vicinity, High Level Plan, London Avenue Outfall Canal GDM.

The structure will be a pile founded, reinforced concrete structure at the required sill elevation with steel butterfly gates to maintain the flow conditions in the waterway. A two-lane highway bridge will be incorporated into the structure for access and maintenance. The structure will have emergency/maintenance stop logs and 4 cellular dolphins to protect the structure.

A typical section of a butterfly-gated structure is depicted on plate S-19.

A detailed load analysis, considering both vertical and horizontal loads, was performed on a typical interior monolith with 2-40-foot wide bays and 12-foot wide divider piers. The detailed analyses considered two of the three levels of risk reduction. A foundation plan was developed for the structure using the USACE program CPGA (X0080) and the calculated vertical and horizontal loads. Typical pile capacities were based on foundation capacities presented herein with a factor of safety of 3.0.

ROLLER/SWING GATE STRUCTURES

Preliminary design considerations indicated that the use of swing gates was not practical for the various gate sizes under consideration. The gate hinge loads for this type of gate would be quite excessive due to the large gate weights and, in addition, moving such a large gate in windy conditions was deemed impractical and dangerous. For these reasons, all required highway and rail crossing structures were evaluated as conventional roller gate structures with both a combined storage monolith and tie-in floodwall structures on each side to transition into the full levee section (see plates S-20 and S-21).

Each gate will be supported by a pile founded, reinforced concrete base and walls. A cursory load analysis, considering both vertical and horizontal loads, was performed on a typical roller gate structure for each of the three levels of risk reduction. A foundation plan for the gate and storage structure, using 24-inch diameter pipe piles, was developed for these structures using graphical methods. Standard T-wall monolith costs for each design level, based on the required levee transition lengths, were included in the cost estimates for each structure. Since these structures will be constructed at grade, no costs for cofferdams were included in the estimates for the gated structures. Costs for highway bypasses, traffic control and signage and for repaving were also included in the estimate. Costs for both 32 and 34-foot wide gate openings and sill elevations at +4.0 and +8.0 were determined. Where the standard 32-foot structure width and/or sill elevation varied, costs were estimated by using factors to revise the items affected by the changes. At locations where 40-foot wide gates were required at rail crossings, the costs for highway bypasses and paving items were deleted and costs for the added width and both track falsework, on two track lines, and required railroad insurance were added.

SECTOR GATED LOCK STRUCTURES

Sector gated lock structures will be provided as part of the closure and flood protection at almost all of the larger, navigable waterways (see plates S-22 to S-28). The sill elevation at each location was selected based on the prevailing bottom elevation at the site. A lock width of 110 feet was generally used in this study. The gate monoliths at each lock structure will be a pile founded, reinforced concrete structure at the required sill elevation. The floodside gate monolith will extend to the required study elevation and will also serve, along with the tie-in floodwalls, as the main line of protection. The lock walls for the protected side gate and the lock chamber will extend only up to El. 9.0. In general the chamber sections will be earthen with timber guidewalls with rock dikes and riprap for scour protection. At Amelia and Calcasieu the design assumes a pile founded concrete chamber section. Each gate structure will have emergency and/or maintenance stop logs and separate control houses to operate the gates. Timber guidewalls and cellular dolphins that serve to protect the guidewalls will be provided on both sides of each approach channel.

A detailed load analysis, considering both vertical and horizontal loads, was performed on each of the gate monoliths at each lock. The detailed analyses considered two of the three levels of risk reduction. A foundation plan was developed for these structures using graphical methods and the calculated vertical and horizontal loads. Given the scope of the study, minor over-stresses were allowed in the foundation piling. Typically, steel pipe piles were used for the taller, floodside gate monoliths while 14” square prestressed concrete piles were provided for the foundations for the protected side gate monolith. Pile capacities were based on foundation capacities presented herein with a factor of safety of 3.0.

INVERTED “T” TYPE WALLS

Each T-wall structure will consist of a wide concrete base with walls to the required study elevations and will be supported by either 24 or 30-inch diameter pipe piles of the length required to develop the appropriate pile capacity (see plate S-6). The use of 30-inch piles is currently limited to the designs for protection to El. 45.0. A detailed load analysis, considering both vertical and horizontal loads, was performed on a typical 60-foot long monolith for each of the three levels of risk reduction. Horizontal loadings considered included both water to the top of the wall and unbalanced soil loads applied at the base. The wall design considered an impact force of 250-kips, applied at the top of the wall and spread out over a 5-foot width at the point of impact. A more accurate assessment of vessel impact will be required for the design criteria at each structure location. Wave loads were not considered at this time, but the final design will incorporate these loads and, quite possibly, a re-curve type of wall to better distribute and minimize the required wave forces.

A foundation plan was developed for these structures using the USACE program CPGA (X0080) and the calculated vertical and horizontal loads. Given the scope of the study, minor over-stresses were allowed in the foundation pilings. Typical pile capacities were assumed to be in excess of 100 tons per pile and were based on foundation capacities presented herein with a factor of safety of 3.0.

INNOVATIVE DESIGNS

HOLLOW CORE LEVEES

As part of the ongoing hurricane protection work, as well as the LACPR effort, an evaluation of a hollow concrete levee concept was undertaken. Details of this evaluation can be found in the report titled “Concrete Levee and Concrete Sliding Flood Gate Concept Evaluation” dated 30 March 2007. The concept of the hollow concrete levee system is such that the section fills with water from the bottom as the storm surge rises. The combined weight of the concrete frame and its water filled voids inside the frame result in a gravity structure that is designed to resist hydrostatic forces and impact forces from vessel collision.

The hollow concrete levees are comprised of trapezoidal shapes similar to that of earthen levees. The levee superstructure sections are comprised of sloped side walls with a flat bottom slab with access to the interior via steel grating or manholes in the crest. Water inlets or ports are incorporated into the cross section near the levee base on the flood side to allow the section to flood with water to contribute to the overall weight for stability purposes. Shear keys in the base were designed to protect against sliding under design loading conditions. The substructure consists of a concrete base slab or pad that will be supported by steel pipe piles. It is anticipated that excavation and granular backfill will be required to construct the pile supported concrete pad. The concrete base slab serves a two-fold purpose. It distributes loads to the pile foundations as well as serves as a “roadway” for cast-in-place construction. A typical section is shown in figure 11.

Table 22 shows a summary of the probable cost of construction and the construction duration. These costs do not include O&M, Real Estate, environmental impacts, wetland mitigations, or other site-specific considerations.

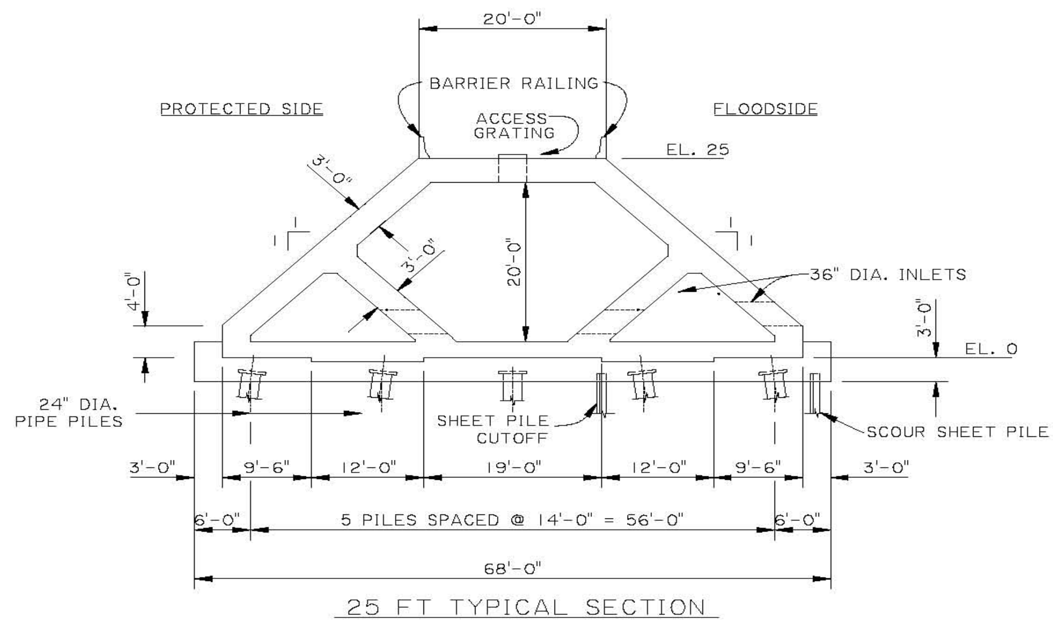


Figure 11 - Hollow Concrete Levee Section

Table 22 Summary of Concrete Levee Cost and Duration		
Description	**Cost**	**Duration**
Concrete Levee		
. 25' Crest Height	$287,485,000/mile	16 months/mile
. 30' Crest Height	$343,040,000/mile	17 months/mile
. 40' Crest Height	$510,576,000/mile	21 months/mile

COMPARISON OF BARRIER OPTIONS

A cost comparison was done among concrete levee, geotextile and soil mix levee sections. The comparison was done between costs per mile for sections in soil reach 1 which has the worst soil conditions. The results of this comparison are shown in table 23. Although for this comparison the total costs per mile are less for the soil mix section other factors should be taken into consideration when deciding which type of levee construction to use. The levee footprint of the concrete section is less than that of the soil mix or geotextile section. This can make a big difference in environmental impacts and real estate concerns. The initial construction time of the concrete section is shorter than the soil mix section. No additional lifts are needed for the concrete section. A disadvantage of the concrete section is that it can't be easily raised to account for future conditions (relative sea level rise and degrading coastline). Because there is such a range in conditions along the proposed levee alignments it is anticipated that all of these levee types may be used for construction. During detailed design a decision will be made as to what type of levee construction is the best for each levee section based on location (environmental and real estate impacts, geotechnical conditions), required levee elevation, cost and any other pertinent factors.

Table 23
Cost and Footprint Comparison Among 30' Soil Mix, 30' Geotextile and 30' Concrete Levee

Type	Construction Cost ($/mile)*	Levee Footprint (ft)
30' Soil Mix	226,886,664	568
30' Geotextile	418,882,469	1,433
30' Concrete	343,040,000	228

*Costs include initial construction and future lifts

COASTAL RESTORATION FEATURES

GENERAL

Coastal restoration measures are included as part of the comprehensive protection plan. A group of coastal restoration measures were developed by the Habitiat Evaluation Team (HET). These measures were put together to develop alternative coastal restoration plans. The goal of these coastal restoration plans is to sustain the current coastline to maintain the current level of hurricane and storm damage risk reduction. Details of how these measures and alternatives were developed can be found in the Coastal Restoration Plan Component Appendix.

One of the alternative plans was selected as a representative plan for use in the Multi Criteria Decision Making Analysis (MCDA). Designs and costs were developed for those measures contained in the representative plan. Details of the design and cost of all coastal restoration features can be found in Annex 1 (Coastal Restoration Features).

MARSH CREATION AND RESTORATION

Designs and cost estimates were developed for marsh creation, ridge restoration, secondary barriers and shoreline protection measures. Cost estimates and implementation schedules were provided. Details of the design and cost estimates can be found in Annex 1.

BARRIER ISLANDS

Several studies have been and are being conducted on restoration of the Barataria and Terrebonne basin barrier islands. These include the ongoing Barataria Basin Barrier Island Feasibility Study. Existing costs and designs were used for where available and new designs and costs were developed when needed.

DIVERSIONS

Freshwater diversions are diversions designed to take river water and its accompanying sediment and divert it into the surrounding areas to create or enhance marsh. Designs and cost estimates were developed for the diversions included as part of the coastal component of the alternatives. See Annex 1 for additional details.

RELOCATIONS

GENERAL

Scope and Purpose

Relocation data was collected and tabulated by the U.S. Army Corps of Engineers, New Orleans District, Engineering Division, Relocations Section, for a feasibility level study. Relocations Section utilized the 1990 Louisiana Pipeline and Industrial Atlas, by Design Technics Corporation and information obtained through the Louisiana Department of Natural Resources, to identify oil and gas facilities located in the planning area. Also used were information gathered while working on previous feasibility studies and site visit information for other projects in the planning area. Relocations Section considered project design features and their effects on existing facilities to determine project relocation requirements. No contacts were made with facility owners.

Estimated Relocation Cost

Cost for relocation of pipelines, roadways, power and communication lines for the alternatives are shown in Annex 4. These amounts include 10% for owner's engineering and design, 8% for owner's contract administration, and 25% contingencies.

DESCRIPTION OF FACILITY RELOCATIONS

Method of Pipeline Relocation

Three methods of relocating affected pipelines were investigated:

(1) Placement of pipelines on the surface of the newly constructed levee.
(2) Construction of permanent pipeline bridges supported by pile founded piers.
(3) Directional drilling.

The conditions influencing the selection of a relocation method include the substantial settlement anticipated by the proposed hurricane protection levee alternatives addressed in this report. The cost of each method was investigated, analyzed and compared for the best method of relocation for each design alternative chosen. Other factors considered in determining the best method include, initial cost, life cycle cost, maintenance, vandalism, potential impacts by future lifts and disruption of service.

Further discussion on the investigated methods of relocation follows:

Placement of Pipelines on the Levee Surface

This method of relocation is typically used for pipelines affected by main line Mississippi River and Atchafalaya Basin levees. Typically, a pipeline is installed on the levee net design section and follows the contour of the levee until it proceeds underground on the floodside and protected sides of the levee. Additional fill producing the gross grade is placed over the pipeline to provide protection. This method presented problems due to the anticipated settlement of levees on which pipelines would rest. Since the levee provides support for the pipeline, the anticipated levee settlement would result in undesirable stresses on the pipeline. The multiple lifts expected to meet project flood protection elevations also raised concerns about multiple relocations, a prospect which would not be welcomed by the pipeline owners. Although the cost for initial pipeline relocation by this method would probably be the least costly, future costs of subsequent adjustments, modifications, and relocations of the pipeline diminish this advantage.

Permanent Pipeline Bridge

This method of relocation involves installation of affected pipelines on bents supported by pile piers. The advantage of this method is that it diminishes the affects of the expected settlement. However, it is possible settlement of the permanent pipeline bridge will also cause stress on the pipeline, requiring additional modification of the bridge. Another disadvantage is that the pipeline is exposed and vulnerable to vandalism. Additionally, the presence of a permanent structure over the levee impedes levee maintenance and construction of future levee lifts.

Directional Drilling

Directional drilling of pipelines under existing levees is an acceptable method of pipeline relocation provided the pipeline is drilled deep enough to avoid fracturing the levee from the pressure of the drilling fluid. To meet geotechnical criteria, pipelines are directionally drilled at least 100 feet under the base of the levee section and selected berm sections to avoid stresses from levee and berm settlement. The pipelines are offset approximately 15 feet from the existing pipeline alignment to allow workspace. The owners will need to perform excavation of a push/false ditch in order to weld together and test the new pipe segments and to utilize this ditch area to pull the pipe back into the hole. The owners will tie the new pipeline into the existing pipeline at each end and remove the old section of pipe in between. The advantage of this method is that it eliminates additional modification and/or relocation in the future. Additionally, the pipeline cannot be vandalized or damaged by levee maintenance or future construction. The initial cost of directional drilling is greater than that of the two previous relocation methods studied. However, the cost of future modification and/or relocations resulting from the use of the previous two methods would most likely make the final relocation costs comparable to directional drilling.

For the purposes of this report, we anticipate pipelines will be directionally drilled to accommodate the levee construction and to avoid any interference with that construction.

HIGHWAYS AND ROADS

The LACPR alternative alignments impact several state and parish highways and roads. In some cases, information was obtained from the applicable transportation agencies to determine the physical characteristics of their existing facilities as well as traffic requirements. Traversing the proposed flood protection requires either relocating the highways and roads over the protection, or construction of permanent floodgates at the points of intersection of the protection and highways and roads. These structures remain open except for times of anticipated flooding, at which time they are closed and remain closed until the flood threat subsides. Relocation of highways and roads atop earthen ramps is the preferred construction method and will be used whenever feasible. Relocation of the applicable roads and highways in this manner eliminates the need for floodgate operation during flood conditions, thus allowing egress from affected areas to areas outside of the flood protection for a longer period of time. Permanent floodgates will be used in other locations.

CRITERIA FOR RELOCATING FACILITIES

Utility Owners

The facility owners will accomplish the design and relocation of their facilities in accordance with USACE facility crossing criteria, the owners' individual criteria and in a manner that eliminates interference with the alternatives.

Highways/Roads

Roads within the planning area are of various widths, surfaces and design standards. The minimum Design Standards for Rural Highways and Roads of the Louisiana Department of Transportation and Development had been reviewed to apply design standards to the highways/roads relocations required by the alternatives. Required road relocations will be accomplished in a manner to eliminate interference with the alternatives.

PROCEDURE FOR ACCOMPLISHING RELOCATIONS

Owners will prepare plans and specifications for their relocations in a manner that will not interfere with the project. The Government will review the owner's plans and specifications to determine if the owner's proposals are compatible with the project and then the owners will construct their relocations. The local assuring agency for the work will advise the affected owners to effect their relocations.

The relocations work for pipelines to be relocated by directional drilling will be performed prior to construction. All other relocations will be performed concurrent with construction of project features.

OPERATION, MAINTENANCE, REPAIR, REPLACEMENT AND REHABILITATION (OMRR&R)

OMRR&R cost estimates were developed for the barrier features investigated. These costs include yearly operation and maintenance costs as well as refurbishment and major rehabilitation (every 10 to 12 years for major structures). The estimates are based on data from existing barriers of similar size, maintenance requirements, and operating criteria. Costs were developed for refurbishment and major rehabilitation based on data from existing locks, structures, and barriers of similar size maintenance requirements, and operating criteria (number of hours/days/months, staffing level, 10 to 12 year major rehab, etc.).

COST ESTIMATES

GENERAL

Cost estimates were developed for the many features of the LACPR study which include but are not limited to levees, structures, rock protection, clearing, soil mixing, marsh nourishment, diversions, beach nourishment, and ridge restoration. The estimated costs were based upon an analysis of each line item evaluating quantity, production rate, and time, together with the appropriate equipment, labor and material costs or on New Orleans District historical data. All of the construction work is generally common to the New Orleans District. In addition, all labor, equipment and materials are typical of this type of construction.

Due to time constraints on this study, the delay in developing final design data, and the number of alternatives, a parametric matrix approach was used to combine and ratio the various individual features that were estimated into the costs for each structural alternative. A structural alternative is an alternative consisting solely of structural measures. Structural measures for LACPR primarily consist of physical structures that reduce surge and wave run-up, such as continuous or ring levees on land connected to floodgates acting as waterway barriers, where necessary. For example, detailed calculations and costs were done for levee templates at El. 25, 30, and 40. When the final design elevations were determined, a ratio of the base costs was used to determine the cost for the alternatives.

The cost estimates for large structures such as locks, closure gates, and pump stations were developed as part of this study. These costs were also done using a parametric approach where detailed calculations and costs were done for structures at El. 30, 35 and 40 and interpolated to determine costs for final design elevations.

Cost estimates for structural and other features (nonstructural, coastal, mitigation) were developed as described in general below and in detail in Annex 2.

The costs prepared for and presented in this report are not to be used for making funding decisions. They are sufficient in detail for comparison of plans for initial screening, for use in performing MCDA and presenting the final array of alternatives. A more detailed cost estimate per regulation will be generated in the future upon completion of additional engineering analysis.

PROJECT COST

Structural Alternatives

Details on how the costs were developed for the structural alternatives can be found in Annex 2. Costs were developed for the different sections shown on plates 1 thru 5. Structures required for each section were identified and added to the section costs along with Real Estate costs. E&D (12%) and Construction management (8%) costs are included. These separate section costs were added together with relocations costs to develop costs for structural alternatives. Figure 12 is a chart showing how the different cost components were combined to develop costs for structural alternatives. Table 24 gives a list of these alternatives and a description of each. Figures 13 – 28, taken from the Structural Plan Component Appendix, show the basic alignments of these alternatives. A more detailed description of the alternatives can be found in the Structural Plan Component Appendix and the Evaluation Results Appendix. First costs including lift construction costs were provided for use in initial screening. Yearly costs for those alternatives carried forward for MCDA were provided for the 50 year planning cycle. This information was used to develop a present value estimate for each of these alternatives. These costs included OMRR&R. Table 25 shows the present value of life cycle cost estimates for the structural alternatives carried forward into the final round of MCDA for two scenarios. These scenarios are sea level rise alternative 1 (low sea level rise) and sea level rise alternative 2 (high sea level rise). These scenarios were accounted for by adding a future lift approximately midway through the project life. Present value of life cycle costs for complete alternatives (structural, non-structural and coastal measures can be found in the Metric Results Tables shown in the Evaluation Results Appendix. Alternatives shown in table 25 include the PU1 alternatives with the new north shore alignments. All costs are in 2007 price levels.

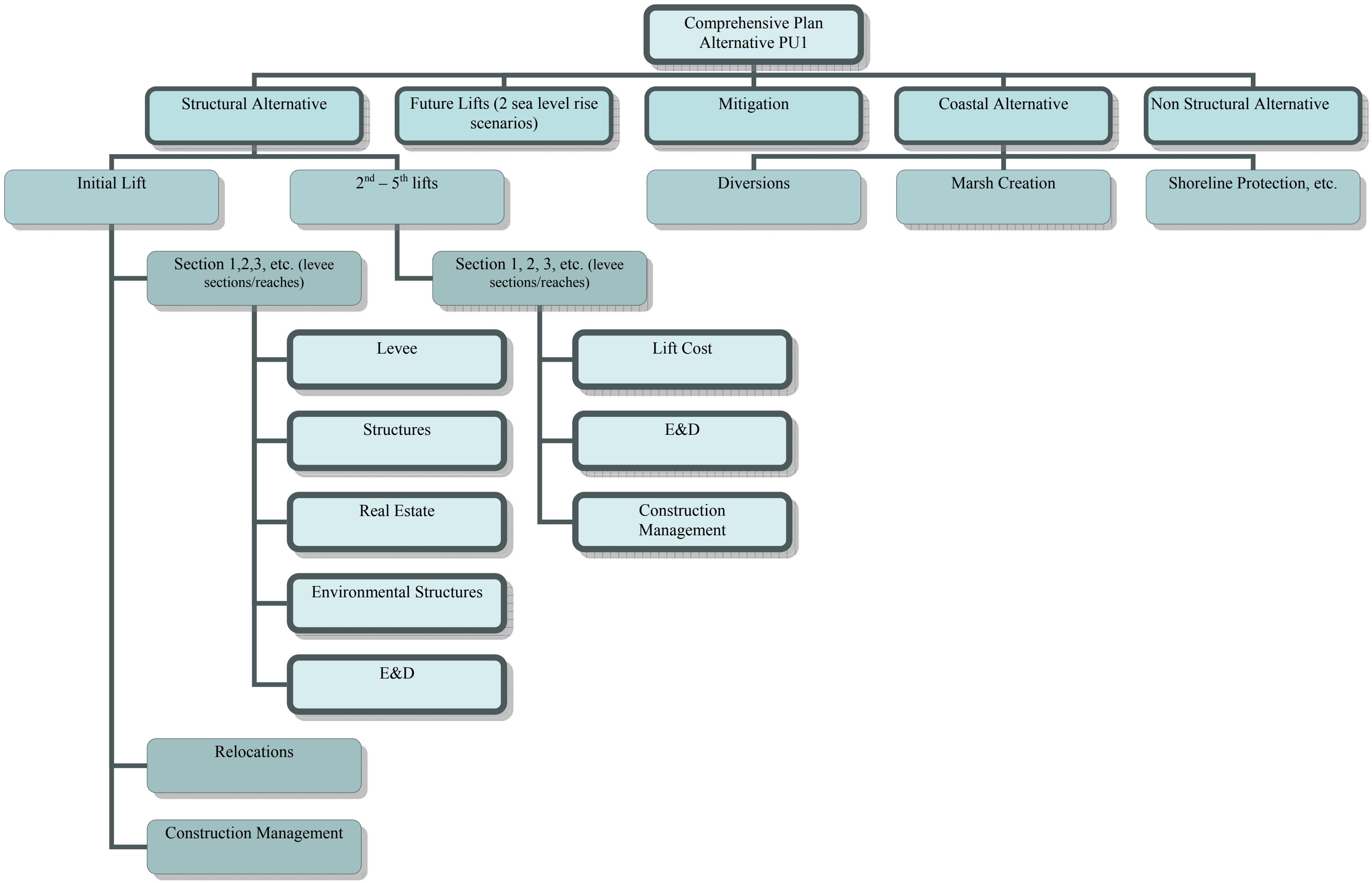


Figure 12 – Comprehensive Plan Alternative Cost Development

Table 24 Alternatives For Which Costs Were Developed (100yr, 400yr and 1000yr Levels Developed for Each)		
Planning Unit	Alternative Measure Code*	Description
1	HL-a-1	High Level Plan – Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Note that the Golden Triangle alignment is the current alignment for the authorized project.
1	HL-b-1	High Level Plan – Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows an alignment at the edge of Golden Triangle and Lake Borgne.
1	HL-a-2	High Level Plan – Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Also includes North Shore and West Shore Levees and a levee in upper Plaquemines Parish.
1	HL-b-2	High Level Plan – Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows an alignment at the edge of Golden Triangle and Lake Borgne. Also includes North Shore and West Shore Levees and a levee in upper Plaquemines Parish
1	HL-a-3	High Level Plan – Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Also includes Slidell and West Shore Levees and a levee in upper Plaquemines Parish.
1	HL-b-3	High Level Plan – Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows an alignment at the edge of Golden Triangle and Lake Borgne. Also includes Slidell and West Shore Levees and a levee in upper Plaquemines Parish.
1	HL-a-4	High Level Plan – Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Also includes West Shore Levee.
1	LP-a-1	Barrier Weir, Existing Levees - (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Also includes a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
1	LP-b-1	Barrier Weir - Raise Existing Levees (includes the Lake

Table 24 Alternatives For Which Costs Were Developed (100yr, 400yr and 1000yr Levels Developed for Each)		
Planning Unit	Alternative Measure Code*	Description
		Pontchartrain and Vicinity Project Levees). Levee follows an alignment at the edge of Golden Triangle and Lake Borgne. Also includes a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
1	LP-a-2	Barrier Weir - Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Includes North Shore and West Shore Levees and a levee in upper Plaquemines Parish. Also includes a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
1	LP-b-2	Barrier Weir - Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows an alignment at the edge of Golden Triangle and Lake Borgne. Includes North Shore and West Shore Levees and a levee in upper Plaquemines Parish. Also includes a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
1	LP-a-3	Barrier Weir - Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Includes Slidell and West Shore Levees and a levee in upper Plaquemines Parish. Also includes a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
1	LP-b-3	Barrier Weir - Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows an alignment at the edge of Golden Triangle and Lake Borgne. Includes Slidell and West Shore Levees and a levee in upper Plaquemines Parish. Also includes a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
1	LP-a-4	Barrier Weir - Raise Existing Levees (includes the Lake Pontchartrain and Vicinity Project Levees). Levee follows Golden Triangle alignment at the Confluence of GIWW and MRGO. Includes West Shore Levee. Also includes a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
Note: For PU1 the full range of estimates was prepared for both the original and revised north shore alignments.		

Table 24
Alternatives For Which Costs Were Developed
(100yr, 400yr and 1000yr Levels Developed for Each)

Planning Unit	Alternative Measure Code*	Description
2	WBI-1	West Bank Interior Plan (includes West Bank and Vicinity (WBV) levees with new sector gate).
2	G-1-1a	GIWW Alignment (Barrier Weir along GIWW), Existing WBV Levees with new sector gate, Larose to Golden Meadow levees.
2	G-1-4a	GIWW Alignment (Barrier Weir along GIWW), Existing WBV Levees with new sector gate, Larose to Golden Meadow levees, with Boutee and Des Allemands levees.
2	R-1-2	Ridge Alignment - Existing WBV Levees with new sector gate, Larose to Golden Meadow levees and Boutee levees.
2	R-1-3	Ridge Alignment - Existing WBV Levees with new sector gate, Larose to Golden Meadow levees and Boutee and Des Allemands levees.
2	R-1-4	Ridge Alignment - Existing WBV Levees with new sector gate, Larose to Golden Meadow levees and Boutee, Des Allemands and Bayou Lafourche levees.
2	G-1-1	GIWW Alignment (Barrier Weir along GIWW), Existing WBV Levees with new sector gate, Larose to Golden Meadow levees and Lafitte ring levees. This alternative replaced G-1-1a.
2	G-1-4	GIWW Alignment (Barrier Weir along GIWW), Existing WBV Levees with new sector gate, Larose to Golden Meadow levees, with Boutee and Des Allemands levees and Lafitte ring levees. This alternative replaced G-1-4a.
3a	PU3a-M-1	Morganza to Gulf (MTG) Alignment then GIWW to tieback west of Morgan City
3a	PU3a-R-1	MTG Alignment with tieback to high ground south of Thibodaux and Morgan City Ring Levee (designation changed to PU3a-M-2)
3a	PU3a-G-1	MTG Alignment at 100yr with GIWW interior levee, Morgan City Ring Levee. This alternative designation was changed from PU3a-R-2.
3b	PU-3b-G-1	GIWW Alignment, Patterson Ring Levee.
3b	PU3b-F-1	Patterson Ring Levee, Franklin to Abeville alignment (inland of the GIWW).
3b	PU3b-R-1	Ring levee alignment - Patterson Ring Levee, Franklin/Baldwin Ring Levee, New Iberia Ring Levee, Erath Ring Levee, Delcambre Ring Levee and Abbeville Ring Levee.
4	PU4-G-1	GIWW levee - GIWW Alignment east of Calcasieu River, Ring Levee west of Calcasieu River.
4	PU4-G-2	GIWW levee - GIWW Alignment east of Calcasieu with tie-in west of the Vermillion River near Kaplan, Ring Levee west of

Table 24 Alternatives For Which Costs Were Developed (100yr, 400yr and 1000yr Levels Developed for Each)		
Planning Unit	Alternative Measure Code*	Description
		Calcasieu River.
4	PU4-G-3	GIWW levee - GIWW Alignment east of Calcasieu River, Ring Levee west of Calcasieu River. with levee set at 12’.
4	PU4-R-1	Ring levee alignment - Ring Levee west of Calcasieu River, Lake Charles Ring Levee, Kaplan Ring Levee, Gueydan Ring Levee.
*A description of the alternative measure codes can be found in attachment 1 to Annex 2.		

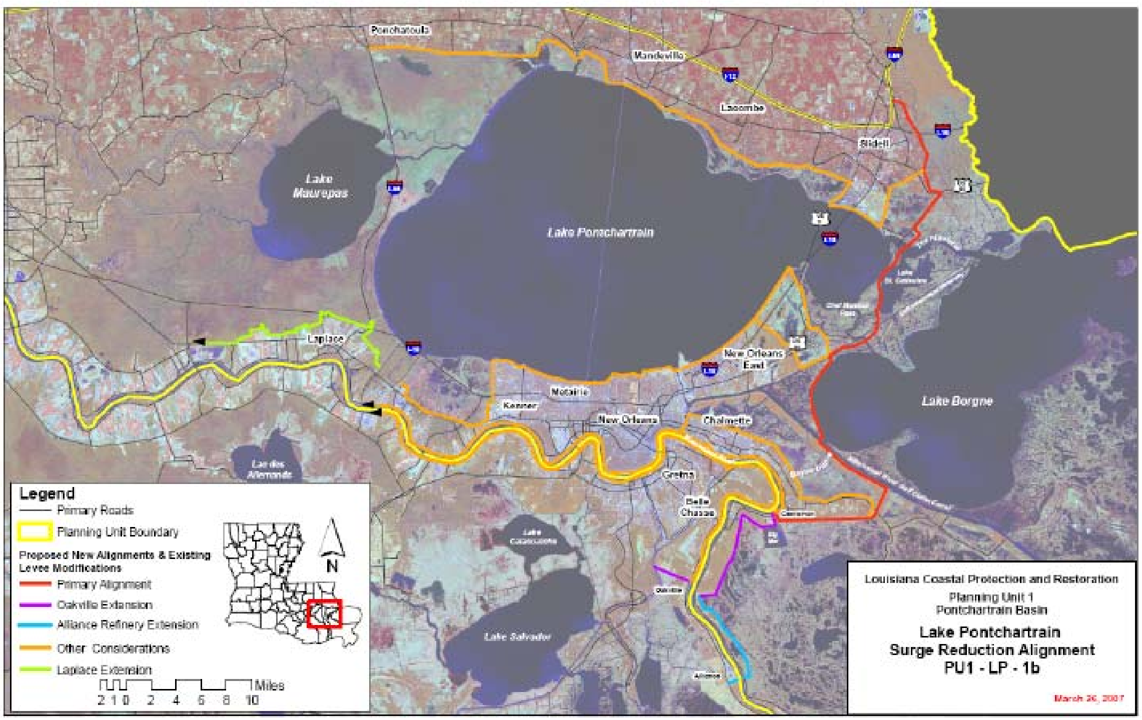


Figure 13 - PU1 Example of a Lake Pontchartrain Surge Reduction Alignment from the Plan Formulation Atlas (Barrier Plan) (Note that the north shore alignments were changed to those shown in figures 14 and 15.)

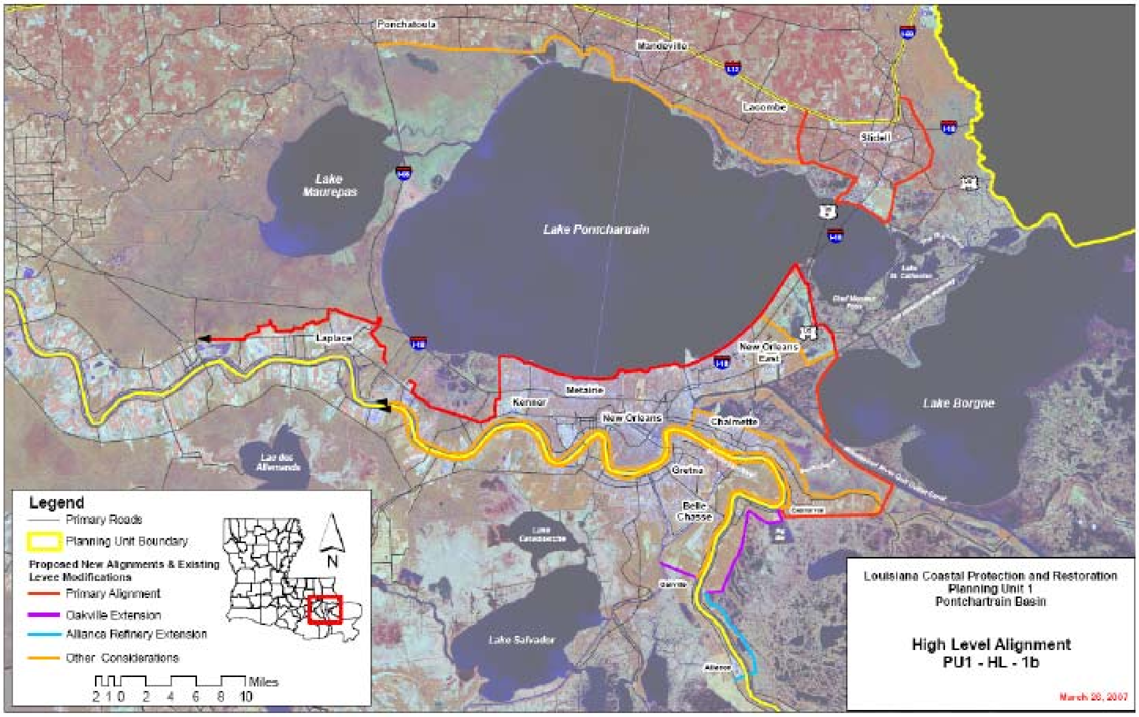


Figure 14 - PU1 Example of a High Level Alignment from the Plan Formulation Atlas (Note that the north shore alignments were changed to those shown in figures 14 and 15.)

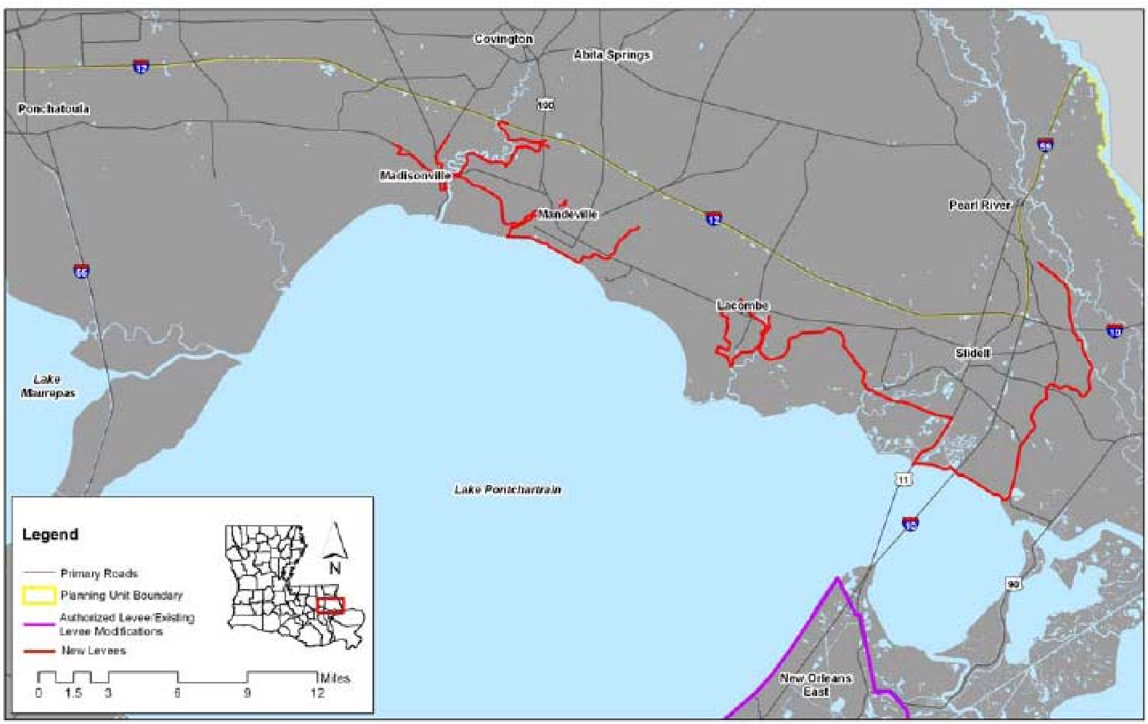


Figure 15 - PU1 Reformulated North Shore Alignment

Figure 16 – PU1 Reformulated Slidell Ring Levee

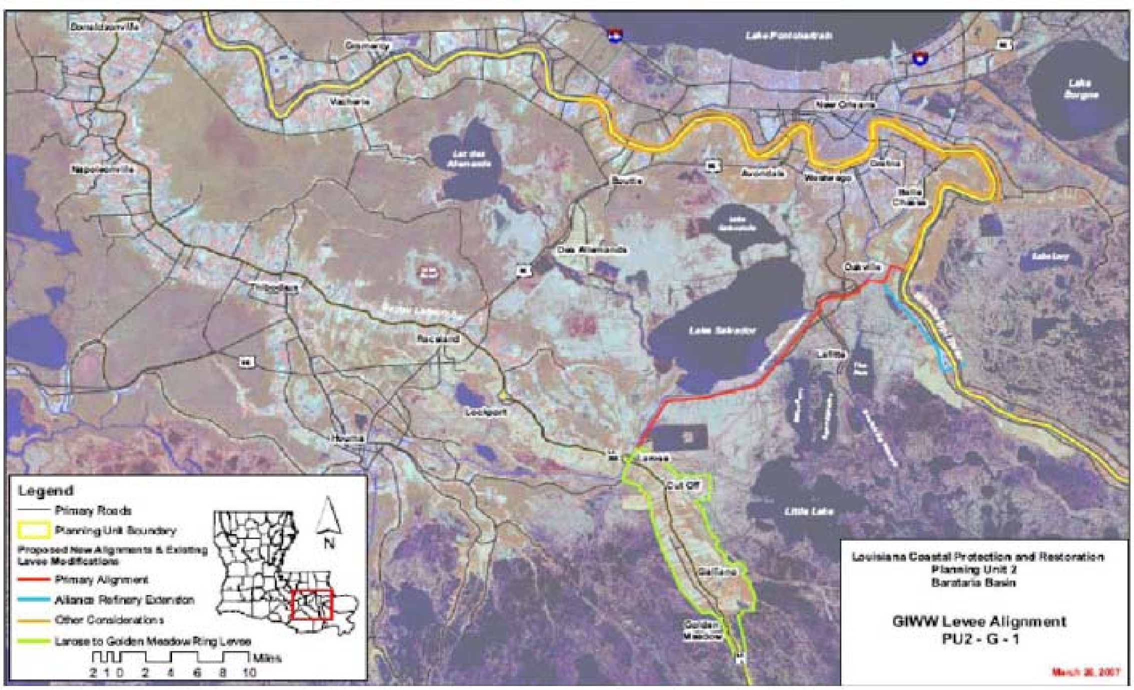


Figure 17 - PU GIWW Alignment from the Plan Formulation Atlas (Note that this alignment was modified to include Lafitte ring levees.)

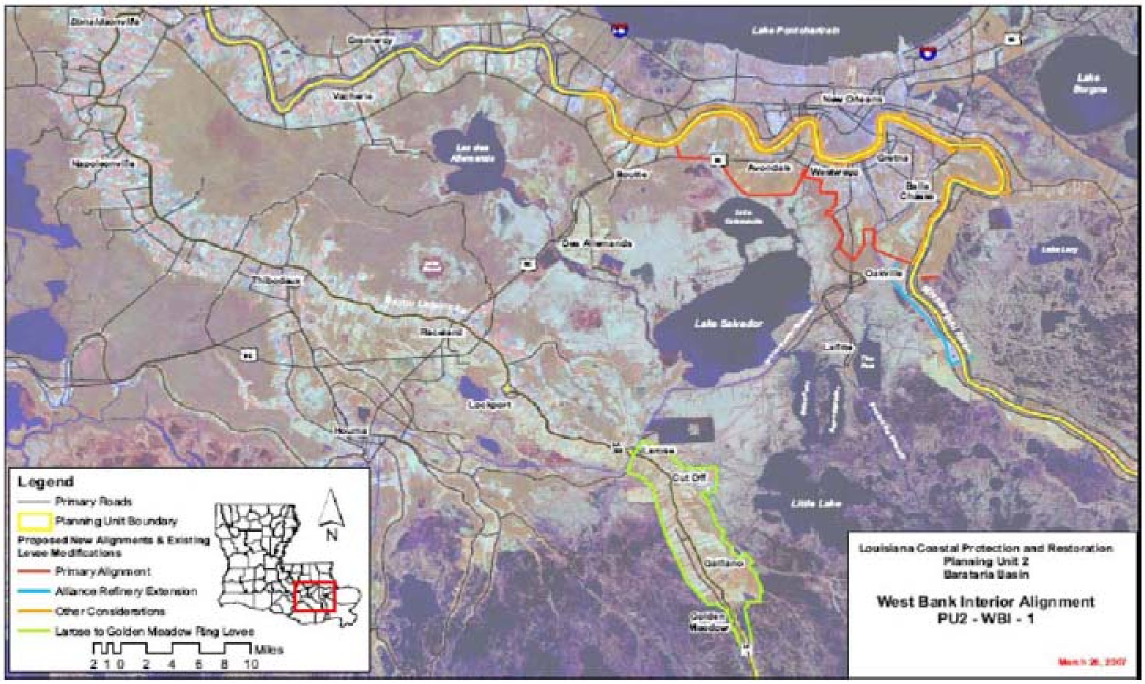


Figure 18 - PU2 West Bank Interior Alignment from the Plan Formulation Atlas

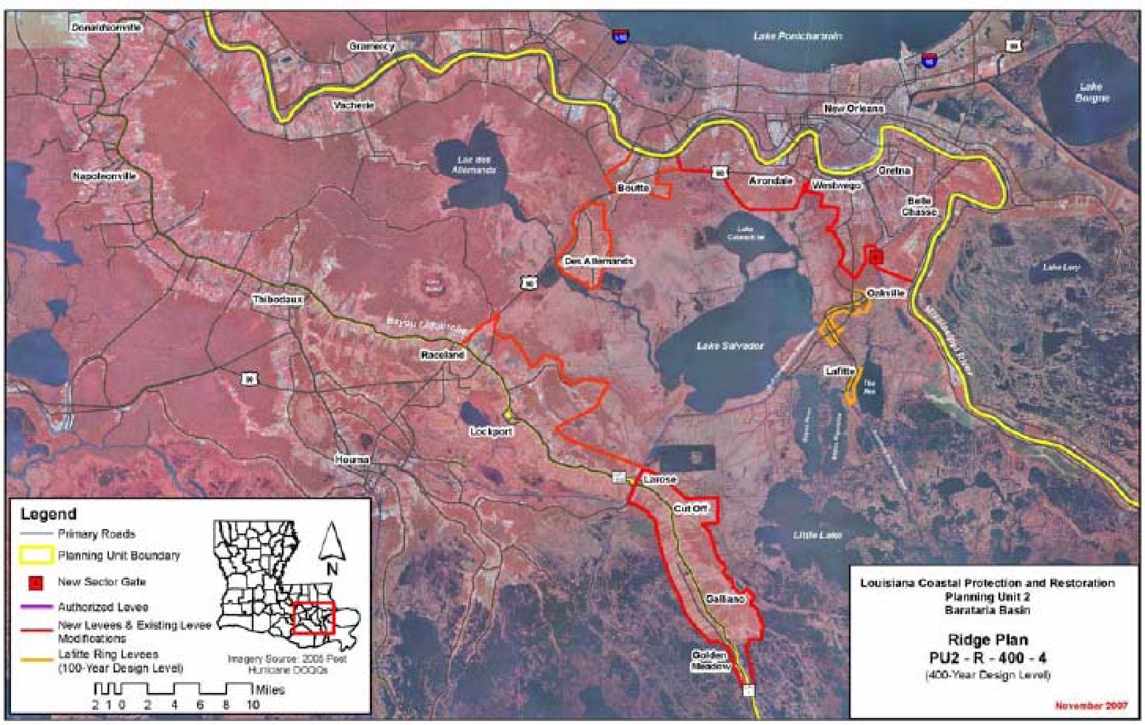


Figure 19 - PU2 Ridge Alignment

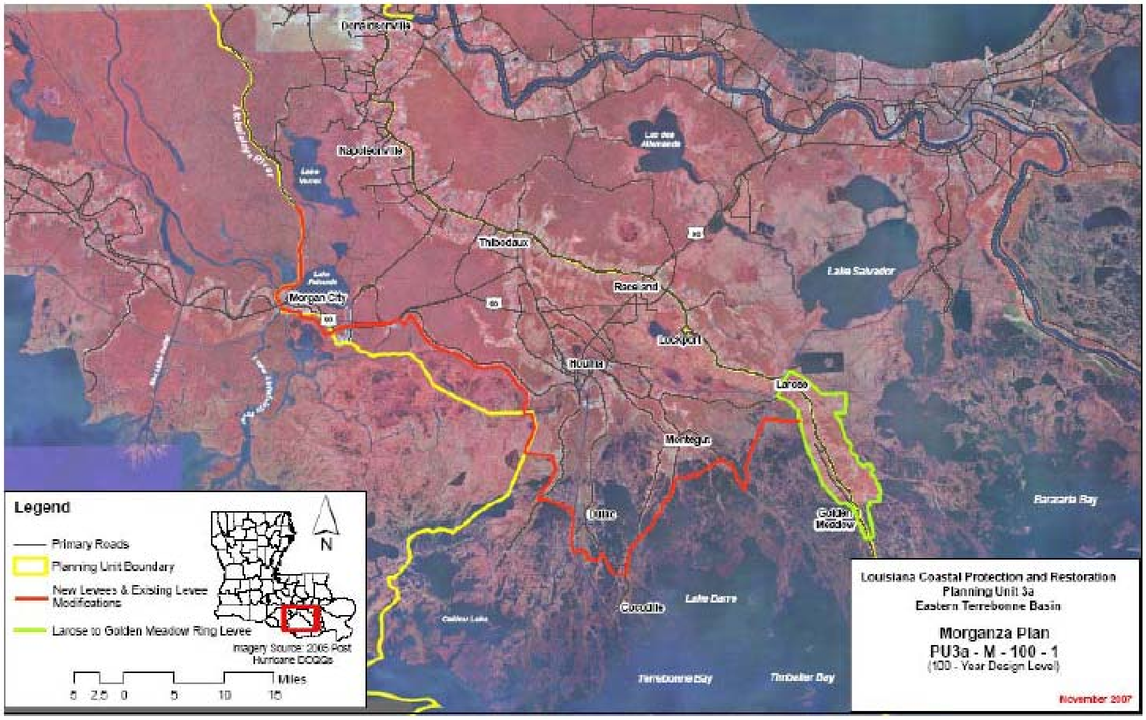


Figure 20 - PU3a Morganza Levee Alignment with Tie-in West of Morgan City

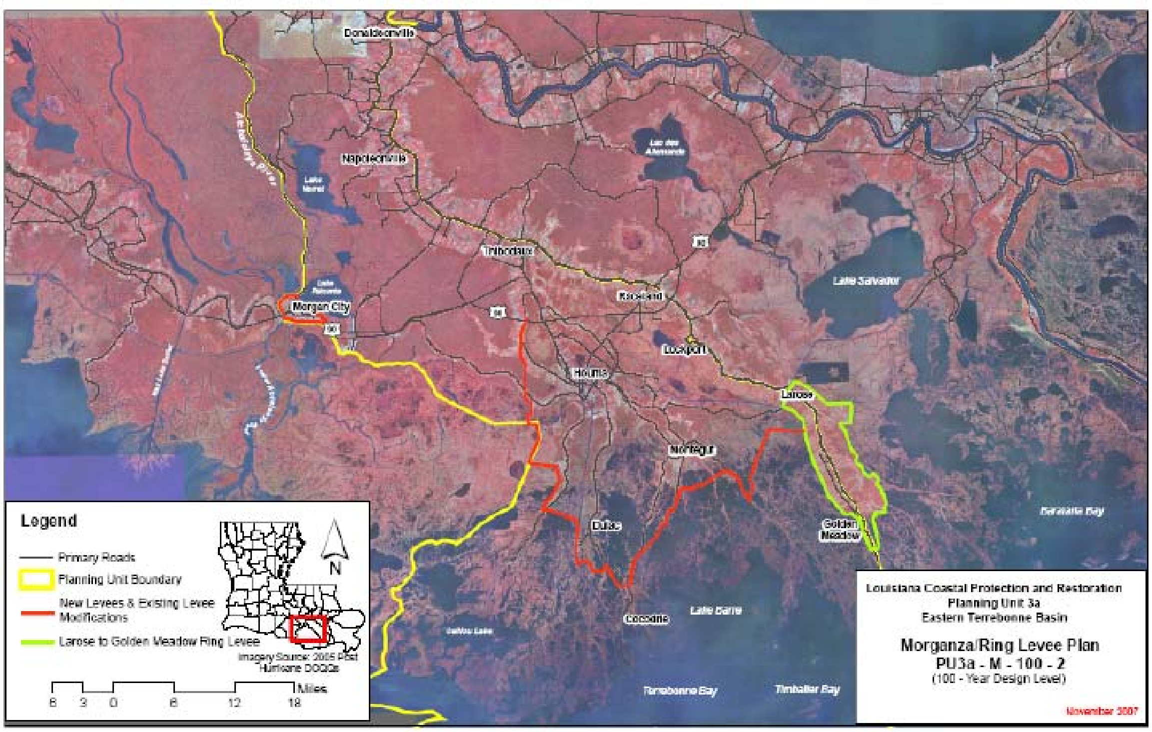


Figure 21 - PU3a Morganza Levee Alignment with Morgan City Ring Levee

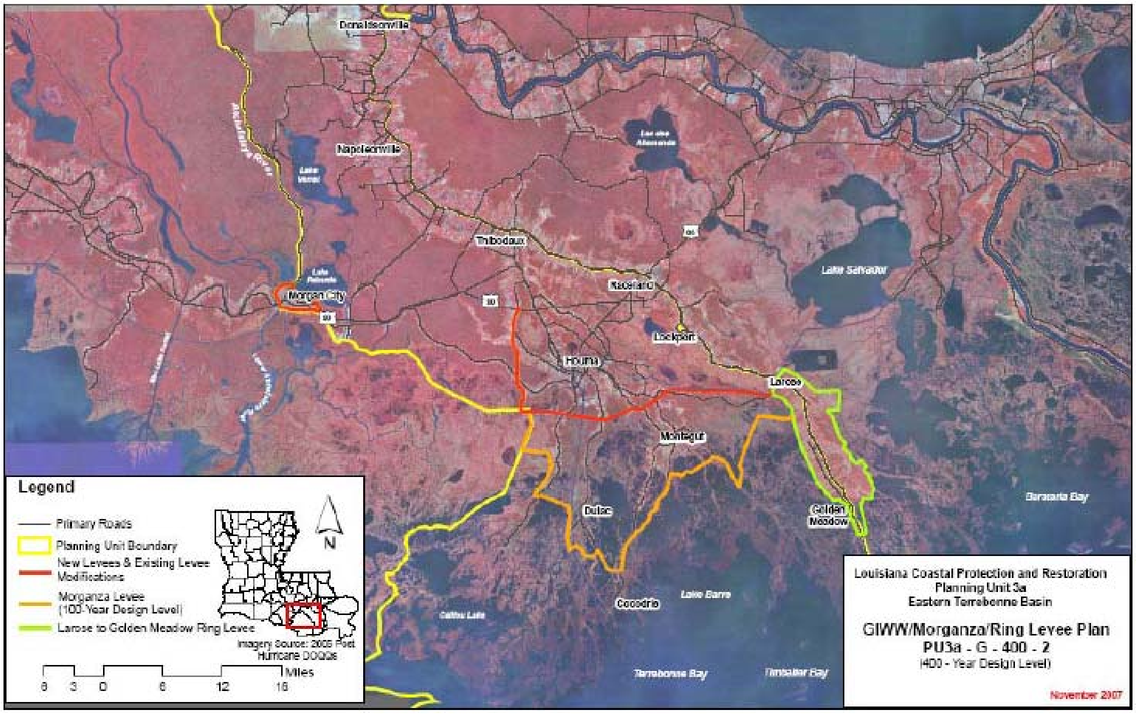


Figure 22 - PU3a GIWW Alignment

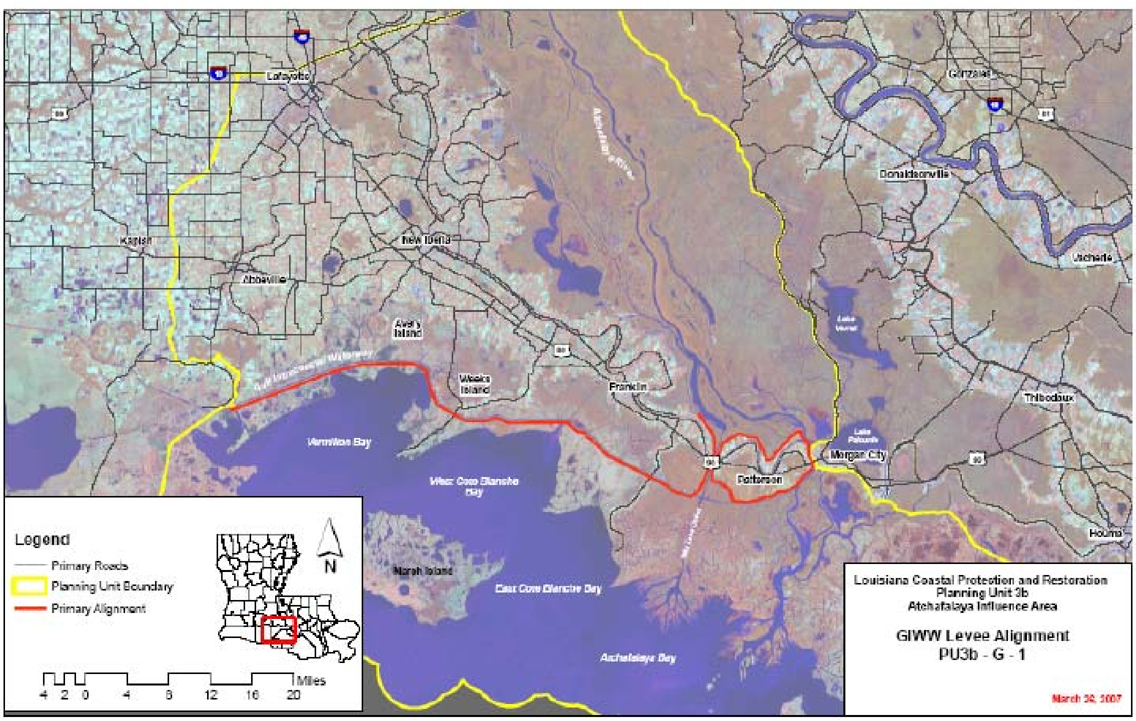


Figure 23 - PU3b Example GIWW Alignment from the Plan Formulation Atlas

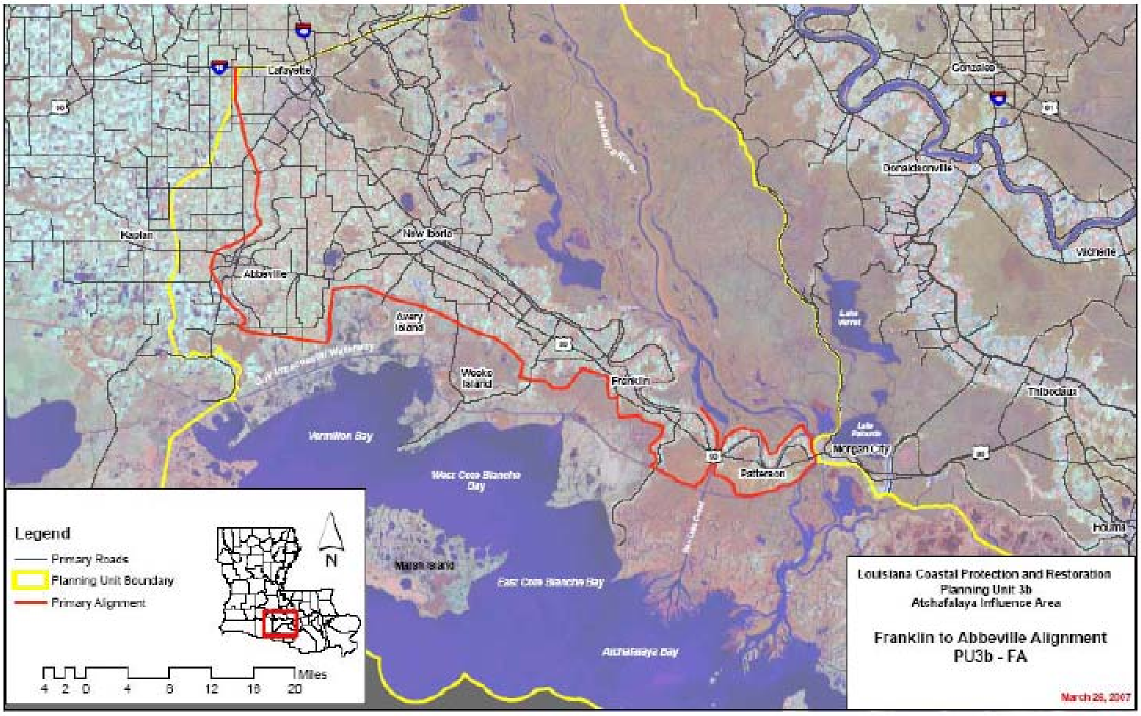


Figure 24 - PU3b Example Franklin to Abbeville Alignment from the Plan Formulation Atlas

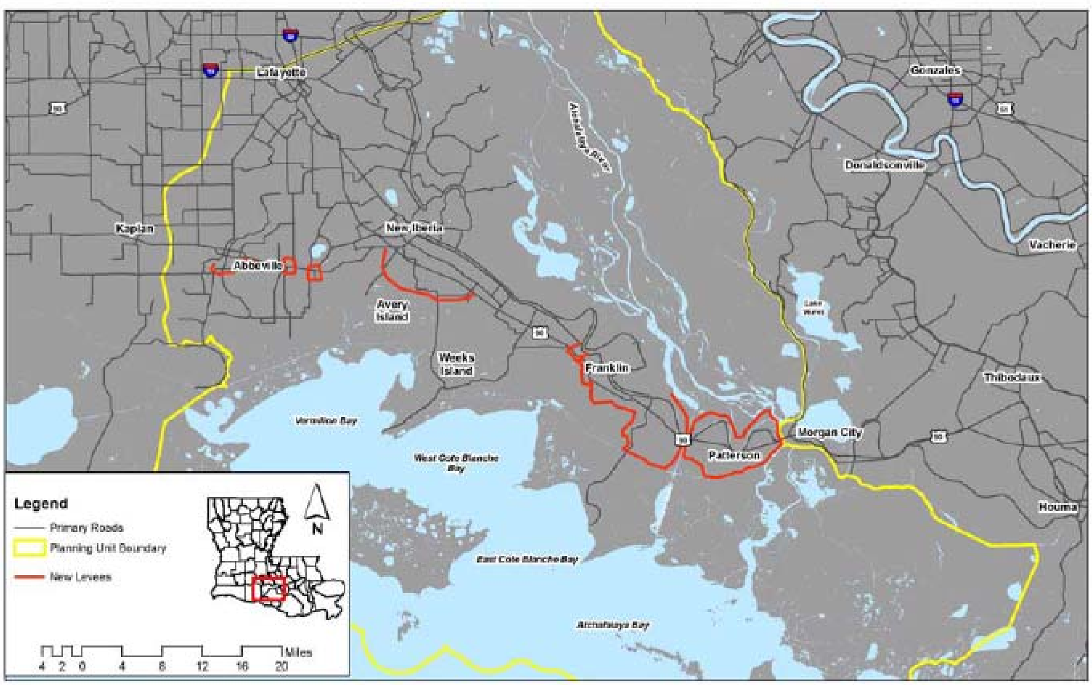


Figure 25 - PU3b Ring Levee Alignment

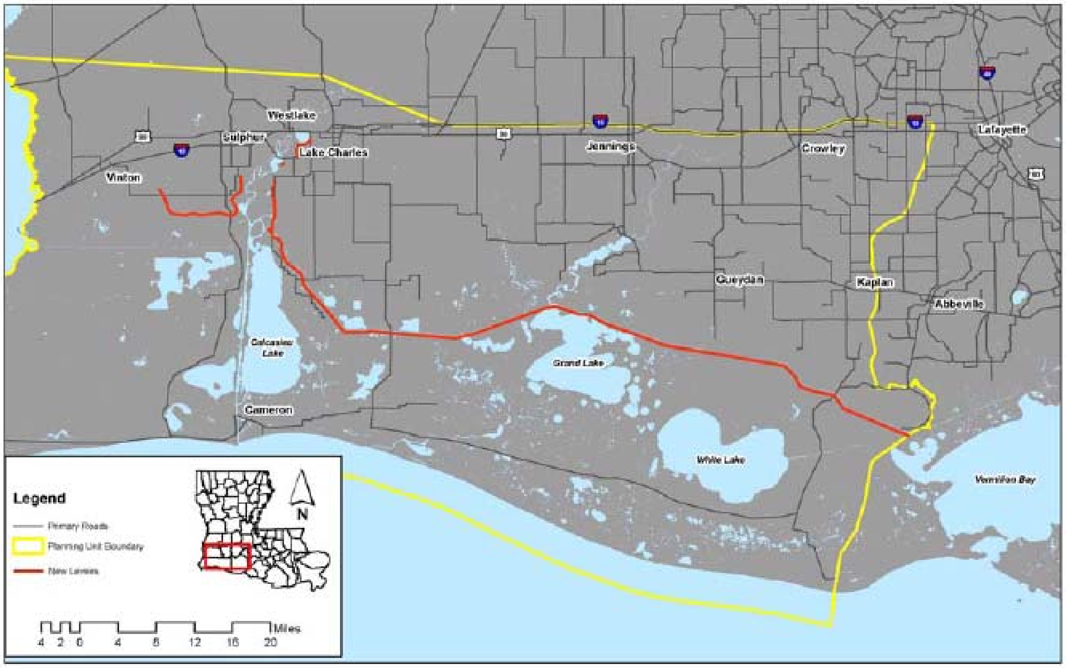


Figure 26 - PU4 GIWW Alignment

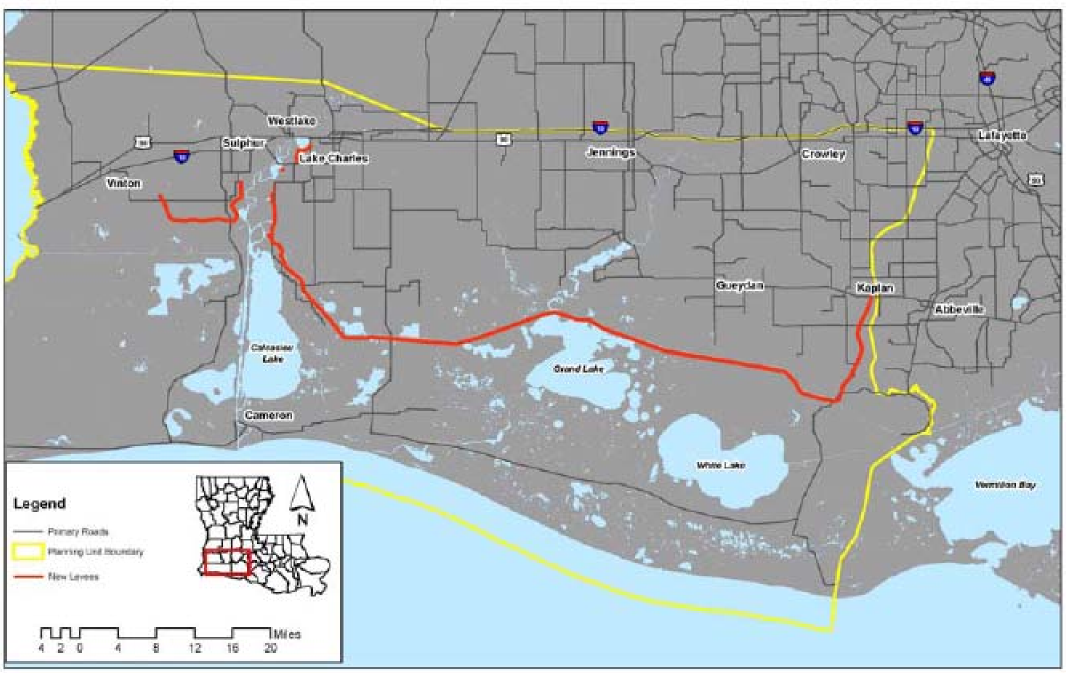


Figure 27 - PU4 Stand Alone GIWW Alignment

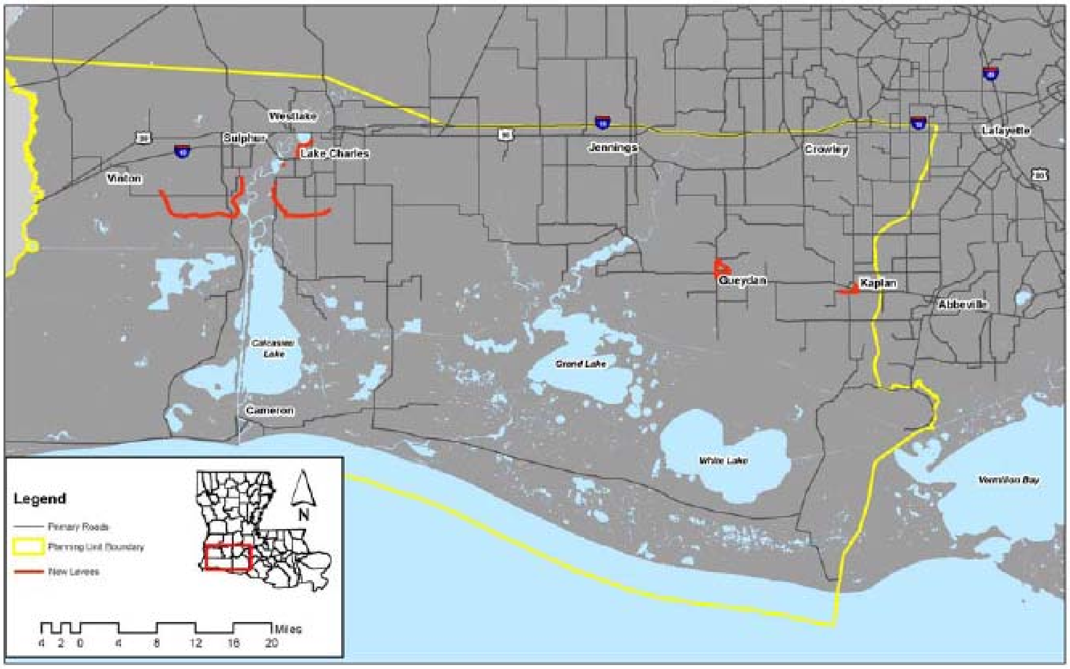


Figure 28 - PU4 Ring Levee Alignments

Table 25 Present Value Cost Estimates For Structural Alternatives Included in MCDA (See Table 24 for a description of these alternatives)			
Planning Unit	Alternative	Scenario (H=high sea level rise, L=low sea level rise)	Present Value Cost $ (B)
1	PU1-LP-a-100-1	L	7.02
		H	7.13
	PU1-LP-a-100-2	L	22.44
		H	22.58
	PU1-LP-a-100-3	L	21.09
		H	21.28
	PU1-LP-b-400-1	L	25.54
		H	25.62
	PU1-LP-b-400-3	L	45.08
		H	45.24
	PU1-LP-b-1000-1	L	33.33
		H	33.56
	PU1-LP-b-1000-2	L	59.40
		H	59.61
	PU1-HL-a-100-3	L	15.89
		H	15.93
	PU1-HL-a-100-2	L	19.19
		H	19.25

Table 25
Present Value Cost Estimates For Structural Alternatives Included in MCDA
(See Table 24 for a description of these alternatives)

Planning Unit	Alternative	Scenario (H=high sea level rise, L=low sea level rise)	Present Value Cost $ (B)
	PU1-HL-b-400-2	L	49.57
		H	49.81
	PU1-HL-b-400-3	L	44.90
		H	45.10
2	PU2-WBI-100-1	L	1.00
		H	1.02
	PU2-R-100-2	L	7.73
		H	7.77
	PU2-R-400-2	L	25.41
		H	25.52
	PU2-R-100-4	L	13.35
		H	13.42
	PU-2-R-400-4	L	31.47
		H	31.61
	PU2-G-1000-4	L	42.34
		H	42.46
	PU2-G-100-1	L	7.6
		H	7.75
	PU2-G-100-4	L	14.52
		H	14.7
	PU2-G-400-4	L	34.75
		H	34.88
	PU2-R-1000-4	L	39.17
		H	39.77
	PU2-R-100-3	L	10.15
		H	10.20
	PU2-WBI-400-1	L	18.29
		H	18.32
	PU2-R-400-3	L	28.32
		H	28.44
3a	PU3a-M-100-1	L	21.41
		H	21.93
	PU3a-M-100-2	L	18.98
		H	19.10
	PU3a-G-400-2	L	25.21
		H	25.28
	PU3a-G-1000-2	L	27.63
		H	27.70
3b	PU3b-G-100-1	L	15.21

Table 25
Present Value Cost Estimates For Structural Alternatives Included in MCDA
(See Table 24 for a description of these alternatives)

Planning Unit	Alternative	Scenario (H=high sea level rise, L=low sea level rise)	Present Value Cost $ (B)
		H	15.24
	PU3b-F-100-1	L	13.92
		H	13.95
	PU3b-F-400-1	L	23.44
		H	23.64
	PU3b-F-1000-1	L	31.07
		H	31.09
	PU3b-RL-100-1	L	11.58
		H	11.61
	PU3b-RL-400-1	L	18.00
		H	18.02
4	PU4-G-100-1	L	11.99
		H	12.27
	PU4-G-100-2	L	11.78
		H	12.07
	PU4-G-400-3	L	11.73
		H	12.01
	PU4-G-1000-3	L	12.21
		H	12.49
	PU4-RL-100-1	L	2.70
		H	2.72
	PU4-RL-400-1	L	3.47
		H	3.49
	PU4-RL-1000-1	L	3.76
		H	3.80

Coastal Restoration Features

Cost for coastal restoration features were developed as described above in the Coastal Restoration Features Section and discussed in detail in Annex 1.

Mitigation

The number of acres of wetlands impacted was developed for each alternative. These acres are to be mitigated at a rate of 1.5 acres to each acre impacted. Current mitigation cost is estimated at $80,000 an acre.

Nonstructural Plan Components

Costs for nonstructural plan components were provided in the Nonstructural Plan Component Appendix. Details of these components and the information on the development of these estimates can be found in the referenced appendix.

ESTIMATES FOR COMPREHENSIVE PLAN ALTERNATIVES

Comprehensive plan alternatives (structural, coastal, nonstructural) are discussed in detail in the Main Report. Figure XX shows how different cost items were combined to develop comprehensive plan alternatives. Table 26 shows the present value costs for all alternatives carried forward into the final round of MCDA. Tables showing costs of individual plan components (coastal features, structural features, mitigation, nonstructural features) for each comprehensive plan alternative are included in Annex 2.

TABLE 26
LACPR ALTERNATIVES
First Cost for Alternatives For Scenarios Used For MCDA

Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Planning Unit 1				
No Action	0	0	0	0
R2 (Coastal)	9,448,607,969	9,637,580,128	9,448,607,969	9,637,580,128
NS-100	13,976,786,412	14,165,758,572	13,707,342,705	13,896,314,864
NS-400	25,988,874,745	26,177,846,904	28,858,222,244	29,047,194,403
NS-1000	36,426,615,692	36,615,587,851	37,689,306,856	37,878,279,015
HL-a-100-2	28,809,443,453	29,114,686,066	28,809,443,453	29,114,686,066
HL-a-100-3	25,621,931,458	25,881,282,879	25,621,931,458	25,881,282,879
HL-b-400-2	63,140,024,338	63,815,915,224	63,140,024,338	63,815,915,224
HL-b-400-3	58,362,881,421	58,975,714,443	58,362,881,421	58,975,714,443
LP-a-100-1	16,115,149,095	16,524,784,241	16,115,149,095	16,524,784,241
LP-a-100-2	29,726,476,210	30,198,417,749	29,726,476,210	30,198,417,749
LP-a-100-3	29,037,286,948	29,607,034,907	29,037,286,948	29,607,034,907
LP-b-400-1	35,247,782,100	35,604,571,107	35,247,782,100	35,604,571,107
LP-b-400-3	54,602,752,270	55,111,460,583	54,602,752,270	55,111,460,583
LP-b-1000-1	45,525,510,246	46,168,402,646	45,525,510,246	46,168,402,646
LP-b-1000-2	71,345,488,335	71,956,944,660	71,345,488,335	71,956,944,660
C-HL-a-100-2	30,841,507,818	31,146,750,431	30,391,395,739	30,696,638,352
C-HL-a-100-3	27,798,358,539	28,057,709,960	27,364,359,000	27,623,710,421
C-HL-b-400-2	65,366,416,079	66,042,306,965	64,896,758,138	65,572,649,024
C-HL-b-400-3	60,748,289,027	61,361,122,049	60,415,682,905	61,028,515,928
C-LP-a-100-1	18,830,206,036	19,239,841,182	18,424,524,432	18,834,159,578
C-LP-a-100-2	31,704,982,805	32,176,924,344	31,208,858,542	31,680,800,081

TABLE 26
LACPR ALTERNATIVES
First Cost for Alternatives For Scenarios Used For MCDA

Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
C-LP-a-100-3	31,126,205,421	31,695,953,380	30,642,400,367	31,212,148,326
C-LP-b-400-1	39,319,329,328	39,676,118,335	39,765,397,390	40,122,186,398
C-LP-b-400-3	56,822,605,370	57,331,313,684	56,370,258,215	56,878,966,529
C-LP-b-1000-1	50,003,978,929	50,646,871,330	51,286,163,182	51,929,055,582
C-LP-b-1000-2	73,758,273,372	74,369,729,697	73,044,983,733	73,656,440,058
Planning Unit 2				
No Action	0	0	0	0
R2 (Coastal)	11,290,051,065	11,312,631,167	11,290,051,065	11,312,631,167
NS-100	14,281,264,591	14,303,844,693	14,371,126,266	14,393,706,368
NS-400	22,007,914,671	22,030,494,773	30,699,665,341	30,722,245,443
NS-1000	31,521,628,364	31,544,208,466	39,530,749,953	39,553,330,055
G-100-1	18,527,843,400	18,842,508,657	18,527,843,400	18,842,508,657
G-100-4	24,017,746,420	24,404,081,288	24,017,746,420	24,404,081,288
G-400-4	45,939,377,941	46,236,618,190	45,939,377,941	46,236,618,190
G-1000-4	51,282,989,993	51,555,389,161	51,282,989,993	51,555,389,161
R-100-2	14,011,898,966	14,097,013,403	14,011,898,966	14,097,013,403
R-100-3	16,172,461,036	16,286,773,530	16,172,461,036	16,286,773,530
R-100-4	18,781,724,515	18,931,286,259	18,781,724,515	18,931,286,259
R-400-2	33,387,679,923	33,607,921,135	33,387,679,923	33,607,921,135
R-400-3	35,810,737,945	36,061,187,200	35,810,737,945	36,061,187,200
R-400-4	38,610,421,339	38,897,597,997	38,610,421,339	38,897,597,997
R-1000-4	46,686,471,376	47,912,192,131	46,686,471,376	47,912,192,131
WBI-100-1	11,948,584,459	12,021,391,685	11,948,584,459	12,021,391,685
WBI-400-1	31,010,321,230	31,200,785,597	31,010,321,230	31,200,785,597
C-G-100-1	20,670,262,205	20,984,927,462	20,722,808,709	21,037,473,966
C-G-100-4	25,813,320,568	26,199,655,436	25,841,372,318	26,227,707,186
C-G-400-4	47,546,688,976	47,843,929,224	48,034,335,706	48,331,575,954
C-G-1000-4	53,373,034,972	53,645,434,140	53,732,936,384	54,005,335,552
C-R-100-2	16,375,944,939	16,461,059,375	16,398,891,388	16,484,005,825
C-R-100-3	18,288,502,874	18,402,815,368	18,283,012,562	18,397,325,056
C-R-100-4	20,773,219,737	20,922,781,481	20,792,919,999	20,942,481,743
C-R-400-2	35,243,884,836	35,464,126,048	36,211,034,110	36,431,275,322
C-R-400-3	37,563,106,079	37,813,555,335	38,318,905,370	38,569,354,626
C-R-400-4	40,215,865,952	40,503,042,610	40,904,545,730	41,191,722,388
C-R-1000-4	48,649,556,447	49,875,277,202	49,094,687,594	50,320,408,348
C-WBI-100-1	14,908,146,322	14,980,953,548	14,999,456,823	15,072,264,049
C-WBI-400-1	33,448,013,929	33,638,478,296	34,627,916,714	34,818,381,080
Planning Unit 3a				
No Action	0	0	0	0
R1 (Coastal)	19,431,425,544	19,625,739,799	19,431,425,544	19,625,739,799
NS-100	24,923,295,980	25,117,610,236	24,912,137,029	25,106,451,285

TABLE 26
LACPR ALTERNATIVES
First Cost for Alternatives For Scenarios Used For MCDA

Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
NS-400	26,906,161,065	27,100,475,320	26,801,113,801	26,995,428,056
NS-1000	27,624,326,837	27,818,641,092	27, 804,592,176	27,998,906,431
M-100-1	38,188,268,343	39,433,809,593	38,188,268,343	39,433,809,593
M-100-2 (was R-100-1)	36,469,900,220	36,898,978,039	36,469,900,220	36,898,978,039
G-400-2	41,876,971,393	42,218,447,087	41,876,971,393	42,218,447,087
G-1000-2	43,993,106,295	44,345,192,507	43,993,106,295	44,345,192,507
C-M-100-1	38,630,924,156	39,876,465,405	38,625,150,100	39,870,691,349
C-M-100-2	36,957,783,303	37,386,861,123	36,953,477,181	37,382,555,001
C-G-400-2	42,937,138,923	43,278,614,617	43,159,226,549	43,500,702,243
C-G-1000-2	45,733,087,045	46,085,173,257	45,912,522,916	46,264,609,128
Planning Unit 3b				
No Action	0	0	0	0
R1 (Coastal)	4,364,994,612	4,408,644,558	4,364,994,612	4,408,644,558
NS-100	6,208,801,097	6,252,451,043	6,258,099,063	6,301,749,010
NS-400	7,551,099,977	7,594,749,924	7,641,051,958	7,684,701,904
NS-1000	8,339,265,602	8,382,915,548	8,799,298,036	8,842,947,983
G-100-1	18,493,569,685	18,586,553,146	18,493,569,685	18,586,553,146
F-100-1	17,685,812,738	17,803,604,048	17,685,812,738	17,803,604,048
F-400-1	26,984,322,398	27,369,959,222	26,984,322,398	27,369,959,222
F-1000-1	35,286,667,844	35,357,865,681	35,286,667,844	35,357,865,681
RL-100-1	15,484,510,089	15,594,753,846	15,484,510,089	15,594,753,846
RL-400-1	21,656,143,131	21,756,499,550	21,656,143,131	21,756,499,550
C-G-100-1	18,664,660,787	18,757,644,248	18,672,714,765	18,765,698,226
C-F-100-1	17,942,124,885	18,059,916,195	17,952,066,339	18,069,857,648
C-F-400-1	27,189,604,379	27,575,241,203	27,300,924,604	27,686,561,427
C-F-1000-1	35,891,880,509	35,678,562,221	35,630,608,036	35,701,805,873
C-RL-100-1	16,089,722,754	16,199,966,511	16,120,956,597	16,231,200,354
C-RL-400-1	22,351,942,103	22,452,298,522	22,902,638,413	23,002,994,831
Planning Unit 4				
No Action	0	0	0	0
R1 (Coastal)	10,295,953,284	10,501,872,350	10,295,953,284	10,501,872,350
NS-100	11,799,111,008	12,005,030,074	11,800,759,074	12,006,678,139
NS-400	12,712,625,681	12,918,544,746	12,670,624,451	12,876,543,516
NS-1000	13,649,358,849	13,855,277,914	13,758,546,808	13,964,465,874
G-100-1	21,101,215,412	21,882,856,502	21,101,215,412	21,882,856,502
G-100-2	21,031,331,562	21,809,167,725	21,031,331,562	21,809,167,725
G-400-3	20,831,662,921	21,608,513,415	20,831,662,921	21,608,513,415
G-1000-3	21,273,016,896	22,055,110,177	21,273,016,896	22,055,110,177
RL-100-1	12,586,970,598	12,830,007,571	12,586,970,598	12,830,007,571
RL-400-1	13,443,833,884	13,696,639,399	13,443,833,884	13,696,639,399

TABLE 26
LACPR ALTERNATIVES
First Cost for Alternatives For Scenarios Used For MCDA

Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
RL-1000-1	13,872,652,090	14,130,326,533	13,872,652,090	14,130,326,533
C-G-100-1	22,438,559,356	23,220,200,446	22,444,957,627	23,226,598,716
C-G-100-2	22,198,009,561	22,975,845,724	22,919,055,370	23,696,891,533
C-G-400-3	23,281,426,175	24,058,276,669	23,384,480,977	24,161,331,471
C-G-1000-3	22,291,343,071	23,073,436,351	22,302,237,190	23,084,330,471
C-RL-100-1	13,606,235,895	13,849,272,867	13,616,981,050	13,860,018,023
C-RL-400-1	14,484,955,687	14,737,761,201	14,975,768,607	15,228,574,121
C-RL-1000-1	16,373,894,553	16,631,568,995	16,403,530,126	16,661,204,569

Color Code
No Action
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Scenario 1 - Low relative sea level rise, High Employment, Dispersed Population
Scenario 2 - High relative sea level rise, High Employment, Dispersed Population
Scenario 3 - Low relative sea level rise, Business-as-usual, Compact Population
Scenario 4 - High relative sea level rise, Business-as-usual, Compact Population

FINAL ARRAY OF ALTERNATIVES

After completion of the alternative analysis including the MCDA the alternatives under consideration were narrowed down to a final array. Tables 27 and 28 show the first cost and fully funded cost of these alternatives.

TABLE 27
LACPR ALTERNATIVES
First Cost for Alternatives In The Final Array ($B)

Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Planning Unit 1				
No Action	0	0	0	0
R2 (Coastal)	36.2	36.9	36.2	36.9
NS-100	41.7	42.4	41.4	42.1
NS-400	56.1	56.8	59.5	60.2
NS-1000	68.6	69.3	70.1	70.8
LP-a-100-1	44.2	45.2	44.2	45.2
C-LP-a-100-1	47.5	48.5	47.0	48.0

TABLE 27
LACPR ALTERNATIVES
First Cost for Alternatives In The Final Array ($B)

Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Planning Unit 2				
No Action	0	0	0	0
NS-400	22.9	23.0	33.1	33.2
WBI-100-1	10.8	11.0	10.8	11.0
C-G-100-1	21.3	21.8	21.4	21.8
C-WBI-100-1	14.4	14.6	14.5	14.7
C-R-100-2	16.2	16.3	16.2	16.4
Planning Unit 3a				
No Action	0	0	0	0
NS-100	6.6	6.6	6.8	6.6
NS-400	9.0	9.0	8.8	8.8
NS-1000	9.9	9.8	10.0	10.0
C-M-100-1	23.0	24.3	23.0	24.3
C-M-100-2	21.0	21.3	21.0	21.3
Planning Unit 3b				
No Action	0	0	0	0
NS-400	3.8	3.8	3.9	3.9
NS-1000	4.8	4.8	5.2	5.3
C-G-100-1	17.2	17.2	17.2	17.2
C-F-100-1	16.3	16.4	16.3	16.4
C-RL-100-1	14.1	14.1	14.1	14.2
Planning Unit 4				
No Action	0	0	0	0
NS-100	1.8	1.8	1.8	1.8
NS-400	2.9	2.9	2.8	2.8
NS-1000	4.0	4.2	4.2	4.2
C-RL-100-1	4.3	4.4	4.4	4.4
C-RL-400-1	5.2	5.2	6.0	6.1
C-RL-1000-1	7.2	7.3	7.4	7.4

Color Code
No Action
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Scenario 1 - Low relative sea level rise, High Employment, Dispersed Population
Scenario 2 - High relative sea level rise, High Employment, Dispersed Population
Scenario 3 - Low relative sea level rise, Business-as-usual, Compact Population

Scenario 4 - High relative sea level rise, Business-as-usual, Compact Population

TABLE 28
LACPR ALTERNATIVES
Fully Funded Cost for Alternatives In The Final Array

Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Planning Unit 1				
No Action	0	0	0	0
R2 (Coastal)	64.0	65.4	64.1	65.4
NS-100	70.8	72.0	70.4	71.7
NS-400	88.7	89.9	92.9	94.2
NS-1000	104.2	105.5	106.0	107.3
LP-a-100-1	76.0	77.8	76.0	77.8
C-LP-a-100-1	80.0	81.8	79.4	81.2
Planning Unit 2				
No Action	0	0	0	0
NS-400	30.2	30.4	42.9	43.0
WBI-100-1	15.4	15.6	15.4	15.6
C-G-100-1	30.6	31.4	30.7	31.5
C-WBI-100-1	19.8	20.0	19.9	20.2
C-R-100-2	22.4	22.7	22.4	22.7
Planning Unit 3a				
No Action	0	0	0	0
NS-100	8.2	8.2	8.2	8.1
NS-400	11.1	11.1	11.0	11.0
NS-1000	12.2	12.2	12.4	12.4
C-M-100-1	34.9	37.3	34.9	37.3
C-M-100-2	32.3	32.8	32.3	32.8
Planning Unit 3b				
No Action	0	0	0	0
NS-400	4.7	4.7	4.9	4.9
NS-1000	5.9	5.9	6.6	6.6
C-G-100-1	27.0	27.1	27.0	27.1
C-F-100-1	25.4	25.6	25.4	25.6
C-RL-100-1	21.8	21.9	21.8	22.0
Planning Unit 4				
No Action	0	0	0	0
NS-100	2.2	2.2	2.2	2.2
NS-400	3.6	3.6	3.5	3.5
NS-1000	5.0	5.0	5.1	5.2
C-RL-100-1	6.1	6.2	6.1	6.2
C-RL-400-1	7.4	7.5	8.5	8.6
C-RL-1000-1	10.2	10.3	10.3	10.4

TABLE 28
LACPR ALTERNATIVES
Fully Funded Cost for Alternatives In The Final Array

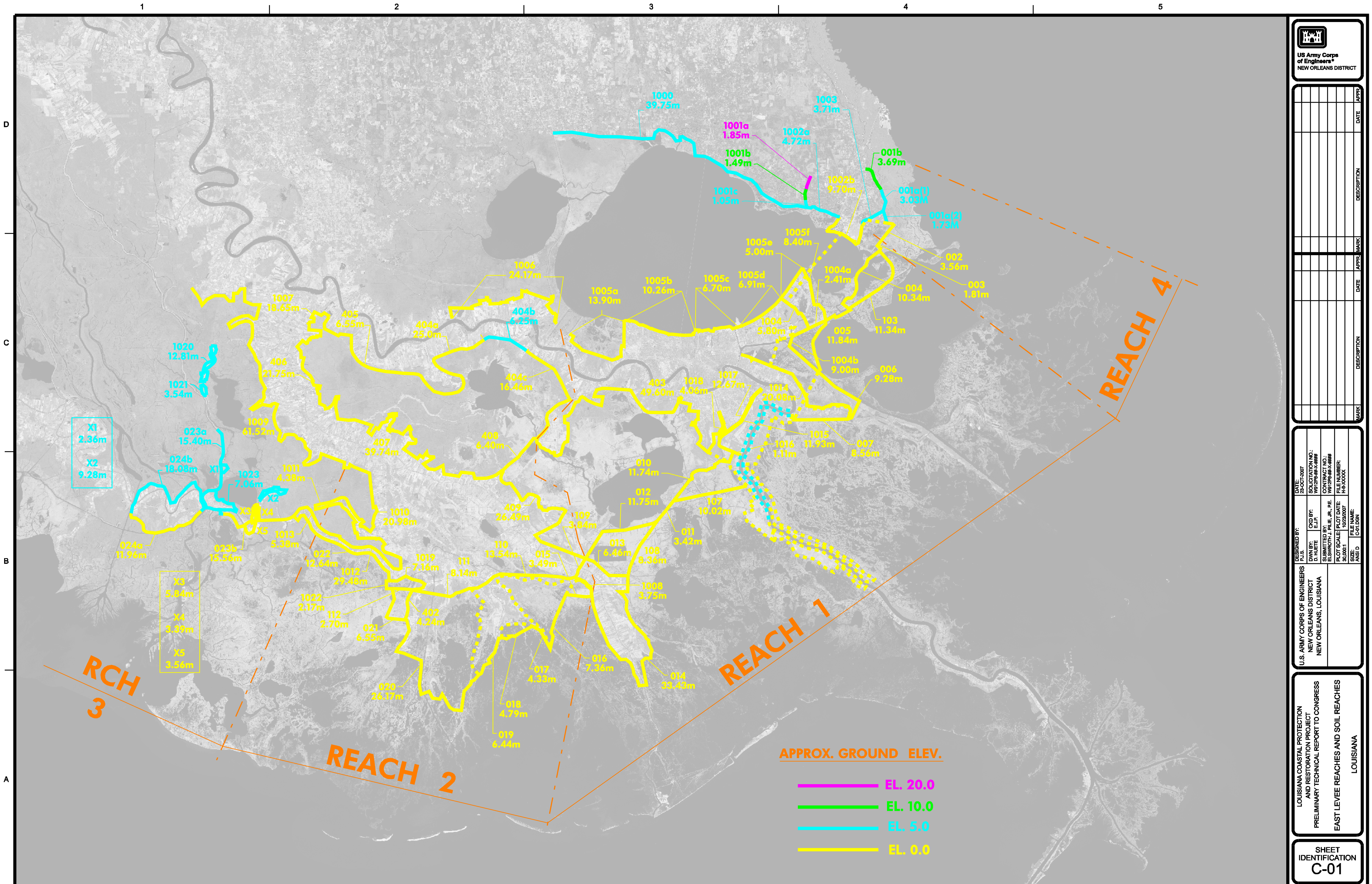
Alternative	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Color Code	Scenario 1 - Low relative sea level rise, High Employment, Dispersed Population			
	Scenario 2 - High relative sea level rise, High Employment, Dispersed Population			
No Action	Scenario 3 - Low relative sea level rise, Business-as-usual, Compact Population			
Nonstructural / Coastal	Scenario 4 - High relative sea level rise, Business-as-usual, Compact Population			
Structural / Coastal				
Comprehensive (Struct + NS + Coastal)				

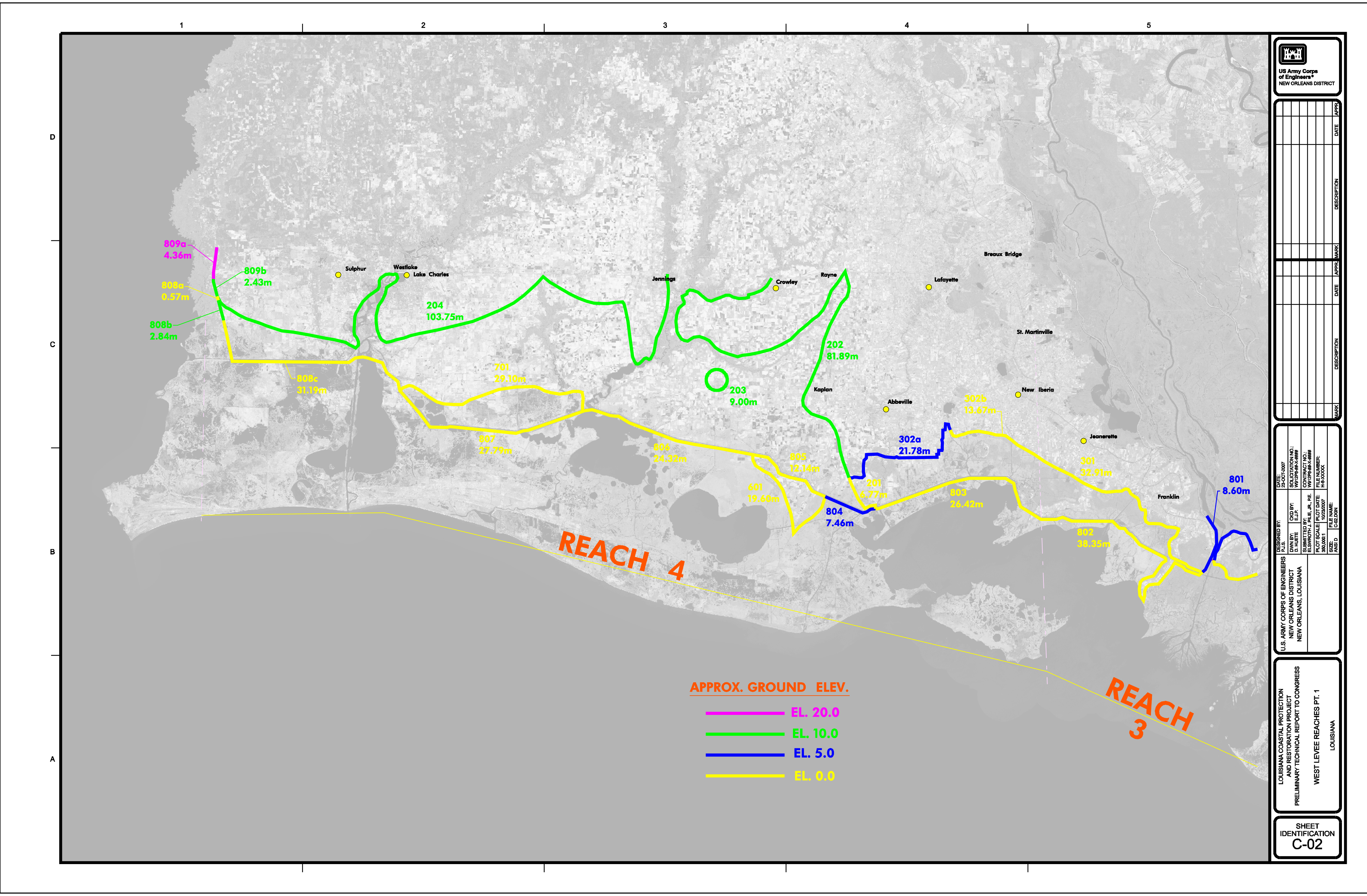
FUTURE STUDIES

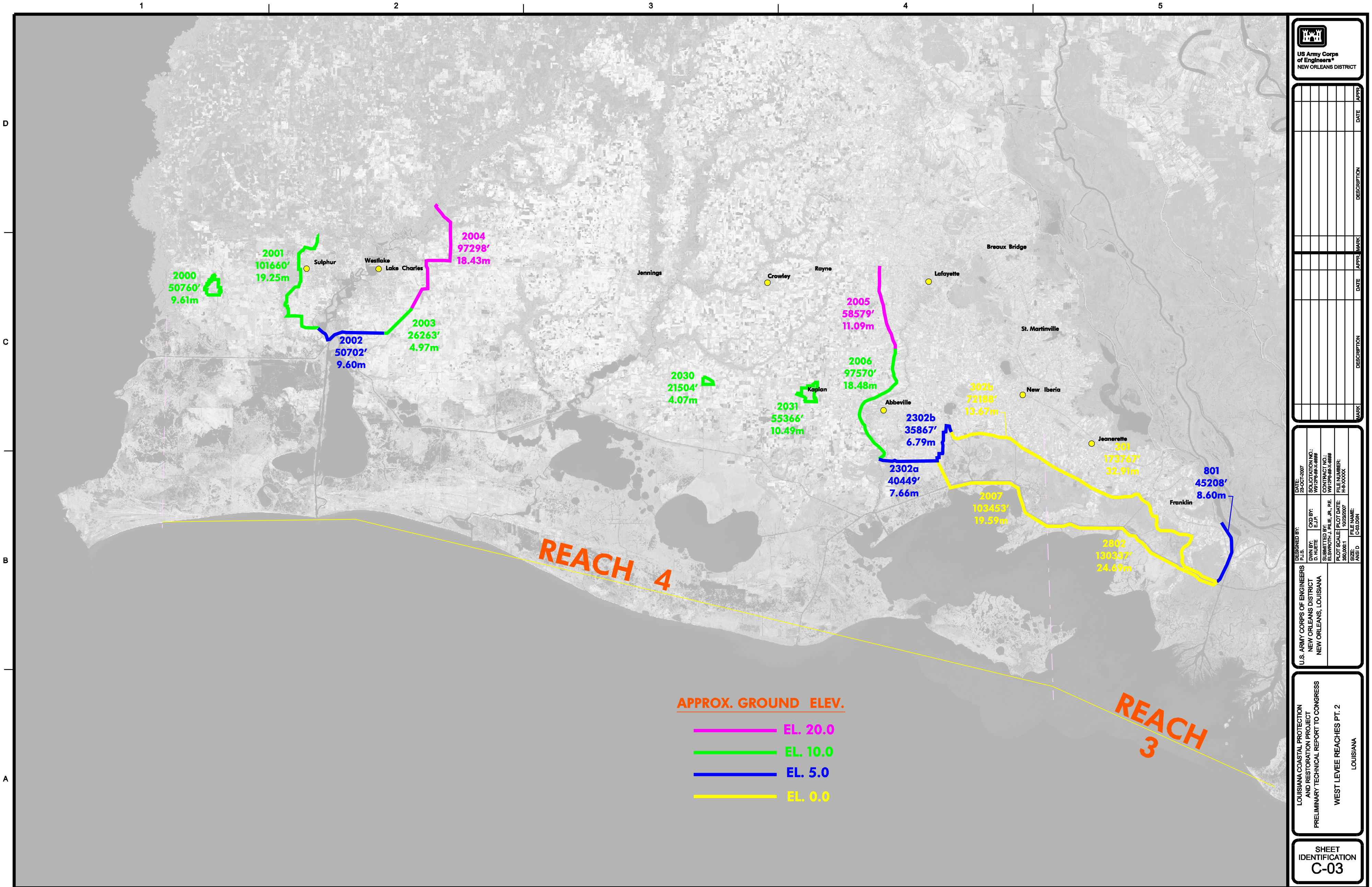
Feasibility level design studies will be required to support any construction recommendations. Once the recommended plan/plans are selected more detailed design efforts will need to be undertaken. These include site specific surveys and borings and alternative studies to determine which method of levee construction (soil mix, geotextile, hollow core or other innovative design) would be best for each area. Design studies will be needed to further develop the hollow core levee concept. Design studies will also look at composite floodwalls. Additional studies will also be needed to determine the impacts of the Lake Pontchartrain Barrier structures and to design the structures so any adverse impacts are minimal. Further studies will also be done to determine the feasibility of other innovative design approaches that were identified at the Engineering Technical Approaches and Innovations Workshop held in March 2006. Advantage will also be taken of the ongoing work being done by USACE on resiliency and armoring.

Further design studies will also be necessary to develop detailed designs of the coastal restoration features selected. These include site specific surveys and borings for proposed barrier island restoration, marsh creation/restoration, and ridge restoration features as well as development of detailed borrow plans for these features. Detailed design investigations will also be necessary for any proposed diversions.

PLATES

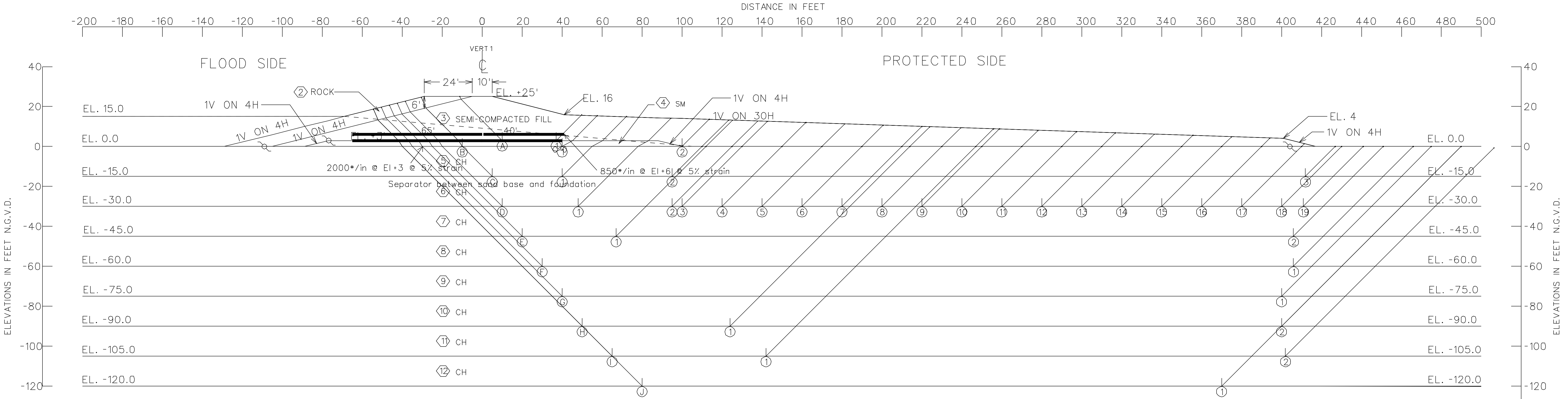

REACH 1
REACH 2
RCH 3
REACH 4
APPROX. GROUND ELEV.
EL. 20.0
EL. 10.0
EL. 5.0
EL. 0.0
1000 39.75m
1001a 1.85m
1001b 1.49m
1001c 1.05m
1002a 4.72m
1002b 9.70m
1003 3.71m
001b 3.69m
001a(1) 3.03m
001a(2) 1.73m
002 3.56m
003 1.81m
004 10.34m
103 11.34m
005 11.84m
006 9.28m
007 8.56m
1004a 2.41m
1004b 9.00m
1005a 13.90m
1005b 10.26m
1005c 6.70m
1005d 6.91m
1005e 5.00m
1005f 8.40m
1006 24.17m
1007 15.65m
405 6.55m
404a 25.0m
404b 6.25m
404c 16.46m
406 21.75m
407 39.74m
408 6.40m
403 49.60m
1018 8.06m
1017 12.67m
1014 20.08m
1015 11.93m
1016 1.11m
1020 12.81m
1021 3.54m
023a 15.40m
024b 18.08m
024a 11.96m
023b 15.56m
1009 61.52m
1011 4.38m
1023 7.04m
1013 5.38m
1010 20.98m
010 11.74m
012 11.75m
107 10.02m
011 3.42m
409 26.49m
109 3.84m
013 6.46m
108 8.36m
1008 3.75m
110 13.54m
015 3.49m
111 8.14m
1019 7.16m
022 13.64m
1012 29.48m
1022 2.17m
112 2.76m
402 4.24m
021 6.55m
020 26.17m
017 4.33m
016 7.36m
014 33.43m
018 4.79m
019 6.44m
X1 2.36m
X2 9.28m
X3 5.84m
X4 3.39m
X5 3.56m
US Army Corps of Engineers
NEW ORLEANS DISTRICT
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
EAST LEVEE REACHES AND SOIL REACHES
LOUISIANA
SHEET IDENTIFICATION
C-01


1
2
3
4
5
D
C
B
A
809a
4.36m
809b
2.43m
808a
0.57m
808b
2.84m
808c
31.19m
Sulphur
Westlake
Lake Charles
204
103.75m
Jennings
Crowley
Rayne
Lafayette
Breaux Bridge
St. Martinville
701
29.10m
203
9.00m
202
81.89m
Kaplan
Abbeville
New Iberia
302b
13.67m
807
27.79m
806
24.32m
302a
21.78m
Jeanerette
805
12.14m
601
19.60m
201
6.77m
301
22.91m
804
7.46m
803
26.42m
802
38.35m
801
8.60m
Franklin
REACH 4
REACH 3
APPROX. GROUND ELEV.
EL. 20.0
EL. 10.0
EL. 5.0
EL. 0.0
US Army Corps of Engineers
NEW ORLEANS DISTRICT
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
WEST LEVEE REACHES PT. 1
LOUISIANA
SHEET IDENTIFICATION
C-02


2000
50760'
9.61m
2001
101660'
19.25m
Sulphur
Westlake
Lake Charles
2004
97298'
18.43m
2002
50702'
9.60m
2003
26263'
4.97m
Jennings
Crowley
Rayne
Lafayette
Breaux Bridge
St. Martinville
2005
58579'
11.09m
2006
97570'
18.48m
2030
21504'
4.07m
Kaplan
2031
55366'
10.49m
Abbeville
New Iberia
302b
72188'
13.67m
2302b
35867'
6.79m
2302a
40449'
7.66m
Jeanerette
301
173767'
32.91m
801
45208'
8.60m
Franklin
2007
103453'
19.59m
2802
130337'
24.69m
REACH 4
REACH 3
APPROX. GROUND ELEV.
EL. 20.0
EL. 10.0
EL. 5.0
EL. 0.0
US Army Corps of Engineers
NEW ORLEANS DISTRICT
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
WEST LEVEE REACHES PT. 2
LOUISIANA
SHEET IDENTIFICATION
C-03


Sulphur
Westlake
Lake Charles
3008
2.97m
3010
14.6m
3009
14.6m
Jennings
Crowley
Rayne
Lafayette
Breaux Bridge
St. Martinville
3007
5.93m
3006
3.15m
Kaplan
3005
6.40m
Abbeville
3003
5.24m
New Iberia
3004
5.89m
3002
12.5m
Jeanerette
3001
5.37m
Franklin
US Army Corps of Engineers
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
DESIGNED BY: P.J.S.
DWN BY: D. HUETE
CKD BY: E.J.P.
SUBMITTED BY: ELSWROTH J. PILIE, JR., P.E.
PLOT SCALE: 350,000:1
PLOT DATE: 10/23/2007
SIZE: ANSI D
FILE NAME: C-04.DGN
DATE: 23-OCT-2007
SOLICITATION NO.: W912P8-##-X-####
CONTRACT NO.: W912P8-##-X-####
FILE NUMBER: H-8-XXXXX
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA
LOUISIANA COASTAL PROTECTION
AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
WEST LEVEE REACHES - RING LEVEES
LOUISIANA
SHEET IDENTIFICATION
C-04


Covington
Abita Springs
NNS7 0.36 mi
NNS8 2.65 mi
NNS0 6.66 mi
Madisonville
NNS9 11.54 mi
NNS1 0.55 mi
Mandeville
NNS2 9.22 mi
NNS3 8.19 mi
St. Tammany Ph.
NNS4 5.56 mi
Lacombe
Pearl River
NNS5 3.61 mi
NNS6a 3.26 mi
Slidell
NNS6d 10.04 mi
NNS6b 7.65 mi
Eden Isle
NNS6c 4.41 mi
Lake Pontchartrain
Jefferson Ph.
Orleans Ph.
Miles
0 2.5 5
N
LEGEND
Revised Alignment Section
NNS0
NNS1
NNS2
NNS3
NNS4
NNS5
NNS6a
NNS6b
NNS6c
NNS6d
NNS7
NNS8
NNS9
Parishes
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
DESIGNED BY: XXX
DWN BY: M. Shields
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXX
FILE NAME: South West LA.mxd
SIZE: ANSI X
PLOT SCALE: NNN:1
DATE: 07/24/2008
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NO.: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY
LOUISIANA COASTAL PROTECTION
AND RESTORATION PROTECTION
PRELIMINARY TECHNICAL REPORT TO CONGRESS
EAST LEVEE REACHES NEW NORTH SHORE
LOUISIANA
SHEET IDENTIFICATION NUMBER
C-05



ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2850 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	3.0	16582	10800	10165	26381	9357	37547	17024	2.21	
B	1	.0	18849	10000	18149	36128	13623	46998	22505	2.09	
B	2	.0	18849	22000	10862	36128	10476	51711	25652	2.02	
C	1	-15.0	24849	7000	23905	88672	50054	55754	38618	1.44	
C	2	-15.0	24849	18000	16604	88672	43720	59453	44952	1.32	
C	3	-15.0	24849	81400	6000	88672	11017	112249	77655	1.45	
D	1	-30.0	29280	7600	29478	161744	106309	66358	55435	1.20	1.81
D	2	-30.0	29280	17000	22216	161744	97814	68496	63930	1.07	1.61
D	3	-30.0	29280	18000	22087	161744	96994	69367	64750	1.07	1.60
D	4	-30.0	29280	22000	21571	161744	93892	72851	67852	1.07	1.58
D	5	-30.0	29280	26000	21055	161744	90838	76335	70906	1.08	1.56
D	6	-30.0	29280	30000	20539	161744	87831	79819	73913	1.08	1.54
D	7	-30.0	29280	34000	20022	161744	84872	83302	76872	1.08	1.53
D	8	-30.0	29280	38000	19506	161744	81959	86786	79785	1.09	1.52
D	9	-30.0	29280	42000	18990	161744	79094	90270	82650	1.09	1.51
D	10	-30.0	29280	46000	18474	161744	76277	93754	85467	1.10	1.51
D	11	-30.0	29280	50000	17958	161744	73507	97238	88237	1.10	1.49
D	12	-30.0	29280	54000	17441	161744	70784	100721	90960	1.11	1.48
D	13	-30.0	29280	58000	16925	161744	68108	104205	93636	1.11	1.48
D	14	-30.0	29280	62000	16409	161744	65480	107689	96264	1.12	1.47

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. W/ lb/in GEOSYNTHETIC AT 5% STRAIN
D	15	-30.0	29280	66000	15893	161744	62899	111173	98845	1.12	1.47
D	16	-30.0	29280	70000	15376	161744	60365	114656	101379	1.13	1.47
D	17	-30.0	29280	74000	13104	161744	56298	116384	105446	1.10	1.43
D	18	-30.0	29280	78000	12000	161744	47227	119280	114517	1.04	1.34
D	19	-30.0	29280	80200	12000	161744	43790	121480	117954	1.03	1.32
E	1	-45.0	36732	16450	30802	254565	180471	83984	74094	1.13	1.60
E	2	-45.0	36732	135100	20250	254565	100067	192082	154498	1.24	1.46
F	1	-60.0	48560	188000	33000	366500	177689	269560	188811	1.43	
G	1	-75.0	64681	234000	50250	497499	280094	348931	217405	1.60	
H	1	-90.0	85301	59200	79919	648676	520489	224420	128187	1.75	
H	2	-90.0	85301	280000	72000	648676	402714	437301	245962	1.78	
I	1	-105.0	111551	73150	105318	819825	674010	290019	145815	1.99	
I	2	-105.0	111551	320150	98003	819825	546764	529704	273061	1.94	
J	1	-120.0	142301	319000	129000	1012645	730399	590301	282246	2.09	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	WATER	62.5	0	0	0
2	RIPRAP	132	0	0	40
3	CH	110	400	400	0
4	SM	122	0	0	30
5	CH	95	200	200	0
6	CH	100	200	200	0
7	CH	100	275	350	0
8	CH	100	425	500	0
9	CH	100	575	650	0
10	CH	100	725	800	0
11	CH	100	875	950	0
12	CH	100	1025	1100	0
13	CH	100	1100	1100	0

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

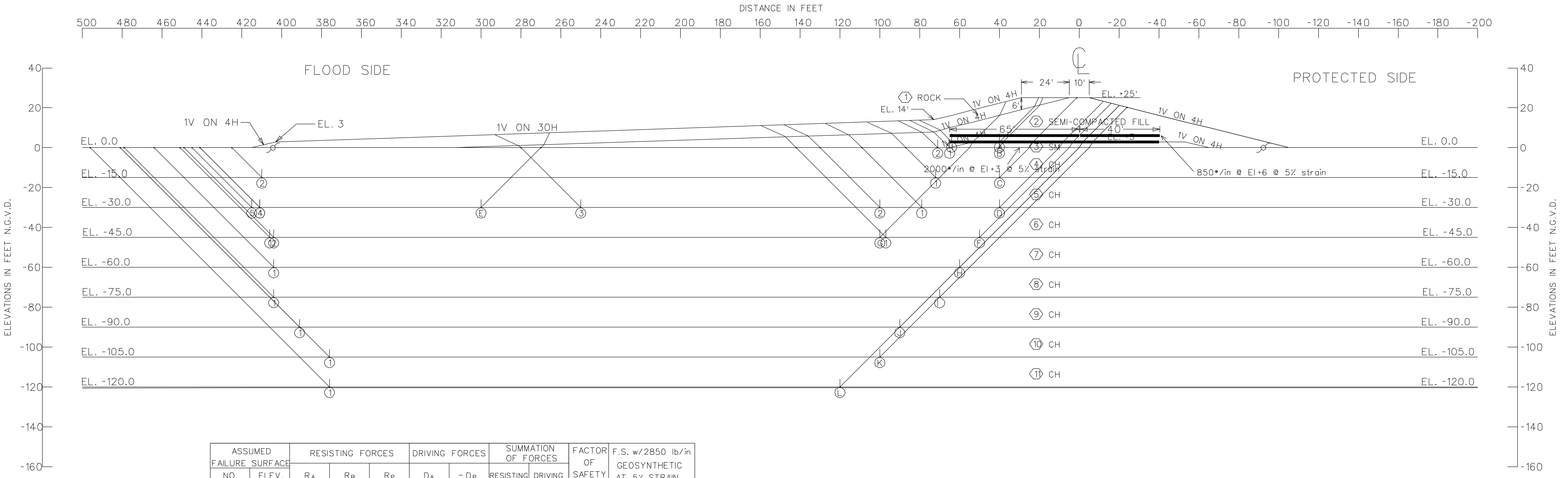
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - GEOTEXTILE
P/S - CROWN EL. +25, WATER AT EL. +15
LOUISIANA

SHEET IDENTIFICATION NUMBER
G1



ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/2850 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
A 1	3.0	15101	9600	11129	27367	8708	35830	18659	1.92	
B 1	.0	20233	5000	14380	35143	12952	39613	22191	1.79	
B 2	.0	20233	6200	14225	35143	11910	40658	23233	1.75	
C 1	-15.0	29015	6400	19812	88405	46432	55227	41973	1.32	
C 2	-15.0	29015	74000	6000	88405	11099	109015	77306	1.41	
D 1	-30.0	33455	7800	25244	161876	101049	66499	60827	1.09	1.66
D 2	-30.0	33455	12000	24703	161876	97722	70158	64154	1.09	1.63
D 3	-30.0	33455	42000	20831	161876	75474	96286	86402	1.11	1.51
D 4	-30.0	33455	74200	12000	161876	43575	119655	118301	1.01	1.30
D 5	-30.0	33455	75000	12000	161876	43311	120455	118565	1.02	1.30
E 1	-30.0	15075	22200	12000	73854	43575	49275	30279	1.63	
F 1	-45.0	40859	16450	32643	254441	174314	89952	80127	1.12	1.55
F 2	-45.0	40859	123900	20250	254441	100429	185009	154012	1.20	1.42
G 1	-45.0	36999	107100	20250	203485	99770	164349	103715	1.58	
H 1	-60.0	52809	172000	33000	366162	178052	257809	188110	1.37	
I 1	-75.0	69212	217100	50250	496804	278174	336562	218630	1.54	
J 1	-90.0	91810	240800	72000	640893	406240	404610	234653	1.72	
K 1	-105.0	117212	262200	98250	813493	558585	477662	254908	1.87	
L 1	-120.0	148810	281600	129000	1000273	726204	559410	274069	2.04	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.	C - UNIT COHESION - P.S.F.		FRICTION ANGLE
			CENTER OF STRATUM	BOTTOM OF STRATUM	
		VERT. 1	VERT. 1	VERT. 1	DEGREES
1	ROCK	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	95	200	200	0
5	CH	100	200	200	0
6	CH	100	275	350	0
7	CH	100	425	500	0
8	CH	100	575	650	0
9	CH	100	725	800	0
10	CH	100	875	950	0
11	CH	100	1025	1100	0
12	CH	100	1100	1100	0

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

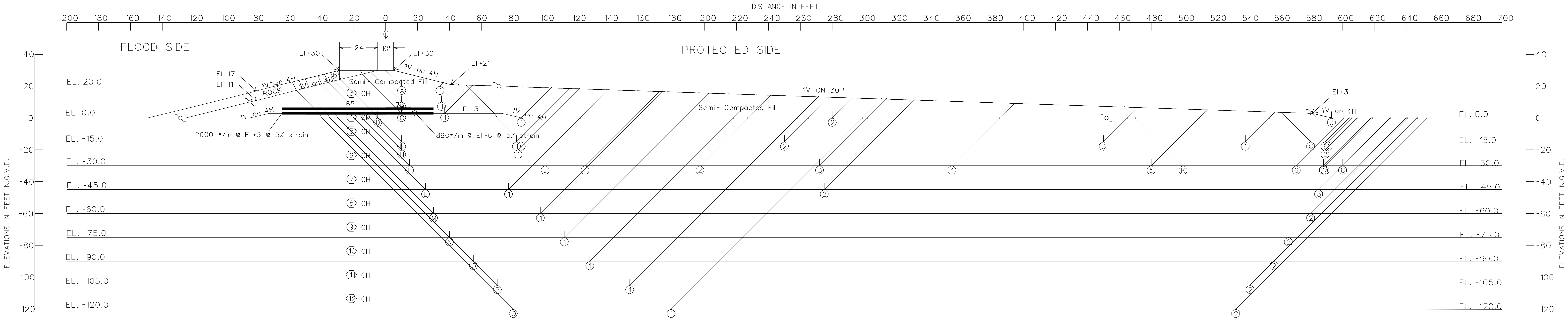
MARK | DESCRIPTION | DATE | APPR. | MARK | APPR. | DATE | DESCRIPTION

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - GEOTEXTILE
F/S - CROWN EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G2



ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2850 lb/in GEOSYNTHETIC AT 5% STRAIN
(A) (1)	20.0	8000	9600	1760	5154	333	19360	4821	4.02	
(B) (1)	10.0	15252	10000	8671	21709	7105	33923	14604	2.32	
(C) (1)	3.0	19978	10800	14038	40065	17691	44816	22374	2.00	
(D) (1)	.0	22643	18000	15122	51286	20307	55765	30979	1.80	
(D) (2)	.0	22643	57000	10089	51286	9039	89732	42247	2.12	
(D) (3)	.0	22643	110096	0	51286	0	132739	51286	2.59	
(E) (1)	-15.0	28643	14400	20813	111667	62166	63856	49501	1.29	1.98
(E) (2)	-15.0	28643	48000	16477	111667	43174	93120	68493	1.36	
(E) (3)	-15.0	28643	88000	11315	111667	24935	127958	86732	1.48	
(E) (4)	-15.0	28643	115800	6000	111667	10907	150443	100760	1.49	
(F) (1)	-15.0	21951	90800	9018	66450	18340	121769	48110	2.53	
(G) (1)	-15.0	8922	2200	6000	16810	10742	17122	6068	2.82	
(H) (1)	-20.0	29926	14600	22658	136508	80531	67184	55977	1.20	1.81
(H) (2)	-20.0	29926	115800	8000	136508	19282	153726	117226	1.31	
(I) (1)	-30.0	33182	22000	25316	192302	117463	80498	74839	1.08	1.53
(I) (2)	-30.0	33182	36400	23457	192302	105454	93039	86848	1.07	1.47
(I) (3)	-30.0	33182	51400	21522	192302	93598	106104	98704	1.07	1.42
(I) (4)	-30.0	33182	68000	19379	192302	81251	120561	111051	1.09	1.39
(I) (5)	-30.0	33182	93000	16153	192302	64196	142335	128106	1.11	1.38
(I) (6)	-30.0	33182	111200	12000	192302	48771	156382	143531	1.09	1.33

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2850 lb/in GEOSYNTHETIC AT 5% STRAIN
(I) (7)	-30.0	33182	114800	12000	192302	43531	159982	148771	1.08	1.30
(I) (8)	-30.0	33182	117000	12000	192302	43311	162182	148991	1.09	1.32
(J) (1)	-30.0	27951	97600	12000	130890	43655	137551	87235	1.58	
(K) (1)	-30.0	17543	17600	12000	66317	43655	47143	22662	2.08	
(L) (1)	-45.0	40687	18200	34417	292006	210647	93304	81359	1.15	1.57
(L) (2)	-45.0	40687	87500	29307	292006	167339	157494	124667	1.26	1.54
(L) (3)	-45.0	40687	196000	20250	292006	99314	256937	192692	1.33	
(M) (1)	-60.0	51811	33500	46264	412183	311354	131575	100829	1.30	
(M) (2)	-60.0	51811	275000	33000	412183	178367	359811	233816	1.54	
(N) (1)	-75.0	67926	46800	62740	550905	433436	177466	117469	1.51	
(N) (2)	-75.0	67926	341900	50250	550905	283517	460076	267388	1.72	
(O) (1)	-90.0	89676	58400	83690	708368	575266	231766	133102	1.74	
(O) (2)	-90.0	89676	401600	72000	708368	409751	563276	298617	1.89	
(P) (1)	-105.0	115926	78850	108908	887497	733213	303684	154284	1.97	
(P) (2)	-105.0	115926	448400	98250	887497	561551	662576	325946	2.03	
(Q) (1)	-120.0	145491	108900	138599	1090197	909790	392990	180407	2.18	
(Q) (2)	-120.0	145491	498300	129000	1090197	733576	772791	356621	2.17	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	WATER	62	0	0	0
2	ROCK	132	0	0	40
3	CH	110	400	400	0
4	SM	122	0	0	30
5	CH	95	200	200	0
6	CH	100	200	200	0
7	CH	100	275	350	0
8	CH	100	425	500	0
9	CH	100	575	650	0
10	CH	100	725	800	0
11	CH	100	875	950	0
12	CH	100	1025	1100	0
13	CH	100	1100	1100	0

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXXXX
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN
FILE NUMBER: H-NN-NNNNN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - GEOTEXTILE
P/S - CROWN EL. +30 WATER AT EL. +20
LOUISIANA

SHEET IDENTIFICATION NUMBER
G3

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/2890 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
(A) (1)	3.0	19101	12800	14483	39644	12251	46384	27393	1.69	
(B) (1)	.0	26163	8800	17255	50589	17153	52218	33436	1.56	
(B) (2)	.0	26163	9800	16617	50589	16938	52580	33651	1.56	
(C) (1)	-15.0	33464	10000	22421	112101	56744	65885	55357	1.19	1.82
(C) (2)	-15.0	33464	30000	20646	112101	48942	84110	63159	1.33	
(C) (3)	-15.0	33464	50000	18870	112101	41693	102334	70408	1.45	
(C) (4)	-15.0	33464	70000	17095	112101	34998	120559	77103	1.56	
(C) (5)	-15.0	33464	90000	15320	112101	28857	138784	83244	1.67	
(C) (6)	-15.0	33464	110000	6000	112101	11100	149464	101001	1.48	
(D) (1)	-15.0	8082	3400	6000	25055	10836	17482	14219	1.23	1.57*
(E) (1)	-30.0	38609	7800	28173	192336	117880	74582	74456	1.00	1.47
(E) (2)	-30.0	38609	27800	26397	192336	106411	92806	85925	1.08	1.48
(E) (3)	-30.0	38609	47800	24622	192336	95497	111031	96839	1.15	1.51
(E) (4)	-30.0	38609	67800	22846	192336	85136	129255	107200	1.21	1.53
(E) (5)	-30.0	38609	87800	21071	192336	75330	147480	117006	1.26	1.56
(E) (6)	-30.0	38609	108000	12000	192336	43724	158609	148612	1.07	1.30
(F) (1)	-30.0	14361	4800	12000	70539	43311	31161	27228	1.14	1.33*
(G) (1)	-45.0	46005	16450	35837	291771	198119	98292	93652	1.05	1.42
(G) (2)	-45.0	46005	44100	34434	291771	186201	124539	105570	1.18	1.51
(G) (3)	-45.0	46005	79100	32659	291771	171610	157764	120161	1.31	
(G) (4)	-45.0	46005	184100	20250	291771	99771	250355	192000	1.30	
(H) (1)	-60.0	57109	28500	48054	412024	299576	133663	112448	1.19	1.47

* Floodside berm fabric strength is 410 #/in

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
(H) (2)	-60.0	57109	78500	46279	412024	280972	181888	131052	1.39
(H) (3)	-60.0	57109	160000	43385	412024	251833	260494	160191	1.63
(H) (4)	-60.0	57109	210000	41609	412024	234684	308718	177340	1.74
(H) (5)	-60.0	57109	260000	33000	412024	177708	350109	234316	1.49
(I) (1)	-75.0	73512	42900	64701	550687	421001	181113	129686	1.40
(I) (2)	-75.0	73512	330200	50250	550687	278555	453962	272132	1.67
(J) (1)	-90.0	93112	60000	85936	710251	564305	239048	145946	1.64
(J) (2)	-90.0	93112	400000	72000	710251	402514	565112	307737	1.84
(K) (1)	-105.0	118287	80750	111564	887986	726771	310601	161215	1.93
(K) (2)	-105.0	118287	465500	98250	887986	547635	682037	340351	2.00
(L) (1)	-120.0	149038	104500	141604	1085205	908090	395142	177115	2.23
(L) (2)	-120.0	149038	522500	129000	1085205	715256	800538	369949	2.16

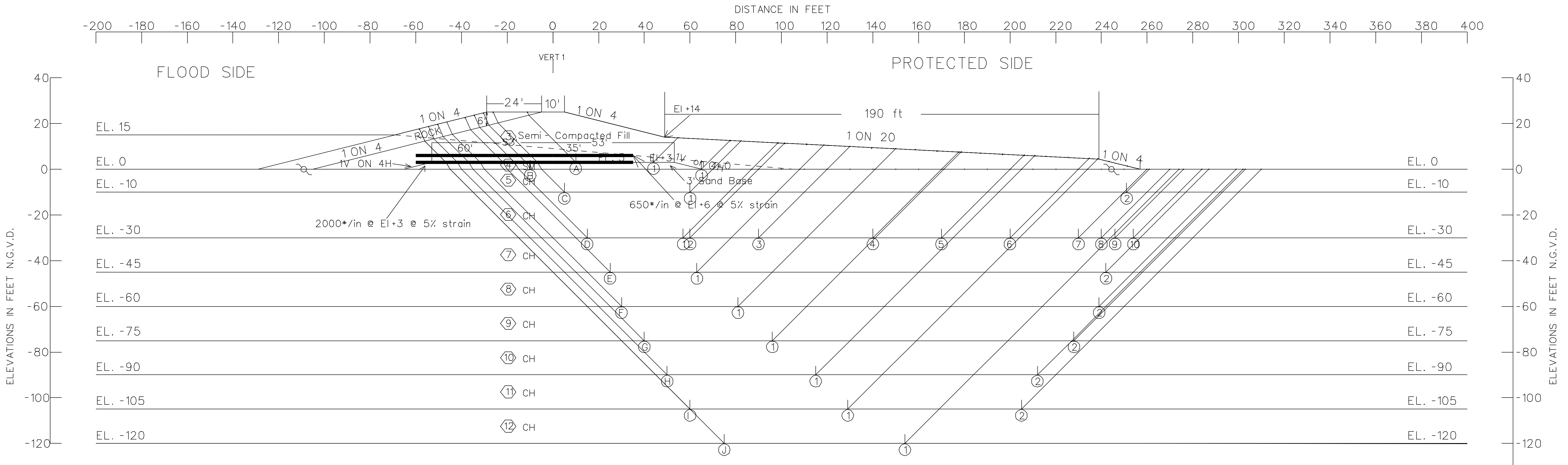
STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.	C - UNIT COHESION - P.S.F. CENTER OF STRATUM	C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM	FRICTION ANGLE DEGREES
		VERT. 1	VERT. 1	VERT. 1	
1	RIPRAP	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	95	200	200	0
5	CH	100	200	200	0
6	CH	100	275	350	0
7	CH	100	425	500	0
8	CH	100	575	650	0
9	CH	100	725	800	0
10	CH	100	875	950	0
11	CH	100	1025	1100	0
12	CH	100	1100	1100	0

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - GEOTEXTILE
F/S - CROWN EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G4



ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. W/2650 lb/in GEOSYNTHETIC AT 5% STRAIN
A 1	3.0	16582	13600	8575	26382	6920	38757	19462	1.99	
B 1	.0	18849	15000	10118	36128	9131	43967	26997	1.63	
C 1	-10.0	23175	11000	13870	68532	28355	48045	40177	1.20	1.99
C 2	-10.0	23175	49200	4000	68532	5511	76375	63021	1.21	1.72
D 1	-30.0	34079	12600	25223	163185	95194	71902	67991	1.06	1.53
D 2	-30.0	34079	13500	25108	163185	94449	72687	68736	1.06	1.52
D 3	-30.0	34079	22500	23965	163185	87698	80544	75487	1.07	1.49
D 4	-30.0	34079	37500	22060	163185	77034	93639	86151	1.09	1.46
D 5	-30.0	34079	46500	20917	163185	70951	101496	92234	1.10	1.45
D 6	-30.0	34079	55500	19774	163185	65103	109353	98082	1.11	1.44
D 7	-30.0	34079	64500	16000	163185	54182	114579	109003	1.05	1.34
D 8	-30.0	34079	67500	16000	163185	49017	117579	114168	1.03	1.31
D 9	-30.0	34079	69300	16000	163185	46692	119379	116493	1.02	1.30
D 10	-30.0	34079	71700	16000	163185	45130	121779	118055	1.03	1.30
E 1	-45.0	44531	17100	35673	256323	167943	97304	88380	1.10	1.46
E 2	-45.0	44531	97650	27250	256323	104381	169431	151942	1.12	1.32
F 1	-60.0	58560	30600	50165	370481	256596	139325	113885	1.22	1.50
F 2	-60.0	58560	125400	43000	370481	184497	226960	185984	1.22	1.39

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
G 1	-75.0	77682	42000	69272	502644	365191	188954	137453	1.37
G 2	-75.0	77682	141000	63250	502644	291525	281932	211119	1.34
H 1	-90.0	101301	58500	92726	654024	490696	252527	163328	1.55
H 2	-90.0	101301	145800	88000	654024	424869	335101	229155	1.46
I 1	-105.0	129358	72450	120871	825823	637640	322679	188183	1.71
I 2	-105.0	129358	152250	117250	825823	575758	398858	250065	1.60
J 1	-120.0	163108	94800	151000	1016191	786460	408908	229731	1.78

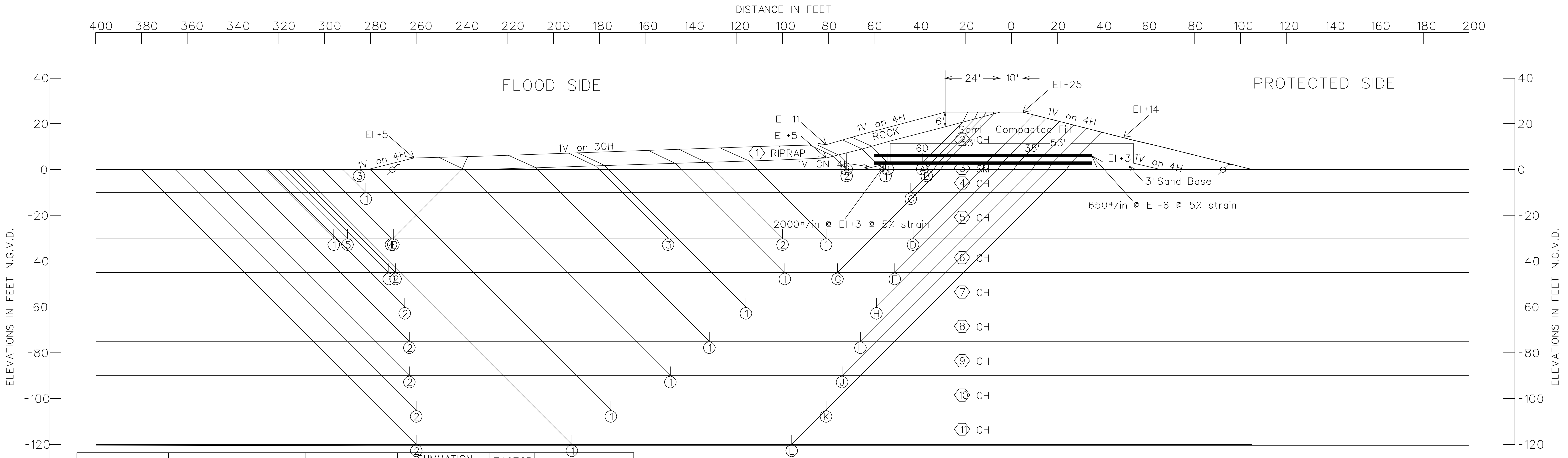
STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	WATER	62.5	0	0	0
2	RIPRAP	132	0	0	40
3	CH	110	400	400	0
4	SM	122	0	0	30
5	CH	100	200	200	0
6	CH	100	300	300	0
7	CH	100	375	450	0
8	CH	100	525	600	0
9	CH	100	675	750	0
10	CH	100	825	900	0
11	CH	100	975	1050	0
12	CH	100	1125	1200	0
13	CH	100	1200	1200	0

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 - GEOTEXTILE
P/S - CROWN EL. +25, WATER AT EL. +15
LOUISIANA

SHEET IDENTIFICATION NUMBER
G5



ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY	F.S. w/2650 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	3.0	15118	6000	11406	27618	11018	32524	16600	1.96	
A	2	3.0	15118	13200	8521	27618	5188	36839	22430	1.64	
B	1	.0	20744	3600	18422	35888	14736	42766	21152	2.02	
B	2	.0	20744	7000	11090	35888	8796	38834	27092	1.43	
B	3	.0	20744	47750	0	35888	0	68494	35888	1.91	
C	1	-10.0	25512	47600	4000	67596	5000	77112	62596	1.23	1.74
D	1	-30.0	37972	11400	27077	163387	89742	76449	73645	1.04	1.47
D	2	-30.0	37972	17100	26586	163387	86918	81658	76469	1.07	1.45
D	3	-30.0	37972	32100	25295	163387	79691	95367	83696	1.14	1.48
D	4	-30.0	37972	68400	16000	163387	46648	122372	116739	1.05	1.32
D	5	-30.0	37972	74100	16000	163387	44998	128072	118389	1.08	1.35
E	1	-30.0	17704	7800	16000	66603	44998	41504	21605	1.92	
F	1	-45.0	48023	21600	37475	256779	159840	107098	96939	1.10	1.43
F	2	-45.0	48023	98100	27250	256779	103622	173373	153157	1.13	1.34
G	1	-45.0	49649	88200	27250	235869	102583	165099	133286	1.24	1.48
H	1	-60.0	62650	34200	52399	369682	250013	149249	119669	1.25	1.49
H	2	-60.0	62650	123600	43000	369682	184217	229250	185465	1.24	1.41
I	1	-75.0	81352	49500	71848	502171	360415	202700	141756	1.43	
I	2	-75.0	81352	147750	63250	502171	286585	292352	215586	1.36	
J	1	-90.0	104598	67500	95284	653717	490474	267382	163243	1.64	
J	2	-90.0	104598	170100	88000	653717	410332	362698	243385	1.49	
K	1	-105.0	132128	98700	117260	825281	629692	348088	195589	1.78	
K	2	-105.0	132128	187950	117250	825281	558493	437328	266788	1.64	
L	1	-120.0	165878	115200	151000	1013741	782028	432078	231713	1.86	
L	2	-120.0	165878	196800	151000	1013741	727238	513678	286503	1.79	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	RIPRAP	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	100	200	200	0
5	CH	100	300	300	0
6	CH	100	375	450	0
7	CH	100	525	600	0
8	CH	100	675	750	0
9	CH	100	825	900	0
10	CH	100	975	1050	0
11	CH	100	1125	1200	0
12	CH	100	1200	1200	0

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

- Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ∇ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

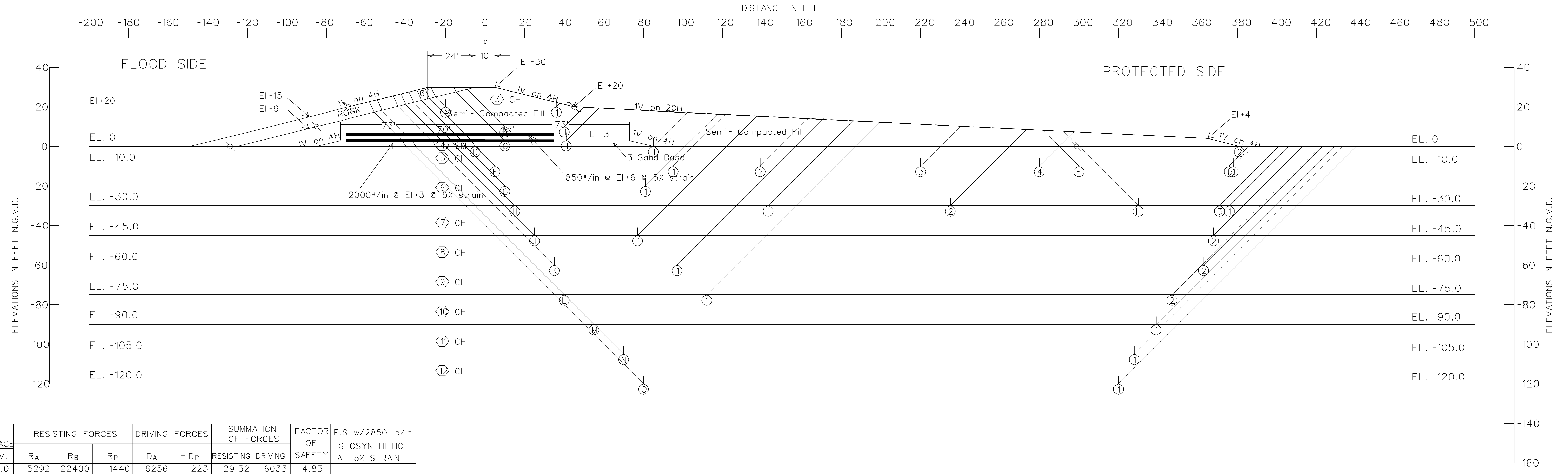
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

REACH 2 - GEOTEXTILE
F/S - CROWN EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G6



ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2850 lb/in GEOSYNTHETIC AT 5% STRAIN
(A) (1)	20.0	5292	22400	1440	6256	223	29132	6033	4.83	
(B) (1)	10.0	15252	12000	7809	21709	5778	35061	15931	2.20	
(C) (1)	3.0	19978	12400	13105	40065	15671	45483	24394	1.86	
(D) (1)	.0	22643	18000	13714	51286	16970	54357	34316	1.58	
(D) (2)	.0	22643	71894	0	51286	0	94537	51286	1.84	
(E) (1)	-10.0	26643	18000	16952	89646	39111	61595	50535	1.22	1.89
(E) (2)	-10.0	26643	26800	15276	89646	33026	68719	56620	1.21	1.82
(E) (3)	-10.0	26643	43000	12190	89646	23150	81833	66496	1.23	1.74
(E) (4)	-10.0	26643	55000	9903	89646	16942	91546	72704	1.26	1.73
(E) (5)	-10.0	26643	74200	4000	89646	5343	104843	84303	1.24	1.65
(F) (1)	-10.0	10525	15600	4000	16723	5124	30125	11599	2.60	
(G) (1)	-20.0	31927	21300	23105	137446	74457	76332	62989	1.21	1.75
(H) (1)	-30.0	37182	38400	26361	193990	102038	101943	91952	1.11	1.48
(H) (2)	-30.0	37182	66000	22856	193990	81410	126038	112580	1.12	1.42
(H) (3)	-30.0	37182	106800	16000	193990	46373	159982	147617	1.08	1.32
(I) (1)	-30.0	22104	13800	16000	69483	45343	51904	24140	2.15	
(J) (1)	-45.0	47687	23400	39554	294819	200512	110641	94307	1.17	1.54
(J) (2)	-45.0	47687	154350	27250	294819	103570	229287	191249	1.20	1.38
(K) (1)	-60.0	62693	37200	53971	414848	295790	153864	119058	1.29	1.58
(K) (2)	-60.0	62693	196800	43000	414848	184403	302493	230445	1.31	

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
(L) (1)	-75.0	80926	54000	73078	555967	411845	208004	144122	1.44
(L) (2)	-75.0	80926	230250	63250	555967	293567	374426	262400	1.43
(M) (1)	-90.0	105676	255600	88000	713319	421800	449276	291519	1.54
(N) (1)	-105.0	134926	270900	117250	891660	574789	523076	316871	1.65
(O) (1)	-120.0	167491	288000	151000	1093982	748857	606491	345125	1.76

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	WATER	62	0	0	0
2	RIPRAP	132	0	0	40
3	CH	110	400	400	0
4	SM	122	0	0	30
5	CH	100	200	200	0
6	CH	100	300	300	0
7	CH	100	375	450	0
8	CH	100	525	600	0
9	CH	100	675	750	0
10	CH	100	825	900	0
11	CH	100	975	1050	0
12	CH	100	1125	1200	0
13	CH	100	1200	1200	0

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

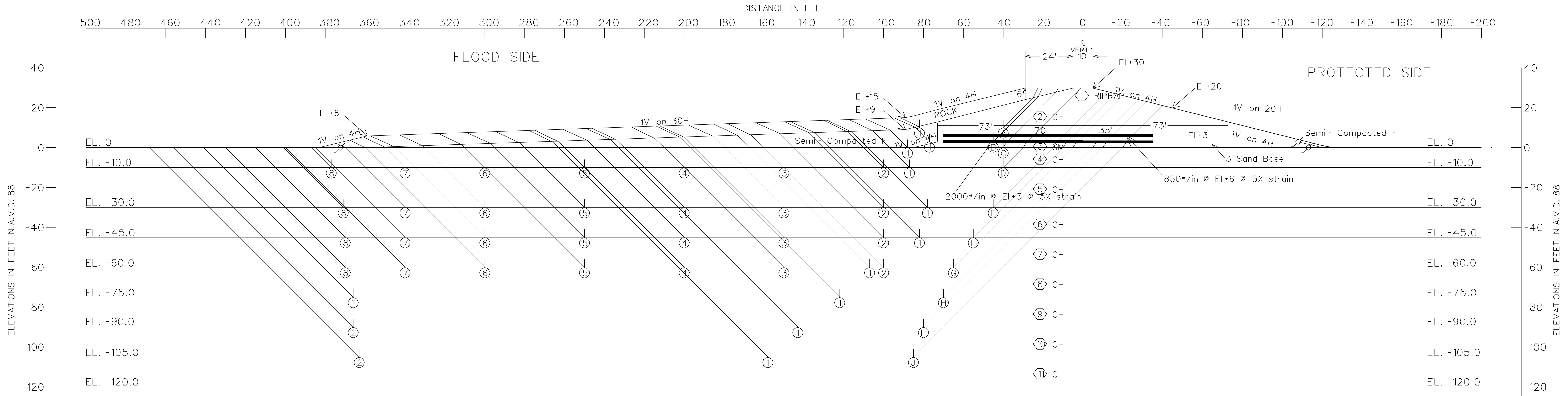
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 - GEOTEXTILE
P/S - CROWN EL. +30; WATER EL. +20
LOUISIANA

SHEET IDENTIFICATION NUMBER
G7



ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2850 lb/in GEOSYNTHETIC AT 5% STRAIN
Ⓐ	①	10.0	13289	16800	6181	22542	2083	36270	20459	1.77	
Ⓑ	①	3.0	19101	12800	11767	39644	10933	43668	28711	1.52	
Ⓒ	①	.0	26163	9600	14973	50589	13495	50736	37094	1.37	
Ⓓ	①	-10.0	32151	9400	18741	89435	35726	60292	53709	1.12	1.76
Ⓓ	②	-10.0	32151	12000	18405	89435	34477	62556	54958	1.14	1.76
Ⓓ	③	-10.0	32151	22000	17114	89435	30040	71265	59395	1.20	1.78
Ⓓ	④	-10.0	32151	32000	15822	89435	25900	79973	63535	1.26	1.80
Ⓓ	⑤	-10.0	32151	42000	14531	89435	22055	88682	67380	1.32	
Ⓓ	⑥	-10.0	32151	52000	13239	89435	18507	97390	70928	1.37	
Ⓓ	⑦	-10.0	32151	60000	12025	89435	15830	104176	73605	1.42	
Ⓓ	⑧	-10.0	32151	67400	4000	89435	5594	103551	83841	1.24	1.64
Ⓔ	①	-30.0	42609	9900	30456	194024	111885	82965	82139	1.01	1.43
Ⓔ	②	-30.0	42609	16500	29888	194024	106764	88997	87260	1.02	1.41
Ⓔ	③	-30.0	42609	31500	28597	194024	98778	102706	95246	1.08	1.44
Ⓔ	④	-30.0	42609	46500	27305	194024	91089	116414	102935	1.13	1.46
Ⓔ	⑤	-30.0	42609	61500	26014	194024	83694	130123	110330	1.18	1.49
Ⓔ	⑥	-30.0	42609	76500	24723	194024	76597	143832	117427	1.22	1.52
Ⓔ	⑦	-30.0	42609	88500	17632	194024	67869	148741	126155	1.18	1.45
Ⓔ	⑧	-30.0	42609	97800	16000	194024	47374	156409	146650	1.07	1.30
Ⓕ	①	-45.0	53005	12150	41216	294584	190799	106371	103785	1.02	1.35

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2850 lb/in GEOSYNTHETIC AT 5% STRAIN
Ⓕ	②	-45.0	53005	20250	40751	294584	186297	114006	108287	1.05	1.37
Ⓕ	③	-45.0	53005	42750	39460	294584	175650	135215	118934	1.14	1.42
Ⓕ	④	-45.0	53005	65250	38168	294584	165298	156423	129286	1.21	1.47
Ⓕ	⑤	-45.0	53005	87750	36877	294584	155242	177632	139342	1.27	1.52
Ⓕ	⑥	-45.0	53005	110250	35586	294584	145482	198841	149102	1.33	
Ⓕ	⑦	-45.0	53005	128250	27250	294584	126453	208505	168131	1.24	1.44
Ⓕ	⑧	-45.0	53005	141750	27250	294584	104035	222005	190549	1.17	1.34
Ⓖ	①	-60.0	67909	25200	55933	414349	285649	149042	128700	1.16	1.42
Ⓖ	②	-60.0	67909	21000	56114	414349	287531	145023	126818	1.14	1.41
Ⓖ	③	-60.0	67909	51000	54822	414349	274222	173731	140127	1.24	1.48
Ⓖ	④	-60.0	67909	81000	53531	414349	261208	202440	153141	1.32	
Ⓖ	⑤	-60.0	67909	111000	52239	414349	248490	231148	165859	1.39	
Ⓖ	⑥	-60.0	67909	141000	48110	414349	235284	257019	179065	1.44	
Ⓖ	⑦	-60.0	67909	165000	43000	414349	205200	275909	209149	1.32	
Ⓖ	⑧	-60.0	67909	183000	43000	414349	182783	293909	231566	1.27	1.42
Ⓗ	①	-75.0	86512	39000	75408	555749	403401	200920	152348	1.32	
Ⓗ	②	-75.0	86512	222000	63250	555749	286009	371762	269740	1.38	
Ⓘ	①	-90.0	110187	56700	99228	714521	539059	266115	175462	1.52	
Ⓘ	②	-90.0	110187	257400	88000	714521	409756	455587	304765	1.49	
Ⓙ	①	-105.0	137287	76650	127704	895098	696762	341641	198336	1.72	
Ⓙ	②	-105.0	137287	291900	117250	895098	557833	546437	337265	1.62	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	RIPRAP	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	100	200	200	0
5	CH	100	300	300	0
6	CH	100	375	450	0
7	CH	100	525	600	0
8	CH	100	675	750	0
9	CH	100	825	900	0
10	CH	100	975	1050	0
11	CH	100	1125	1200	0

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES:

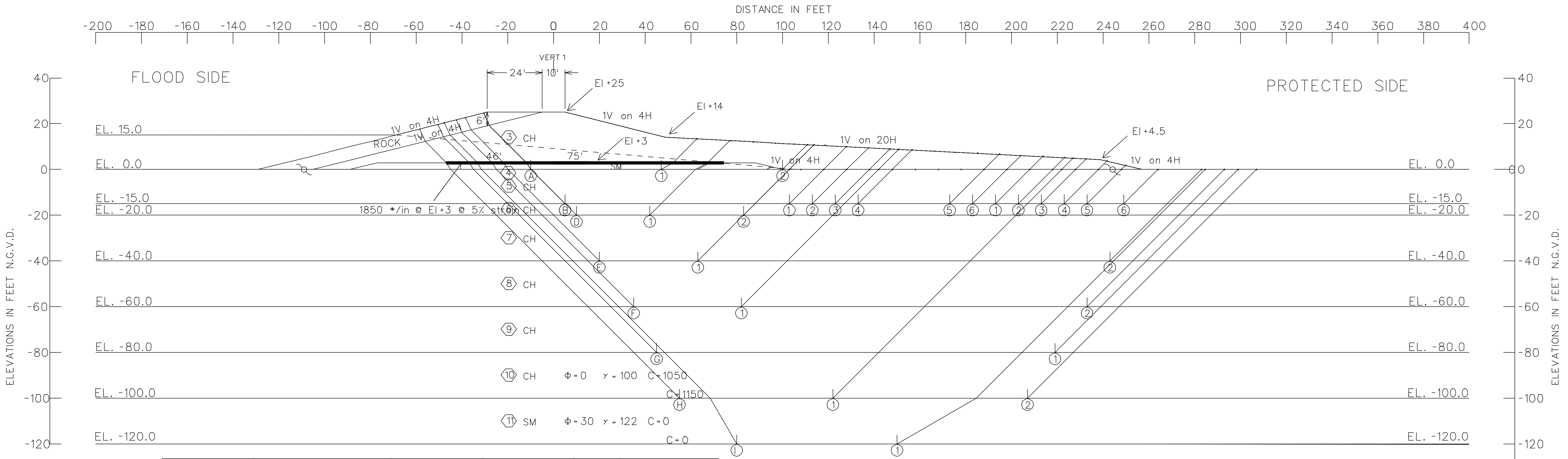
CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 - GEOTEXTILE
F/S - CROWN EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G8



ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/1850 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
A	1	.0	18848	11400	15394	36128	10330	45642	25798	1.77	
A	2	.0	18848	22000	8716	36128	6855	49564	29273	1.69	
B	1	-15.0	24848	19600	14030	88672	34514	58478	54158	1.08	1.49
B	2	-15.0	24848	21600	13649	88672	33150	60097	55522	1.08	1.48
B	3	-15.0	24848	23600	13268	88672	31811	61716	56861	1.09	1.48
B	4	-15.0	24848	25600	12887	88672	30500	63335	58172	1.09	1.47
B	5	-15.0	24848	33600	11363	88672	25514	69811	63158	1.11	1.46
B	6	-15.0	24848	35600	10981	88672	24333	71429	64339	1.11	1.46
C	1	-15.0	24848	37600	10600	88672	23179	73048	65493	1.12	1.45
C	2	-15.0	24848	39600	10219	88672	22050	74667	66622	1.12	1.45
C	3	-15.0	24848	41600	9838	88672	20948	76286	67724	1.13	1.45
C	4	-15.0	24848	43600	9007	88672	19757	77455	68915	1.12	1.45
C	5	-15.0	24848	45600	7407	88672	17250	77855	71422	1.09	1.40
C	6	-15.0	24848	48800	6000	88672	11523	79648	77149	1.03	1.32
D	1	-20.0	28099	11200	24021	110630	59980	63320	50650	1.25	1.69
D	2	-20.0	28099	25550	17852	110630	52070	71501	58560	1.22	1.60
E	1	-40.0	44527	23650	35852	221081	139425	104029	81656	1.27	1.55
E	2	-40.0	44527	122650	27250	221081	80177	194427	140904	1.38	
F	1	-60.0	69727	35250	60366	364634	252597	165343	112037	1.48	
F	2	-60.0	69727	148500	53250	364634	183472	271477	181162	1.50	
G	1	-80.0	101672	165300	87250	544565	329882	354222	214683	1.65	
H	1	-100.0	141343	77050	133317	759820	580766	351710	179054	1.96	
H	2	-100.0	141343	174800	129250	759820	516017	445393	243803	1.83	
I	1	-120.0	218318	243456	335556	1003040	773020	797330	230020	3.47	

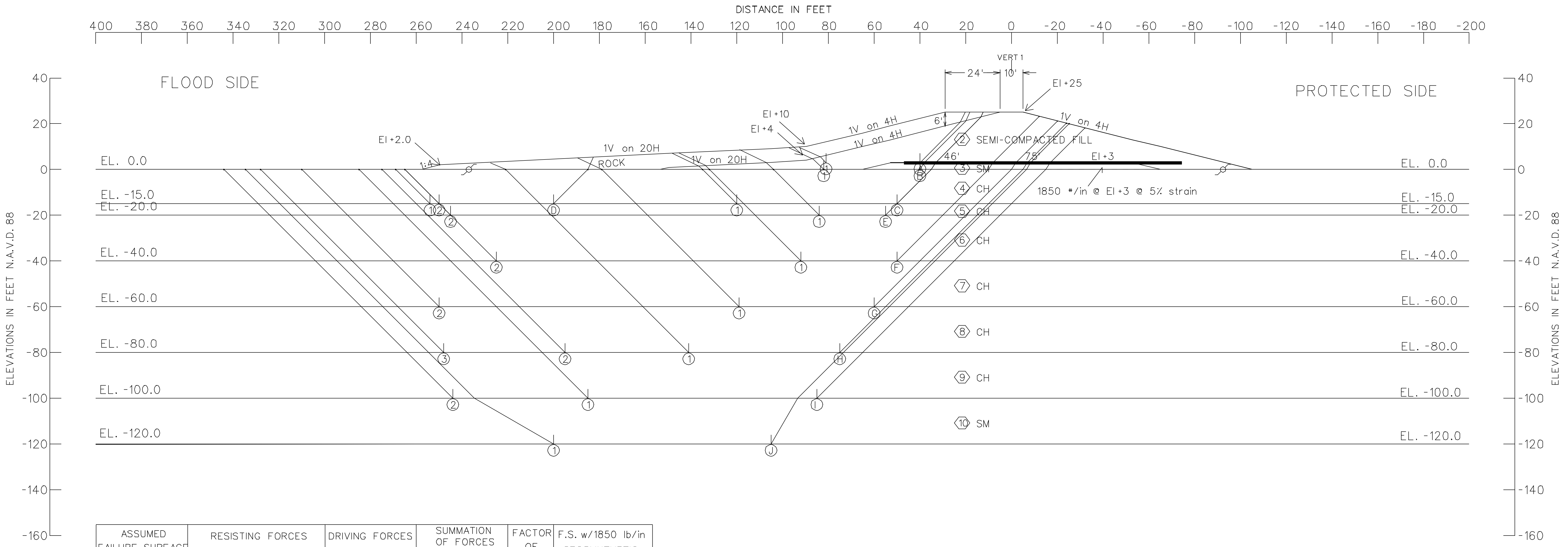
STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.	C - UNIT COHESION - P.S.F. CENTER OF STRATUM	BOTTOM OF STRATUM	FRICTION ANGLE DEGREES
		VERT. 1	VERT. 1	VERT. 1	
1	WATER	62.5	0	0	0
2	RIPRAP	132	0	0	40
3	CH	110	400	400	0
4	SM	122	0	0	30
5	CH	95	200	200	0
6	CH	100	325	350	0
7	CH	100	450	550	0
8	CH	100	650	750	0
9	CH	100	850	950	0
10	CH	100	1050	1150	0
11	SM	122	0	0	30
12	SM	122	0	0	30

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 - GEOTEXTILE
P/S - CROWN EL. +25; WATER EL. +15
LOUISIANA

SHEET IDENTIFICATION NUMBER
G9



ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/1850 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
(A) (1)	3.0	15113	16400	7743	27368	3996	39256	23372	1.68	
(B) (1)	.0	20249	8400	10286	35145	7046	38935	28099	1.39	
(C) (1)	-15.0	27349	14000	15039	85061	29634	56388	55427	1.02	1.42
(C) (2)	-15.0	27349	40000	6000	85061	11614	73349	73447	1.00	1.30
(D) (1)	-15.0	7443	10800	6000	22131	10889	24243	11242	2.16	
(E) (1)	-20.0	30599	10150	19467	104811	48712	60216	56099	1.07	1.47
(E) (2)	-20.0	30599	66500	9250	104811	21370	106349	83441	1.27	1.54
(F) (1)	-40.0	48704	23100	36403	220928	125632	108207	95296	1.14	1.37
(F) (2)	-40.0	48704	96250	27250	220928	87057	172204	133871	1.29	1.45
(G) (1)	-60.0	73060	44250	59796	366243	232284	177106	133959	1.32	
(G) (2)	-60.0	73060	142500	53250	366243	176984	268810	189259	1.42	
(H) (1)	-80.0	106212	62700	89764	543815	372259	258676	171556	1.51	
(H) (2)	-80.0	106212	114000	87250	543815	339786	307462	204029	1.51	
(H) (3)	-80.0	106212	164350	87250	543815	316011	357812	227804	1.57	
(I) (1)	-100.0	146063	115000	129250	758409	524846	390313	233563	1.67	
(I) (2)	-100.0	146063	182850	129250	758409	495653	458163	262756	1.74	
(J) (1)	-120.0	220521	315207	319082	997748	731167	854810	266581	3.21	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.	C - UNIT COHESION - P.S.F.		FRICTION ANGLE DEGREES
			CENTER OF STRATUM	BOTTOM OF STRATUM	
		VERT. 1	VERT. 1	VERT. 1	
1	RIPRAP	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	95	200	200	0
5	CH	100	325	350	0
6	CH	100	450	550	0
7	CH	100	650	750	0
8	CH	100	850	950	0
9	CH	100	1050	1150	0
10	SM	122	0	0	30
11	SM	122	0	0	30

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
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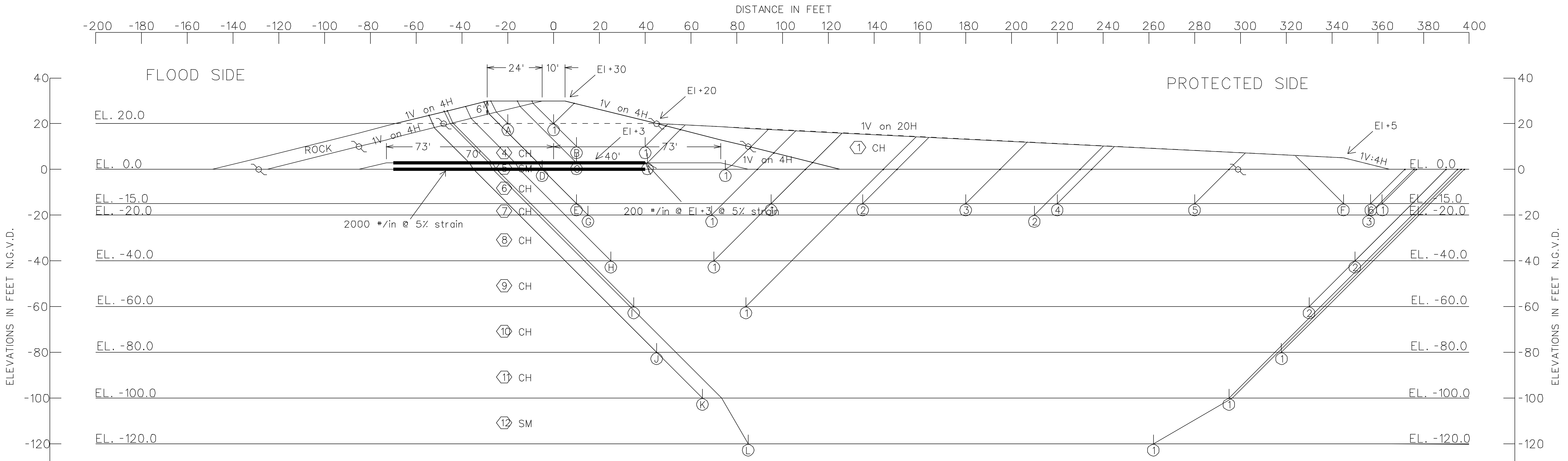
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 - GEOTEXTILE
F/S - CROWN EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G10



ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/2200 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
(A) (1)	20.0	5292	8000	7199	6256	5223	20491	1033	19.84	
(B) (1)	10.0	15252	12000	7809	21709	5778	35061	15931	2.20	
(C) (1)	3.0	19978	12400	13104	40065	15671	45482	24394	1.86	
(D) (1)	.0	22643	16000	15611	51286	17835	54254	33451	1.62	
(E) (1)	-15.0	28643	17000	18762	111667	53637	64405	58030	1.11	1.56
(E) (2)	-15.0	28643	25000	17238	111667	47036	70881	64631	1.10	1.51
(E) (3)	-15.0	28643	34000	15523	111667	40112	78166	71555	1.09	1.46
(E) (4)	-15.0	28643	42000	13999	111667	34402	84642	77265	1.10	1.44
(E) (5)	-15.0	28643	54000	11713	111667	26623	94356	85044	1.11	1.42
(E) (6)	-15.0	28643	69400	6000	111667	11567	104043	100100	1.04	1.30
(F) (1)	-15.0	10840	3400	6000	21465	10811	20240	10654	1.90	
(G) (1)	-20.0	31893	18900	22812	135689	76275	73605	59414	1.24	1.68
(G) (2)	-20.0	31893	68250	17440	135689	49860	117583	85829	1.37	
(G) (3)	-20.0	31893	119350	9250	135689	20175	160493	115514	1.39	
(H) (1)	-40.0	48432	24750	40012	255783	170675	113194	85108	1.33	
(H) (2)	-40.0	48432	178750	27250	255783	80652	254432	175131	1.45	
(I) (1)	-60.0	72943	36750	64716	410911	297147	174409	113764	1.53	
(I) (2)	-60.0	72943	221250	53250	410911	190420	347443	220491	1.58	
(J) (1)	-80.0	104926	259350	87250	600800	336900	451526	263900	1.71	
(K) (1)	-100.0	146926	264500	129250	822913	532910	540676	290003	1.86	
(L) (1)	-120.0	217453	563044	315769	1080966	772679	1096266	308287	3.56	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.	C - UNIT COHESION - P.S.F.		FRICTION ANGLE
			CENTER OF STRATUM	BOTTOM OF STRATUM	
		VERT. 1	VERT. 1	VERT. 1	DEGREES
1	CH	110	400	400	0
2	WATER	62	0	0	0
3	RIPRAP	132	0	0	40
4	CH	110	400	400	0
5	SM	122	0	0	30
6	CH	95	200	200	0
7	CH	100	325	350	0
8	CH	100	450	550	0
9	CH	100	650	750	0
10	CH	100	850	950	0
11	CH	100	1050	1150	0
12	SM	122	0	0	30
13	SM	122	0	0	30

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

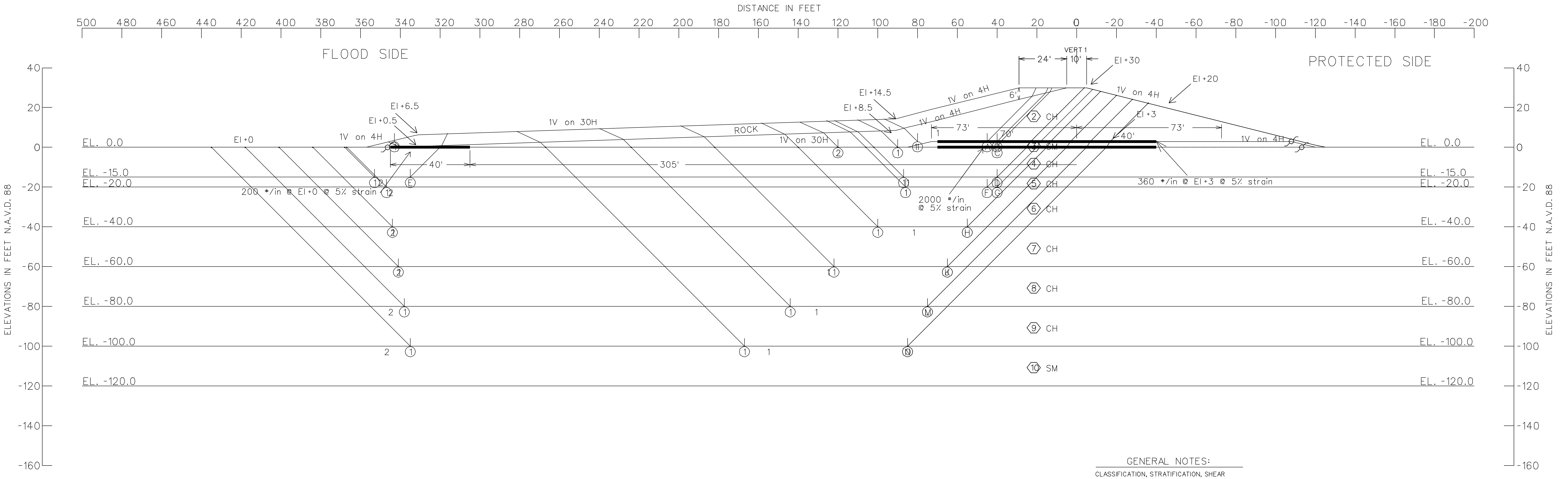
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 - GEOTEXTILE
P/S - CROWN EL. +30 WATER EL. +20
LOUISIANA

SHEET IDENTIFICATION NUMBER
G11



GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2360 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	3.0	19101	14000	11391	39644	9918	44492	29726	1.50	
B	1	3.0	19832	121200	391	41226	-263	141423	41489	3.41	
C	1	.0	26163	10000	14586	50589	12645	50749	37944	1.34	
C	2	.0	26163	16000	13811	50589	11011	55974	39578	1.41	
D	1	-15.0	34116	9400	20276	111779	48560	63792	63219	1.01	1.46
E	1	-15.0	8604	3600	6000	26543	10951	18204	15592	1.17	1.30*
F	1	-20.0	37366	14350	23423	135636	65286	75139	70350	1.07	1.47
G	1	-20.0	36714	107450	9250	136646	20711	153414	115935	1.32	
H	1	-40.0	53859	24750	40546	255486	152372	119155	103114	1.16	1.40
I	1	-40.0	53859	158950	27250	255486	80348	240059	175138	1.37	
J	1	-60.0	78159	42750	65461	410411	274247	186370	136164	1.37	
K	1	-60.0	78159	207000	53250	410411	180280	338409	230131	1.47	
L	1	-80.0	110512	65550	98377	600412	431635	274439	168777	1.63	
M	1	-80.0	110512	249850	87250	600412	320508	447612	279904	1.60	
N	1	-100.0	150362	94300	139267	824941	624136	383929	200805	1.91	
O	1	-100.0	150362	287500	129250	824941	501032	567112	323909	1.75	

* FABRIC STRENGTH AT TOE OF BERM IS 200#/IN

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	RIPRAP	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	95	200	200	0
5	CH	100	325	350	0
6	CH	100	450	550	0
7	CH	100	650	750	0
8	CH	100	850	950	0
9	CH	100	1050	1150	0
10	SM	122	0	0	30

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

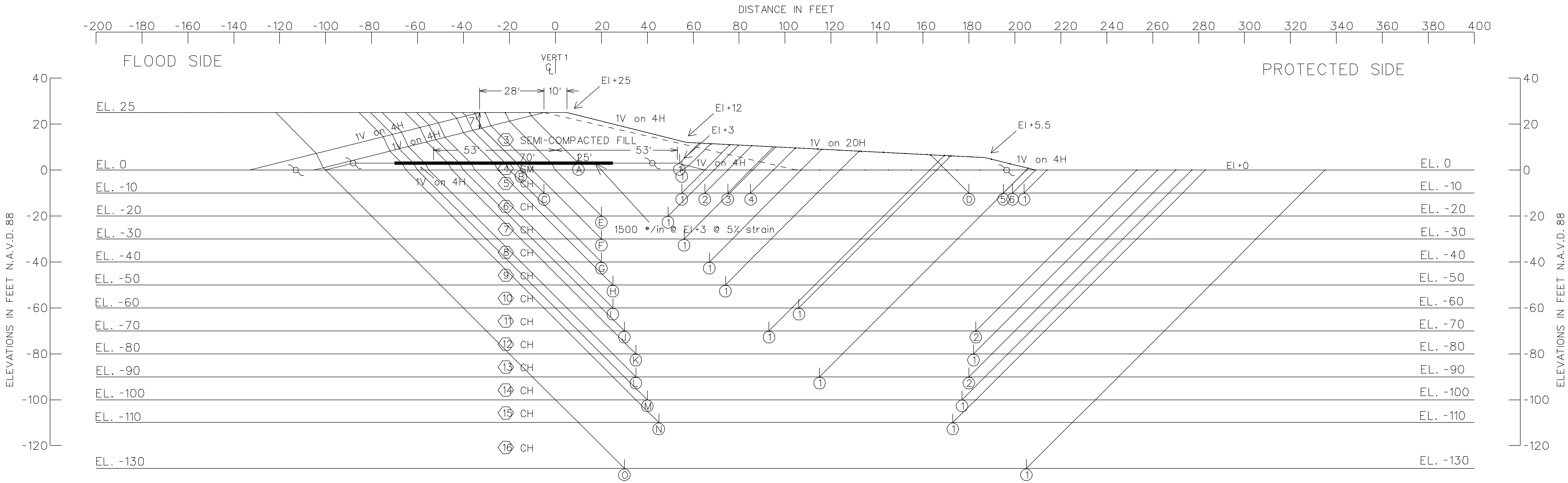
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

REACH 3 - GEOTEXTILE
F/S - CROWN EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G12



ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/1500 lb/in GEOSYNTHETIC AT 5% STRAIN
(A) (1)	3.0	16534	17076	6971	26382	4484	40581	21898	1.85	
(B) (1)	.0	15770	14000	9944	36656	7645	39714	29011	1.37	
(C) (1)	-10.0	19770	12000	12838	69540	25026	44608	44514	1.00	1.41
(C) (2)	-10.0	19770	14000	12457	69540	23687	46227	45853	1.01	1.40
(C) (3)	-10.0	19770	16000	12076	69540	22569	47846	46971	1.02	1.40
(C) (4)	-10.0	19770	18000	11695	69540	21477	49465	48063	1.03	1.40
(C) (5)	-10.0	19770	40000	4640	69540	7268	64410	62272	1.03	1.32
(C) (6)	-10.0	19770	40800	4000	69540	6124	64570	63416	1.02	1.30
(D) (1)	-10.0	9346	4800	4000	13790	5093	18146	8697	2.09	
(E) (1)	-20.0	42371	31900	33685	107819	54047	107956	53772	2.01	
(F) (1)	-30.0	64235	43200	56038	163513	89998	163473	73515	2.22	
(G) (1)	-40.0	88040	61100	80238	230537	135921	229378	94616	2.42	
(H) (1)	-50.0	114295	68600	106590	305760	193111	289485	112649	2.57	
(I) (1)	-60.0	141706	121500	133989	394138	251363	397195	142775	2.78	
(J) (1)	-70.0	171787	100800	165104	490850	336149	437691	154701	2.83	
(J) (2)	-70.0	171787	244800	160000	490850	277858	576587	212992	2.71	
(K) (1)	-80.0	203869	249900	193000	598136	362736	646769	235400	2.75	
(L) (1)	-90.0	237032	144000	228641	718956	513019	609673	205937	2.96	
(L) (2)	-90.0	237032	261000	228000	718956	459758	726032	259198	2.80	
(M) (1)	-100.0	273113	260300	265000	847843	568959	798413	278884	2.86	
(N) (1)	-110.0	311194	256000	304000	987305	690391	871194	296914	2.93	
(O) (1)	-130.0	385995	0	383999	1307480	946942	769994	360538	2.14	

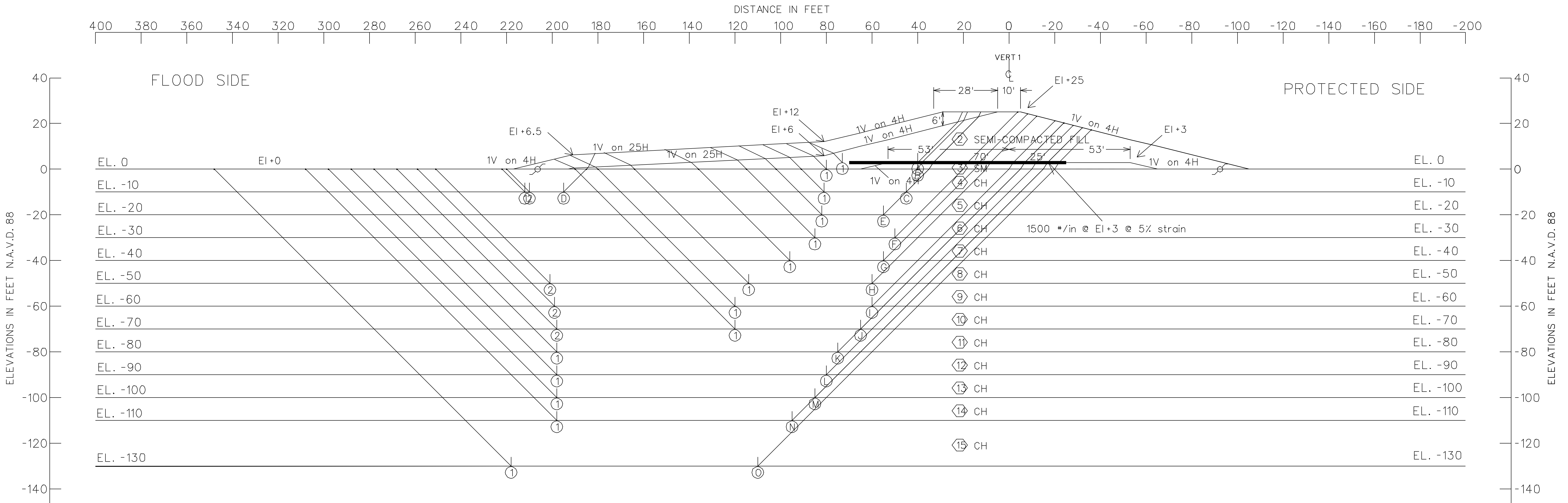
STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	WATER	62.5	0	0	0
2	RIPRAP	132	0	0	40
3	CH	110	400	400	0
4	SM	122	0	0	30
5	CH	95	200	200	0
6	CH	115	1050	1100	0
7	CH	115	1150	1200	0
8	CH	115	1250	1300	0
9	CH	115	1350	1400	0
10	CH	115	1450	1500	0
11	CH	115	1550	1600	0
12	CH	115	1650	1700	0
13	CH	115	1750	1800	0
14	CH	115	1850	1900	0
15	CH	115	1950	2000	0
16	CH	115	2000	2000	0

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - GEOTEXTILE
P/S - CROWN EL. +25, WATER EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G13



ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/1500 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	3.0	15101	13200	9355	27367	5977	37656	21390	1.76	
B	1	.0	20233	8000	12332	35143	8637	40565	26506	1.53	
C	1	-10.0	25339	7200	15913	67051	26872	48452	40179	1.21	1.65
C	2	-10.0	25339	33000	4000	67051	5558	62339	61493	1.01	1.31
D	1	-10.0	6576	3400	4000	16220	5162	13976	11058	1.26	2.89
E	1	-20.0	46339	29700	36493	105696	54990	112532	50706	2.22	
F	1	-30.0	70961	42000	58998	163137	93528	171959	69609	2.47	
G	1	-40.0	95309	53300	83197	226480	140523	231806	85957	2.70	
H	1	-50.0	121455	75600	109130	300040	195107	306185	104933	2.92	
H	2	-50.0	121455	197400	100000	300040	138969	418855	161071	2.60	
I	1	-60.0	148810	90000	137479	386099	263317	376289	122782	3.06	
I	2	-60.0	148810	208500	129000	386099	201339	486310	184760	2.63	
J	1	-70.0	178962	88000	166159	480252	343905	433121	136347	3.18	
J	2	-70.0	178962	212800	160000	480252	274697	551762	205555	2.68	
K	1	-80.0	211963	209100	193000	582042	358945	614063	223097	2.75	
L	1	-90.0	245888	212400	228000	696402	454692	686288	241710	2.84	
M	1	-100.0	281813	214700	265000	821196	561939	761513	259257	2.94	
N	1	-110.0	320813	206000	304000	953967	680685	830813	273282	3.04	
O	1	-130.0	399739	216000	383999	1255738	946723	999738	309015	3.24	

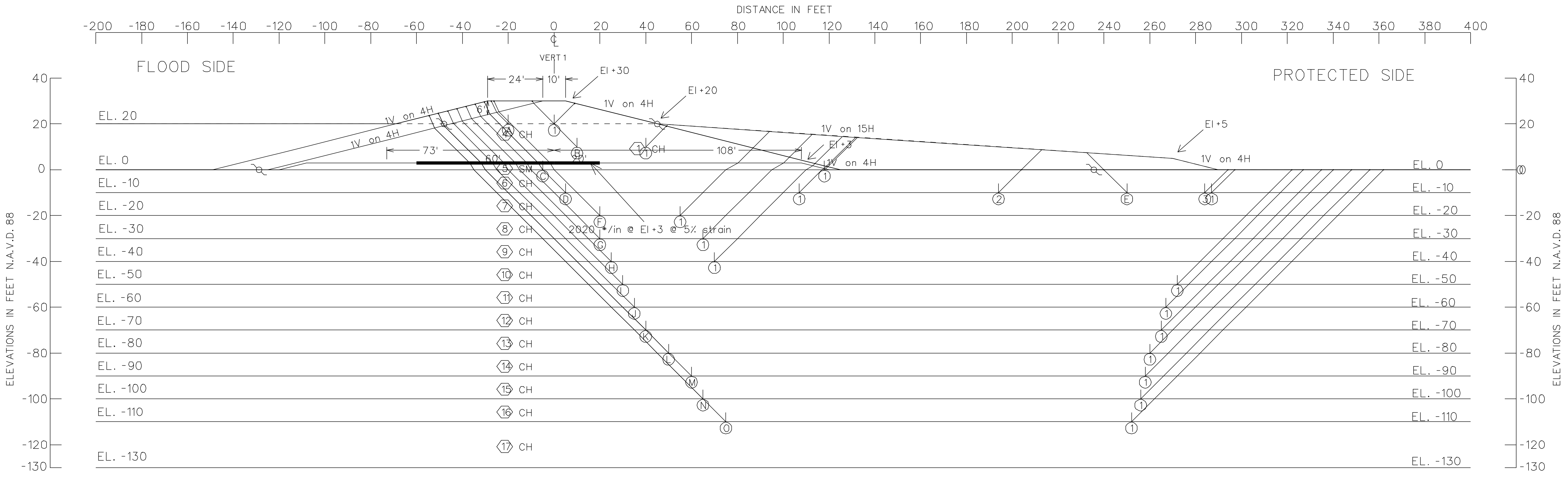
STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	RIPRAP	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	95	200	200	0
5	CH	115	1050	1100	0
6	CH	115	1150	1200	0
7	CH	115	1250	1300	0
8	CH	115	1350	1400	0
9	CH	115	1450	1500	0
10	CH	115	1550	1600	0
11	CH	115	1650	1700	0
12	CH	115	1750	1800	0
13	CH	115	1850	1900	0
14	CH	115	1950	2000	0
15	CH	115	2000	2000	0
16	CH	115	2000	2000	0

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - GEOTEXTILE
F/S - CROWN EL.+25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G14



ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY	F.S. w/2020 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	20.0	5292	8000	7199	6256	5223	20491	1033	19.84	
B	1	10.0	15252	12000	7750	21709	5757	35002	15952	2.19	
C	1	.0	22643	24600	11555	51286	11782	58798	39504	1.49	
D	1	-10.0	26643	20400	15708	89396	33949	62751	55447	1.13	1.57
D	2	-10.0	26643	37800	11049	89396	20009	75492	69387	1.09	1.44
D	3	-10.0	26643	55800	4000	89396	5245	86443	84151	1.03	1.31
E	1	-10.0	9998	7400	4000	14967	4874	21398	10093	2.12	
F	1	-20.0	47960	38500	40750	134411	78296	127210	56115	2.27	
G	1	-30.0	69927	54000	62370	194802	120274	186297	74528	2.50	
H	1	-40.0	94182	58500	85777	263221	173778	238459	89443	2.67	
I	1	-50.0	120437	338800	100000	341903	139199	559237	202704	2.76	
J	1	-60.0	148693	348000	129000	430848	203174	625693	227674	2.75	
K	1	-70.0	178811	360000	160000	529978	277081	698811	252897	2.76	
L	1	-80.0	211811	357000	192999	636836	364352	761810	272484	2.80	
M	1	-90.0	246812	356400	227999	754208	461361	831211	292847	2.84	
N	1	-100.0	282676	362900	264999	885482	569897	910575	315585	2.89	
O	1	-110.0	321676	354000	303999	1024756	691313	979675	333443	2.94	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	CH	110	400	400	0
2	WATER	62	0	0	0
3	RIPRAP	132	0	0	40
4	CH	110	400	400	0
5	SM	122	0	0	30
6	CH	95	200	200	0
7	CH	115	1050	1100	0
8	CH	115	1150	1200	0
9	CH	115	1250	1300	0
10	CH	115	1350	1400	0
11	CH	115	1450	1500	0
12	CH	115	1550	1600	0
13	CH	115	1650	1700	0
14	CH	115	1750	1800	0
15	CH	115	1850	1900	0
16	CH	115	1950	2000	0
17	CH	115	2000	2000	0

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

- Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ∇ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

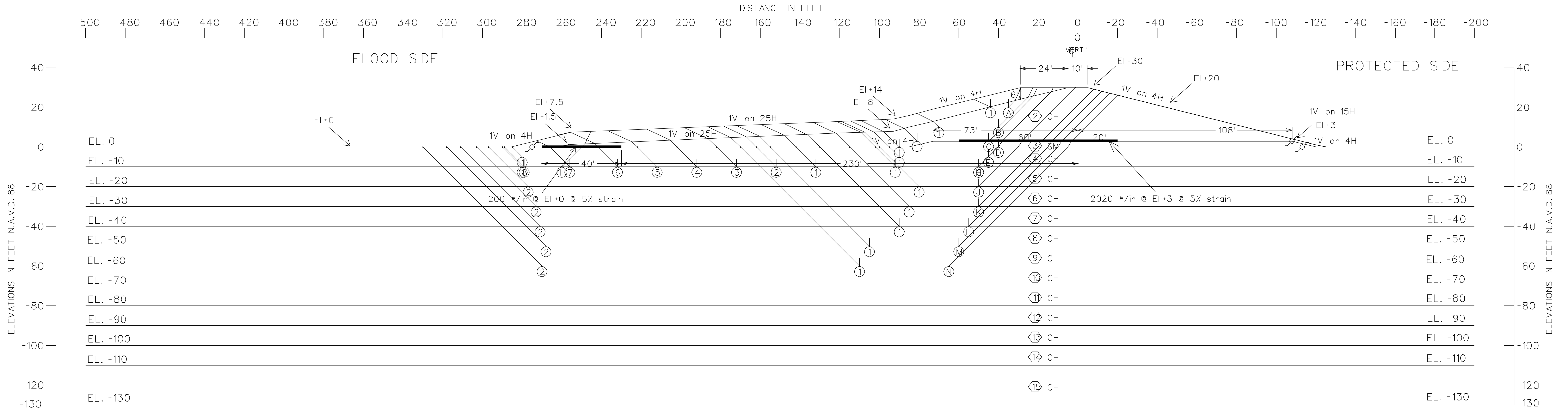
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

REACH 4 - GEOTEXTILE
P/S - CROWN EL. +30, WATER EL. +20
LOUISIANA

SHEET IDENTIFICATION NUMBER
G15



ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/2020 lb/in GEOSYNTHETIC AT 5% STRAIN
(A) (1)	20.0	4763	3600	5725	5777	1706	14088	4071	3.46	
(B) (1)	10.0	13289	12000	7965	22542	4539	33254	18003	1.85	
(C) (1)	3.0	19101	14400	10941	39644	9500	44442	30144	1.47	
(D) (1)	.0	26163	10000	14121	50589	11962	50284	38627	1.30	
(E) (1)	-5.0	28163	9000	15967	67259	21198	53130	46061	1.15	1.68
(F) (1)	-5.0	28163	47000	2002	67259	1683	77165	65576	1.18	1.55
(G) (1)	-10.0	30163	8400	17752	85615	32397	56315	53218	1.06	1.51
(H) (1)	-10.0	30163	16400	16520	85615	28249	63083	57366	1.10	1.52
(H) (2)	-10.0	30163	20400	15905	85615	26282	66468	59333	1.12	1.53
(H) (3)	-10.0	30163	24400	15289	85615	24383	69852	61232	1.14	1.54
(H) (4)	-10.0	30163	28400	14674	85615	22551	73237	63064	1.16	1.55
(H) (5)	-10.0	30163	32400	14058	85615	20787	76621	64828	1.18	1.56
(H) (6)	-10.0	30163	36400	13441	85615	19091	80004	66524	1.20	1.57
(H) (7)	-10.0	30163	41200	7673	85615	13769	79036	71846	1.10	1.44
(H) (8)	-10.0	30163	45800	4000	85615	5447	79963	80168	1.00	1.30
(I) (1)	-10.0	7326	4000	4000	18112	5249	15326	12863	1.19	1.38*
(J) (1)	-20.0	53151	33000	38813	134711	66908	124964	67803	1.84	
(J) (2)	-20.0	53151	249700	25000	134711	21191	327851	113520	2.89	
(K) (1)	-30.0	75464	42000	61352	194609	107011	178816	87598	2.04	
(K) (2)	-30.0	75464	267600	48000	194609	49326	391064	145283	2.69	

* Floodside berm fabric strength is 200 #/in

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
(L) (1)	-40.0	99610	45500	85890	262925	158388	231000	104537	2.21
(L) (2)	-40.0	99610	280800	73000	262925	88466	453410	174459	2.60
(M) (1)	-50.0	125755	63000	112120	341502	218205	300875	123297	2.44
(M) (2)	-50.0	125755	291200	100000	341502	139798	516955	201704	2.56
(N) (1)	-60.0	153910	67500	140659	430348	291115	362069	139233	2.60
(N) (2)	-60.0	153910	307500	129000	430348	199958	590410	230390	2.56

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 1	FRICTION ANGLE DEGREES
1	RIPRAP	132	0	0	40
2	CH	110	400	400	0
3	SM	122	0	0	30
4	CH	95	200	200	0
5	CH	115	1050	1100	0
6	CH	115	1150	1200	0
7	CH	115	1250	1300	0
8	CH	115	1350	1400	0
9	CH	115	1450	1500	0
10	CH	115	1550	1600	0
11	CH	115	1650	1700	0
12	CH	115	1750	1800	0
13	CH	115	1850	1900	0
14	CH	115	1950	2000	0
15	CH	115	2000	2000	0

GENERAL NOTES:

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATES.

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

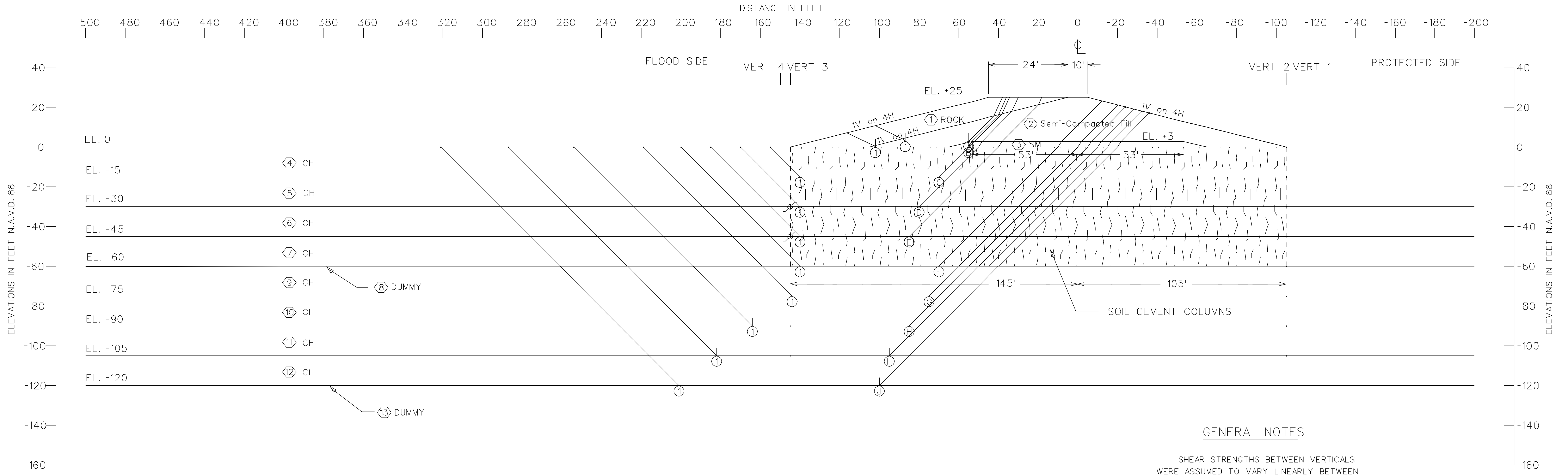
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - GEOTEXTILE
F/S - CROWN EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G16



GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

NOTES

- ◯ -- STRATUM NUMBER
- ◯ -- WEDGE NUMBER
- -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ▽ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
(A) (1)	3.0	14631	12800	16417	28964	5977	43848	22987	1.91
(B) (1)	.0	16919	18800	15936	37302	5111	51655	32191	1.60
(C) (1)	-15.0	79623	140000	6000	86700	11098	225623	75602	2.98
(D) (1)	-30.0	139940	120000	12000	159568	43723	271940	115845	2.35
(E) (1)	-45.0	200903	110000	20250	259164	98846	331153	160318	2.07
(F) (1)	-60.0	261455	35000	33000	396070	176469	329455	219601	1.50
(G) (1)	-75.0	277045	44850	50235	540396	276197	372130	264199	1.41
(H) (1)	-90.0	297948	63200	71985	702978	398802	433133	304176	1.42
(I) (1)	-105.0	323123	82650	98235	884617	543924	504008	340693	1.48
(J) (1)	-120.0	351724	111100	128985	1088284	711545	591809	376739	1.57

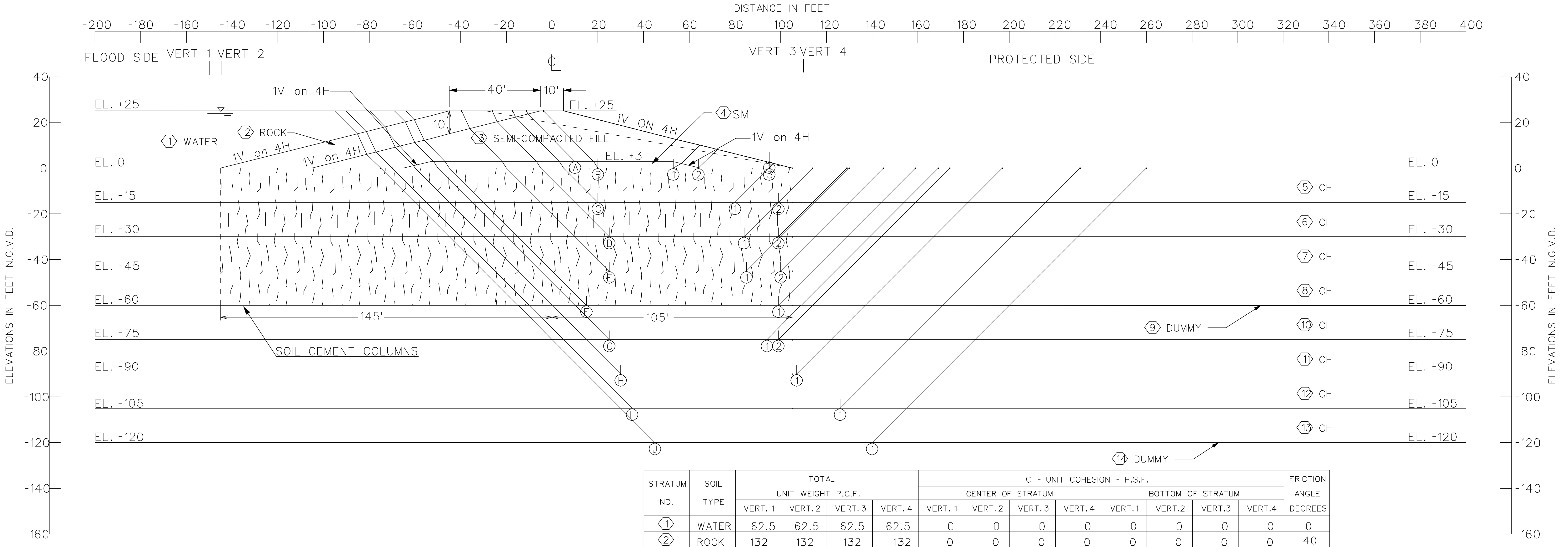
STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F. CENTER OF STRATUM				C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM				FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	275	2000	2000	275	350	2000	2000	350	0
7	CH	100	108	108	100	425	2000	2000	425	500	2000	2000	500	0
8	DUMMY	100	100	100	100	500	500	500	500	500	500	500	500	0
9	CH	100	100	100	100	575	575	575	575	650	650	650	650	0
10	CH	100	100	100	100	725	725	725	725	800	800	800	800	0
11	CH	100	100	100	100	875	875	875	875	950	950	950	950	0
12	CH	100	100	100	100	1025	1025	1025	1025	1100	1100	1100	1100	0
13	DUMMY	100	100	100	100	1100	1100	1100	1100	1100	1100	1100	1100	0

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - SOIL CEMENT COLUMNS
F/S - CROWN EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 17



ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
Ⓐ	①	3.0	16582	33963	-320	26381	11	50225	26370	1.90
Ⓑ	①	.0	20213	21353	9582	30836	7086	51148	23750	2.15
Ⓑ	②	.0	20213	26150	6611	30836	4598	52974	26238	2.02
Ⓑ	③	.0	20213	33377	1600	30836	275	55190	30561	1.81
Ⓒ	①	-15.0	78831	119892	61600	85682	19642	260323	66040	3.94
Ⓒ	②	-15.0	78831	157452	6000	85682	11182	242283	74500	3.25
Ⓓ	①	-30.0	137396	117828	66000	162343	53199	321224	109144	2.94
Ⓓ	②	-30.0	137396	147452	12000	162343	43806	296848	118537	2.50
Ⓔ	①	-45.0	195669	119825	72000	267045	109559	387494	157486	2.46
Ⓔ	②	-45.0	195669	149467	20250	267045	98778	365386	168267	2.17
Ⓕ	①	-60.0	252528	42000	33000	400221	176553	327528	223668	1.46
Ⓖ	①	-75.0	268845	44850	50235	545888	286113	363930	259775	1.40
Ⓖ	②	-75.0	268845	48100	50235	545888	276675	367180	269213	1.36
Ⓗ	①	-90.0	288702	61600	71985	713639	398801	422287	314838	1.34
Ⓘ	①	-105.0	313273	86450	98235	902135	543922	497958	358213	1.39
Ⓙ	①	-120.0	343223	104500	128985	1108449	711542	576708	396907	1.45

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F. CENTER OF STRATUM				C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM				FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
7	CH	100	108	108	100	275	2000	2000	275	350	2000	2000	350	0
8	CH	100	108	108	100	425	2000	2000	425	500	2000	2000	500	0
9	DUMMY	100	100	100	100	500	500	500	500	500	500	500	500	0
10	CH	100	108	108	100	575	575	575	575	650	650	650	650	0
11	CH	100	100	100	100	725	725	725	725	800	800	800	800	0
12	CH	100	100	100	100	875	875	875	875	950	950	950	950	0
13	CH	100	100	100	100	1025	1025	1025	1025	1100	1100	1100	1100	0
14	DUMMY	100	100	100	100	1100	1100	1100	1100	1100	1100	1100	1100	0

NOTES

⬡ -- STRATUM NUMBER
◯ -- WEDGE NUMBER
⌀ -- CROSSOVER POINT
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
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A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

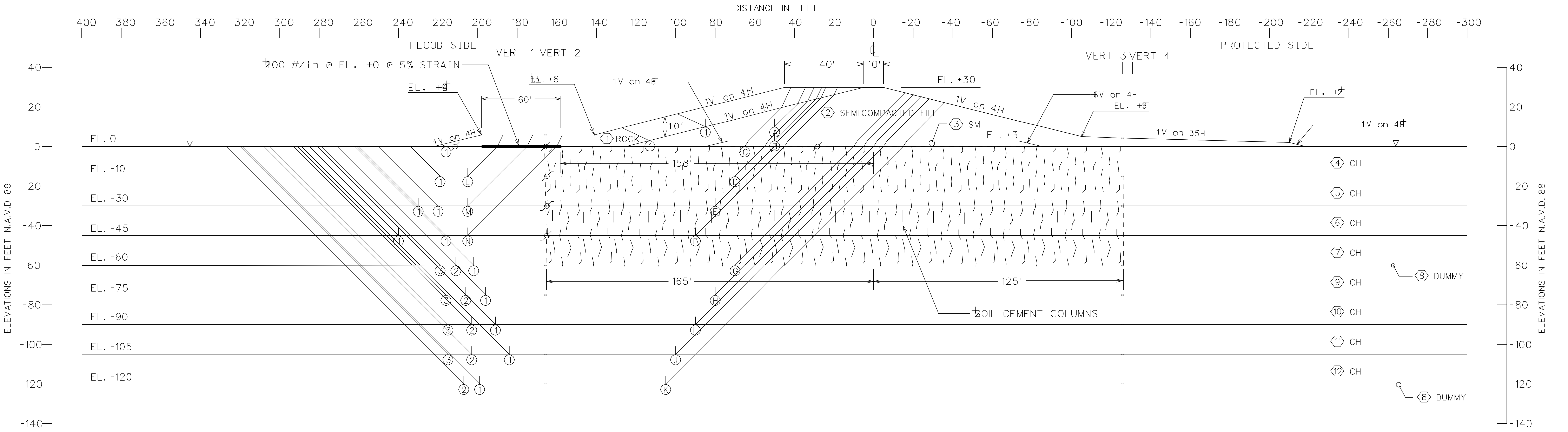
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK | DESCRIPTION | DATE | APPR.

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - SOIL CEMENT COLUMNS
P/S - CROWN EL. +25, Water at EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 18



ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
Ⓐ	①	10.0	12919	14000	15461	24859	4294	42380	20565	2.06
Ⓑ	①	3.0	18658	25200	15457	44057	4294	59315	39763	1.49
Ⓒ	①	.0	24483	105500	348	48817	97	130331	48720	2.68
Ⓓ	①	-15.0	84765	201679	6000	111339	10836	292444	100503	2.91
Ⓔ	①	-30.0	145297	181880	12000	192561	43377	339177	149184	2.27
Ⓕ	①	-45.0	206058	168656	20250	294867	99028	394964	195839	2.02
Ⓖ	①	-60.0	265755	66000	33000	443354	182655	364755	260699	1.40
Ⓖ	②	-60.0	265755	70500	33000	443354	178053	369255	265301	1.39
Ⓖ	③	-60.0	265755	74500	33000	443354	176206	373255	267148	1.40
Ⓗ	①	-75.0	282890	71125	50235	593900	287264	404250	306636	1.32
Ⓗ	②	-75.0	282890	77625	50235	593900	280402	410750	313498	1.31
Ⓗ	③	-75.0	282890	84125	50235	593900	276773	417250	317127	1.32
Ⓘ	①	-90.0	303840	80800	71985	763427	413845	456625	349582	1.31
Ⓘ	②	-90.0	303840	90400	71985	763427	404756	466225	358671	1.30
Ⓘ	③	-90.0	303840	100000	71985	763427	399609	475825	363818	1.31
Ⓙ	①	-105.0	329243	79800	98235	952084	564509	507278	387575	1.31
Ⓙ	②	-105.0	329243	97850	98235	952084	549877	525328	402207	1.31
Ⓙ	③	-105.0	329243	109250	98235	952084	544730	536728	407354	1.32
Ⓚ	①	-120.0	357843	103400	128985	1163311	720268	590228	443043	1.33
Ⓚ	②	-120.0	357843	112200	128985	1163311	715253	599028	448058	1.34

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/200 lb/in GEOSYNTHETIC AT 5% STRAIN
Ⓛ	①	-15.0	7858	2800	6000	24129	10836	16658	13293	1.25	1.43
Ⓜ	①	-30.0	13859	5000	12000	68632	43311	30859	25321	1.22	1.31
Ⓝ	①	-45.0	22109	12250	20250	135635	98434	54609	37201	1.47	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	275	2000	2000	275	350	2000	2000	350	0
7	CH	100	108	108	100	425	2000	2000	425	500	2000	2000	500	0
8	CH	100	100	100	100	500	500	500	500	500	500	500	500	0
9	CH	100	100	100	100	575	600	600	575	650	600	600	650	0
10	CH	100	100	100	100	725	725	725	725	800	800	800	800	0
11	CH	100	100	100	100	875	875	875	875	950	950	950	950	0
12	CH	100	100	100	100	1025	1025	1025	1025	1100	1100	1100	1100	0
13	CH	100	100	100	100	1100	1100	1100	1100	1100	1100	1100	1100	0

NOTE: REQUIRED STRENGTH OF GEOSYNTHETIC AT 5% STRAIN IS 200 LB\IN.

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

CONTROLING FAILURE WEDGE Ⓜ-①

T = DRIVING(F.S.) - RESISTING

T = (25321) (1.3) - 30859 = 2058 LB/FT

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

NOTES

- ◇ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ▽ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
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- A -- AS A SUBSCRIPT,REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

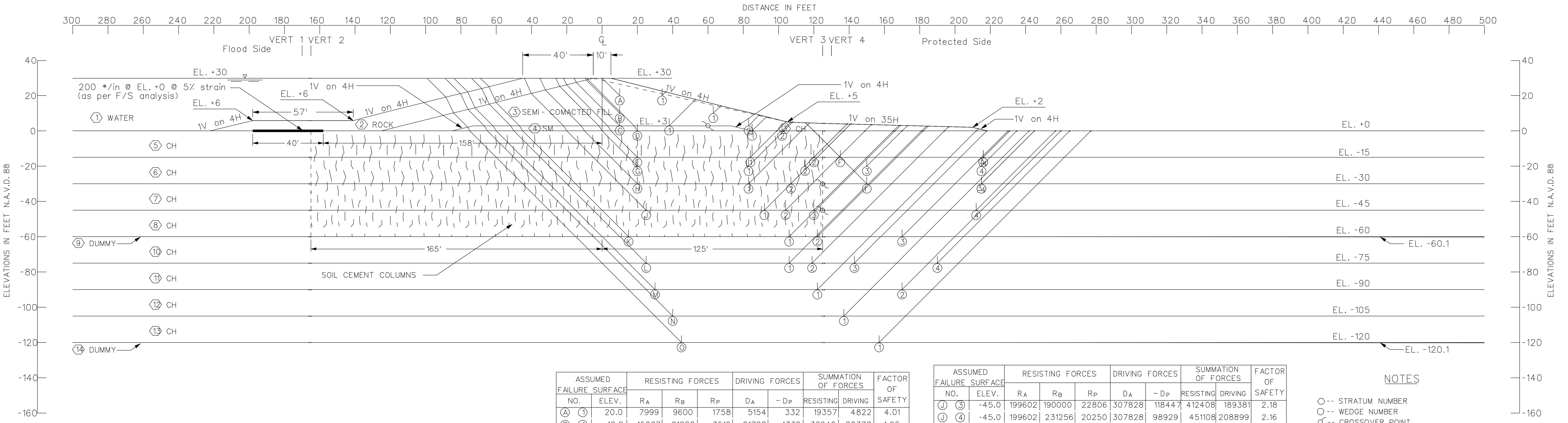
MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - SOIL CEMENT COLUMNS
F/S - CROWN EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 19



STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F. CENTER OF STRATUM				C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM				FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62	62	62	62	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
7	CH	100	108	108	100	275	2000	2000	275	350	2000	2000	350	0
8	CH	100	108	108	100	425	2000	2000	425	500	2000	2000	500	0
9	DUMMY	100	100	100	100	500	500	500	500	500	500	500	500	0
10	CH	100	100	100	100	575	575	575	575	650	650	650	650	0
11	CH	100	100	100	100	725	725	725	725	800	800	800	800	0
12	CH	100	100	100	100	875	875	875	875	950	950	950	950	0
13	CH	100	100	100	100	1025	1025	1025	1025	1100	1100	1100	1100	0
14	DUMMY	100	100	100	100	1100	1100	1100	1100	1100	1100	1100	1100	0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO. (Wedge)	NO. (Surface)	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	20.0	7999	9600	1758	5154	332	19357	4822	4.01
B	1	10.0	15227	21200	3519	21708	1330	39946	20378	1.96
C	1	3.0	19837	11200	11999	40065	15465	43036	24600	1.75
C	2	3.0	19837	27972	4799	40065	2474	52608	37591	1.40
D	1	.0	23669	36325	6399	45991	4398	66393	41593	1.60
D	2	.0	23669	40155	3953	45991	1492	67777	44499	1.52
E	1	-15.0	81988	128000	64160	109414	27826	274148	81588	3.36
E	2	-15.0	81988	200000	9224	109414	18780	291212	90634	3.21
E	3	-15.0	81988	229079	6000	109414	10742	317067	98672	3.21
F	4	-15.0	9751	16200	6000	19035	10742	31951	8293	3.85
G	1	-20.0	101277	126000	83930	136011	40617	311207	95394	3.26
G	2	-20.0	101277	190000	29224	136011	30773	320501	105238	3.05
G	3	-20.0	101277	215879	10444	136011	27134	327600	108877	3.01
G	4	-20.0	101277	228879	8000	136011	19186	338156	116825	2.89
H	1	-30.0	140249	126000	123696	197673	72859	389945	124814	3.12
H	2	-30.0	140249	174000	69179	197673	62893	383428	134780	2.84
H	3	-30.0	140249	228880	12000	197673	43435	381129	154238	2.47
I	4	-30.0	15751	13000	12000	58143	43435	40751	14708	2.77
J	1	-45.0	199602	134000	129179	307828	134207	462781	173621	2.67
J	2	-45.0	199602	158000	74912	307828	126498	432514	181330	2.39

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO. (Wedge)	NO. (Surface)	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
J	3	-45.0	199602	190000	22806	307828	118447	412408	189381	2.18
J	4	-45.0	199602	231256	20250	307828	98929	451108	208899	2.16
K	1	-60.0	256187	45500	82783	447939	211174	384470	236765	1.62
K	2	-60.0	256187	53500	35177	447939	200608	344864	247331	1.39
K	3	-60.0	256187	77500	33000	447939	188247	366687	259692	1.41
L	1	-75.0	272499	52650	52435	601601	317077	377584	284524	1.33
L	2	-75.0	272499	61100	52145	601601	305599	385744	296002	1.30
L	3	-75.0	272499	76700	50235	601601	298852	399434	302749	1.32
L	4	-75.0	272499	107250	50235	601601	282084	429984	319517	1.35
M	1	-90.0	292403	73600	72945	777381	430805	438948	346576	1.27
M	2	-90.0	292403	112000	71985	777381	410990	476388	366391	1.30
N	1	-105.0	317729	92150	98235	971201	569236	508114	401965	1.26
O	1	-120.0	346593	123200	128985	1188371	728493	598778	459878	1.30

NOTES

- ⬡ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- ⌀ -- CROSSOVER POINT
- φ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ▽ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT,REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

FACTOR OF SAFETY $= \frac{R_A + R_B + R_P}{D_A - D_P}$

GENERAL NOTES

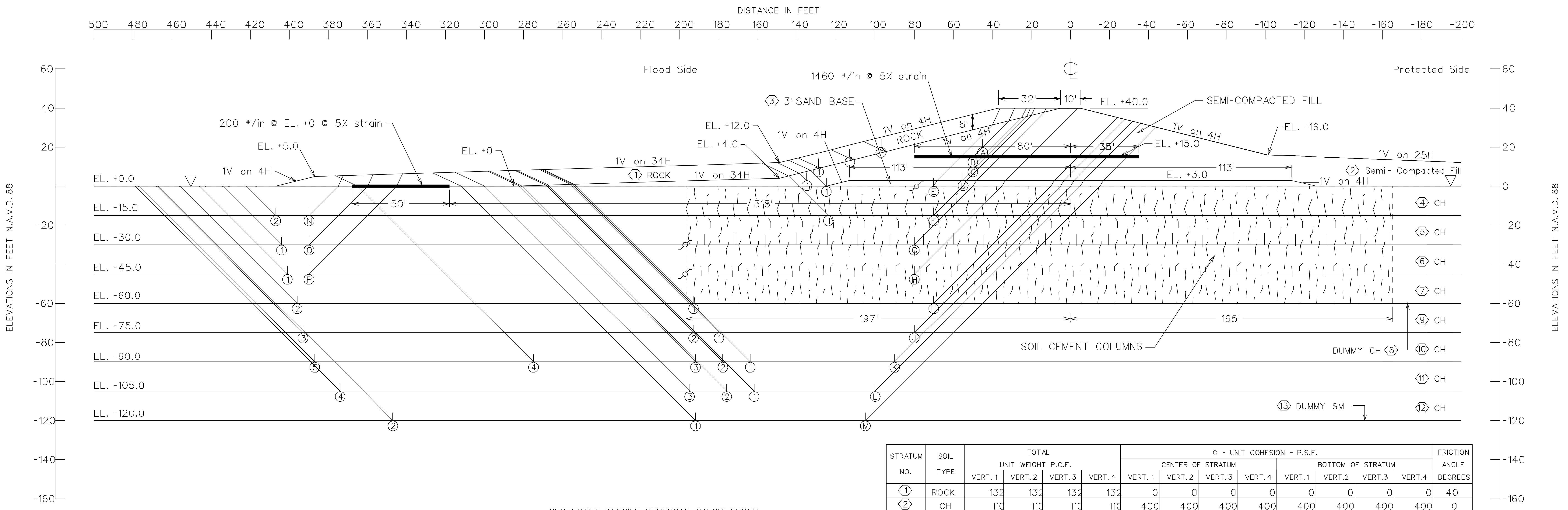
SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - SOIL CEMENT COLUMNS
P/S - CROWN EL.+30 WATER EL.+30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 20



ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/1460 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	20.0	12960	20800	7974	23872	610	41734	23262	1.79	
B	1	15.0	16960	25200	8614	35681	1235	50774	34446	1.47	
C	1	10.0	21290	31600	9255	51447	1948	62145	49499	1.26	1.61
D	1	3.0	27101	32000	12797	76194	7447	71898	68747	1.05	1.30
E	1	.0	33388	92887	16296	78091	15595	142571	62496	2.28	
F	1	-15.0	95236	108000	75488	159538	52303	278724	107235	2.60	
F	2	-15.0	95236	295977	6000	159538	10687	397213	148851	2.67	
G	1	-30.0	156341	275378	12000	254328	43459	443719	210869	2.10	
H	1	-45.0	218426	305378	20250	382164	99028	544054	283136	1.92	
I	1	-60.0	274355	61500	48029	536074	256435	383884	279639	1.37	
I	2	-60.0	274355	163000	33000	536074	178052	470355	358022	1.31	
J	1	-75.0	290760	65000	65234	699453	384999	420994	314454	1.34	
J	2	-75.0	290760	73450	64936	699453	373099	429146	326354	1.31	
J	3	-75.0	290760	203450	50250	699453	279411	544460	420042	1.30	
K	1	-90.0	311710	59200	87007	882062	537569	457917	344493	1.33	
K	2	-90.0	311710	70400	86687	882062	524713	468797	357349	1.31	
K	3	-90.0	311710	81600	86366	882062	511878	479676	370184	1.30	
K	4	-90.0	311710	148000	79120	882062	483545	538830	398517	1.35	
K	5	-90.0	311710	237600	72000	882062	405397	621310	476665	1.30	
L	1	-105.0	337113	58900	112959	1083839	699927	508972	383912	1.33	

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

EL. +15.0 CONTROLLING FAILURE WEDGE D - 1

T = DRIVING(F.S.) - RESISTING
T = (68747)(1.3) - 71898 = 17475 LB/FT

EL. +0.0 CONTROLLING FAILURE WEDGE O - 1

T = DRIVING(F.S.) - RESISTING
T = (22709)(1.3) - 27957 = 1565 LB/FT

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/200 lb/in GEOSYNTHETIC AT 5% STRAIN
L	2	-105.0	337113	72200	112639	1083839	686410	521952	397429	1.31	
L	3	-105.0	337113	90250	111013	1083839	671010	538376	412829	1.30	
L	4	-105.0	337113	260300	98250	1083839	559424	695663	524415	1.33	
M	1	-120.0	365713	95700	140598	1308226	854056	602011	454170	1.33	
M	2	-120.0	365713	266200	129000	1308226	747636	760913	560590	1.36	
N	2	-15.0	7499	2400	6000	22630	11100	15899	11530	1.38	
O	1	-30.0	13757	2200	12000	66614	43905	27957	22709	1.23	1.33
P	1	-45.0	22285	2800	20250	133998	99771	45335	34227	1.32	

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	275	2000	2000	275	350	2000	2000	350	0
7	CH	100	108	108	100	425	2000	2000	425	500	2000	2000	500	0
8	DUMMY	100	100	100	100	500	500	500	500	500	500	500	500	0
9	CH	100	100	100	100	575	575	575	575	650	650	650	650	0
10	CH	100	100	100	100	725	725	725	725	800	800	800	800	0
11	CH	100	100	100	100	875	875	875	875	950	950	950	950	0
12	CH	100	100	100	100	1025	1025	1025	1025	1100	1100	1100	1100	0
13	DUMMY	100	100	100	100	1100	1100	1100	1100	1100	1100	1100	1100	0

NOTES

⬡ -- STRATUM NUMBER
○ -- WEDGE NUMBER
⌀ -- CROSSOVER POINT
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES

CLASSIFICATION STRATIFICATION
SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS.

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT PRELIMINARY TECHNICAL REPORT TO CONGRESS

REACH 1 - SOIL CEMENT COLUMNS F/S - CROWN EL. +40 LOUISIANA

SHEET IDENTIFICATION NUMBER G 21

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
7	CH	100	108	108	100	275	2000	2000	275	350	2000	2000	350	0
8	CH	100	108	108	100	425	2000	2000	425	500	2000	2000	500	0
9	DUMMY	100	100	100	100	500	500	500	500	500	500	500	500	0
10	CH	100	100	100	100	575	575	575	575	650	650	650	650	0
11	CH	100	100	100	100	725	725	725	725	800	800	800	800	0
12	CH	100	100	100	100	875	875	875	875	950	950	950	950	0
13	CH	100	100	100	100	1025	1025	1025	1025	1100	1100	1100	1100	0
14	DUMMY	100	100	100	100	1100	1100	1100	1100	1100	1100	1100	1100	0

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/1460 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
A 1	20.0	15252	22000	3199	21708	1099	40451	20609	1.96	
B 1	10.0	22065	32000	5600	49647	3368	59665	46279	1.29	1.67
C 1	3.0	27477	14000	16479	74550	29171	57956	45379	1.28	1.66
C 2	3.0	27477	20000	14080	74550	21294	61557	53256	1.16	1.48
C 3	3.0	27477	32000	10185	74550	9686	69662	64864	1.07	1.34
C 4	3.0	27477	43323	9264	74550	7669	80064	66881	1.20	1.46
C 5	3.0	27477	53323	8496	74550	6451	89296	68099	1.31	
D 1	.0	32331	46400	11538	88800	11898	90269	76902	1.17	1.40
D 2	.0	32331	57809	10646	88800	10129	100786	78671	1.28	1.50
D 3	.0	32331	68701	9723	88800	8448	110755	80352	1.38	
E 1	-15.0	92331	100000	75503	162328	61899	267834	100429	2.67	
E 2	-15.0	92331	326879	6000	162328	10701	425210	151627	2.80	
F 1	-30.0	152241	306880	12000	259160	43325	471121	215835	2.18	
G 1	-45.0	211757	329556	20250	383253	98929	561563	284324	1.98	
H 1	-60.0	267578	65000	41642	536235	264804	374220	271431	1.38	
H 2	-60.0	267578	177500	33000	536235	177720	478078	358515	1.33	
I 1	-75.0	283850	78000	58416	699943	382275	420266	317668	1.32	
I 2	-75.0	283850	221000	50235	699943	279698	555085	420245	1.32	
J 1	-90.0	304333	88000	79705	882692	521294	472038	361398	1.31	
J 2	-90.0	304333	252000	71985	882692	410612	628318	472080	1.33	

NOTE: REQUIRED STRENGTH OF GEOSYNTHETIC AT 5% STRAIN IS 1460 LB\IN.

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

CONTROLLING FAILURE WEDGE C - 3

T = DRIVING(F.S.) - RESISTING

T = (64864)(1.3) - 69662 = 14661LB/FT

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
K 1	-105.0	329202	99750	105340	1084592	679349	534292	405243	1.32
K 2	-105.0	329202	266000	98235	1084592	572061	693437	512531	1.35
L 1	-120.0	357222	110000	135629	1308951	861146	602851	447805	1.35
L 2	-120.0	357222	280500	128985	1308951	754723	766707	554228	1.38
M 1	-30.0	17531	5000	12000	65757	43806	34531	21951	1.57

NOTES

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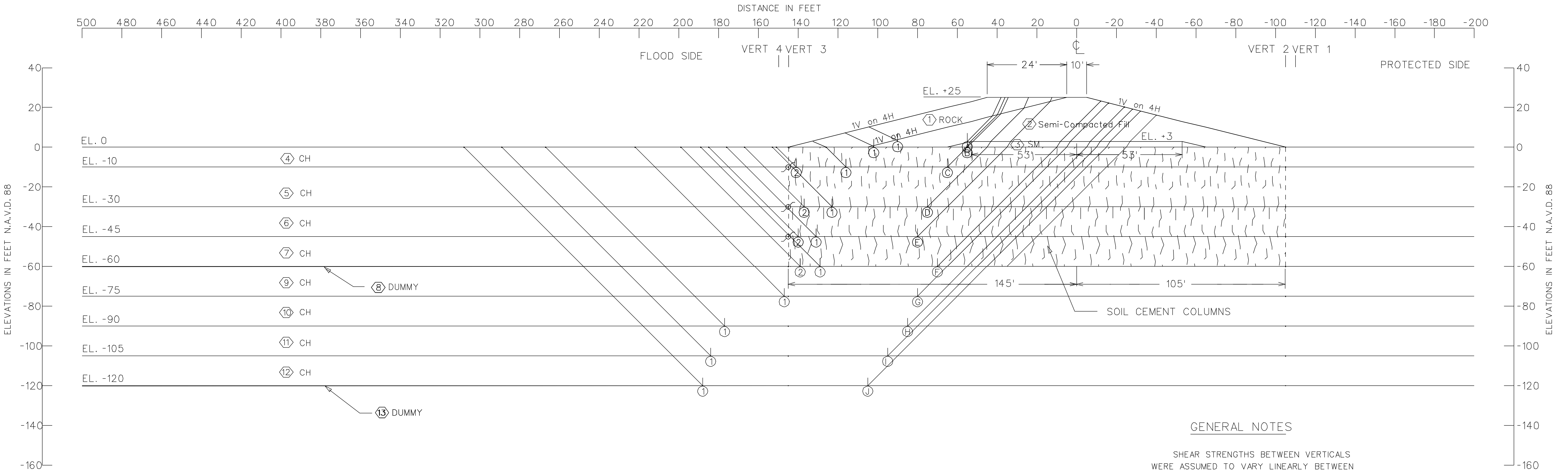
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 - SOIL CEMENT COLUMNS
P/S - CROWN EL.+40, WATER EL.+30
LOUISIANA

SHEET IDENTIFICATION NUMBER G 22



GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A	1	3.0	14631	14000	15937	28964	5111	44568	23853	1.87
B	1	.0	16919	18800	15936	37302	5111	51655	32191	1.60
C	1	-10.0	59623	102000	43486	68195	14285	205109	53910	3.80
C	2	-10.0	59623	152000	4001	68195	5263	215624	62932	3.43
D	1	-30.0	140415	96000	84000	163944	56178	320415	107766	2.97
D	2	-30.0	140415	124000	16000	163944	46052	280415	117892	2.38
E	1	-45.0	201678	102000	76000	263689	108977	379678	154712	2.45
E	2	-45.0	201678	120000	27250	263689	101658	348928	162031	2.15
F	1	-60.0	261455	35400	87250	396070	190514	384105	205556	1.87
F	2	-60.0	261455	41400	43000	396070	180588	345855	215482	1.61
G	1	-75.0	280845	50250	63235	538631	281243	394330	257388	1.53
H	1	-90.0	303948	82800	87985	702978	404989	474733	297989	1.59
I	1	-105.0	332123	93450	117235	884616	551233	542808	333383	1.63
J	1	-120.0	364798	99600	150985	1085454	719979	615383	365475	1.68

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	300	2000	2000	300	300	2000	2000	300	0
6	CH	100	108	108	100	375	2000	2000	375	450	2000	2000	450	0
7	CH	100	108	108	100	525	2000	2000	525	600	2000	2000	600	0
8	DUMMY	100	100	100	100	600	600	600	600	600	600	600	600	0
9	CH	100	100	100	100	675	675	675	675	750	750	750	750	0
10	CH	100	100	100	100	825	825	825	825	900	900	900	900	0
11	CH	100	100	100	100	975	975	975	975	1050	1050	1050	1050	0
12	CH	100	100	100	100	1125	1125	1125	1125	1200	1200	1200	1200	0
13	DUMMY	100	100	100	100	1200	1200	1200	1200	1200	1200	1200	1200	0

NOTES

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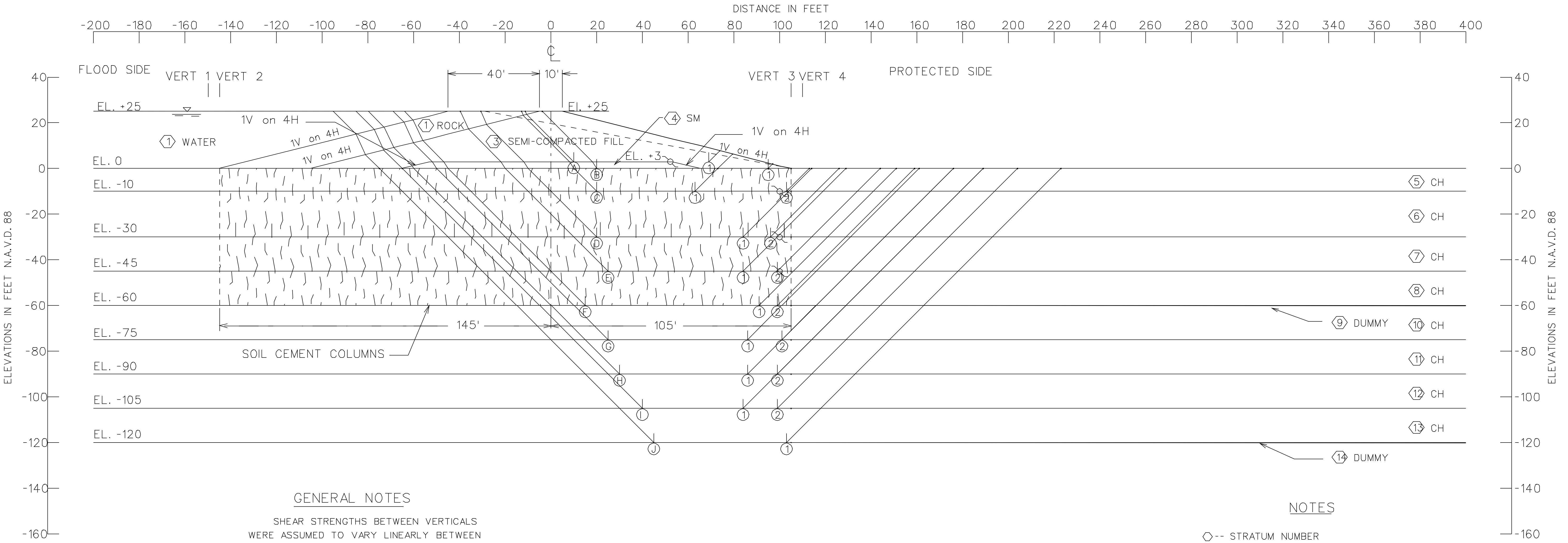
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 - SOIL CEMENT COLUMNS
F/S - CROWN EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 23



GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

NOTES

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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F. CENTER OF STRATUM				C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM				FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	300	2000	2000	300	300	2000	2000	300	0
7	CH	100	108	108	100	375	2000	2000	375	450	2000	2000	450	0
8	CH	100	108	108	100	525	2000	2000	525	600	2000	2000	600	0
9	DUMMY	100	100	100	100	600	600	600	600	600	600	600	600	0
10	CH	100	100	100	100	675	675	675	675	750	750	750	750	0
11	CH	100	100	100	100	825	825	825	825	900	900	900	900	0
12	CH	100	100	100	100	975	975	975	975	1050	1050	1050	1050	0
13	CH	100	100	100	100	1125	1125	1125	1125	1200	1200	1200	1200	0
14	DUMMY	100	100	100	100	1125	1125	1125	1125	1200	1200	1200	1200	0

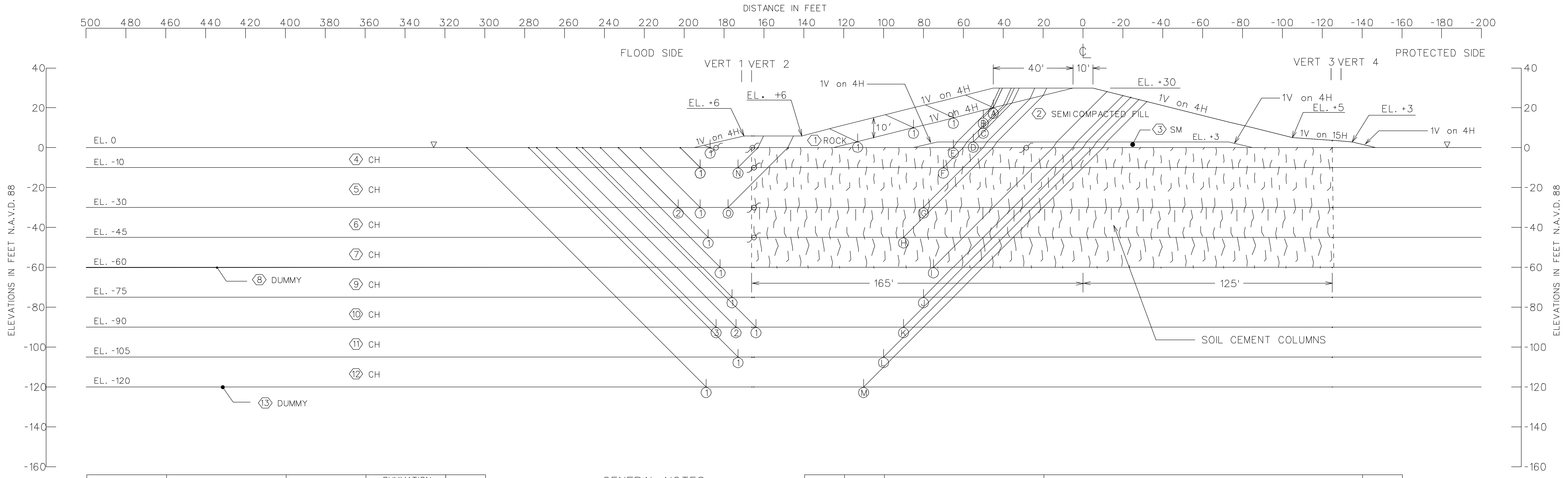
ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A	1	3.0	16582	23544	3839	26381	1583	43965	24798	1.77
B	1	.0	20213	33383	1599	30836	274	55195	30562	1.81
C	1	-10.0	59291	86000	45119	64612	18394	190410	46218	4.12
C	2	-10.0	59291	165966	4000	64612	5055	229257	59557	3.85
D	1	-30.0	136685	128000	84000	165363	54258	348685	111105	3.14
D	2	-30.0	136685	152000	16004	165363	46112	304689	119251	2.56
E	1	-45.0	195668	118000	76000	267046	111806	389668	155240	2.51
E	2	-45.0	195668	148000	27250	267046	101741	370918	165305	2.24
F	1	-60.0	252528	45600	87250	400221	188987	385378	211234	1.82
F	2	-60.0	252528	50400	43000	400221	180489	345928	219732	1.57
G	1	-75.0	271845	45750	63235	545889	293401	380830	252488	1.51
G	2	-75.0	271845	57000	63235	545889	281461	392080	264428	1.48
H	1	-90.0	294703	50400	87985	713640	417149	433088	296491	1.46
H	2	-90.0	294703	62100	87985	713640	405483	444788	308157	1.44
I	1	-105.0	323074	46200	117235	899223	564494	486509	334729	1.45
I	2	-105.0	323074	61950	117235	899223	551728	502259	347495	1.45
J	1	-120.0	355223	69600	150985	1108451	720034	575808	388417	1.48

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 - SOIL CEMENT COLUMNS
P/S - CROWN EL. +25 WATER EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 24



ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A	1	20.0	5163	0	15460	6597	4294	20623	2303	8.96
B	1	15.0	9163	6000	15461	14227	4294	30624	9933	3.08
C	1	10.0	12919	14000	15461	24859	4294	42380	20565	2.06
D	1	3.0	18501	23200	15457	43373	4294	57158	39079	1.46
E	1	.0	24483	99814	578	48817	161	124875	48656	2.57
F	1	-10.0	64520	196280	4000	86864	5142	264800	81722	3.24
G	1	-30.0	145297	178931	16000	192562	45141	340228	147421	2.31
H	1	-45.0	206058	161107	27250	294868	102023	394415	192845	2.05
I	1	-60.0	266610	64200	43000	441936	182671	373810	259265	1.44
J	1	-75.0	285145	72000	63235	593900	286959	420380	306941	1.37
K	1	-90.0	309095	66600	87985	763427	419637	463680	343790	1.35
K	2	-90.0	309095	75600	87985	763427	411972	472680	351455	1.34
K	3	-90.0	309095	84600	87985	763427	406905	481680	356522	1.35
L	1	-105.0	337498	76650	117235	952083	558900	531383	393183	1.35
M	1	-120.0	370173	94800	150985	1159799	720551	615958	439248	1.40
N	1	-10.0	5859	3800	4000	15152	5142	13659	10010	1.36
O	2	-30.0	53860	7500	16000	70518	44999	77360	25519	3.03

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

NOTES

- ⬡ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- ⌀ -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ▽ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	300	2000	2000	300	300	2000	2000	300	0
6	CH	100	108	108	100	375	2000	2000	375	450	2000	2000	450	0
7	CH	100	108	108	100	525	2000	2000	525	600	2000	2000	600	0
8	DUMMY	100	100	100	100	600	600	600	600	600	600	600	600	0
9	CH	100	100	100	100	675	675	675	675	750	750	750	750	0
10	CH	100	100	100	100	825	825	825	825	900	900	900	900	0
11	CH	100	100	100	100	975	975	975	975	1050	1050	1050	1050	0
12	CH	100	100	100	100	1125	1125	1125	1125	1200	1200	1200	1200	0
13	DUMMY	100	100	100	100	1200	1200	1200	1200	1200	1200	1200	1200	0

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

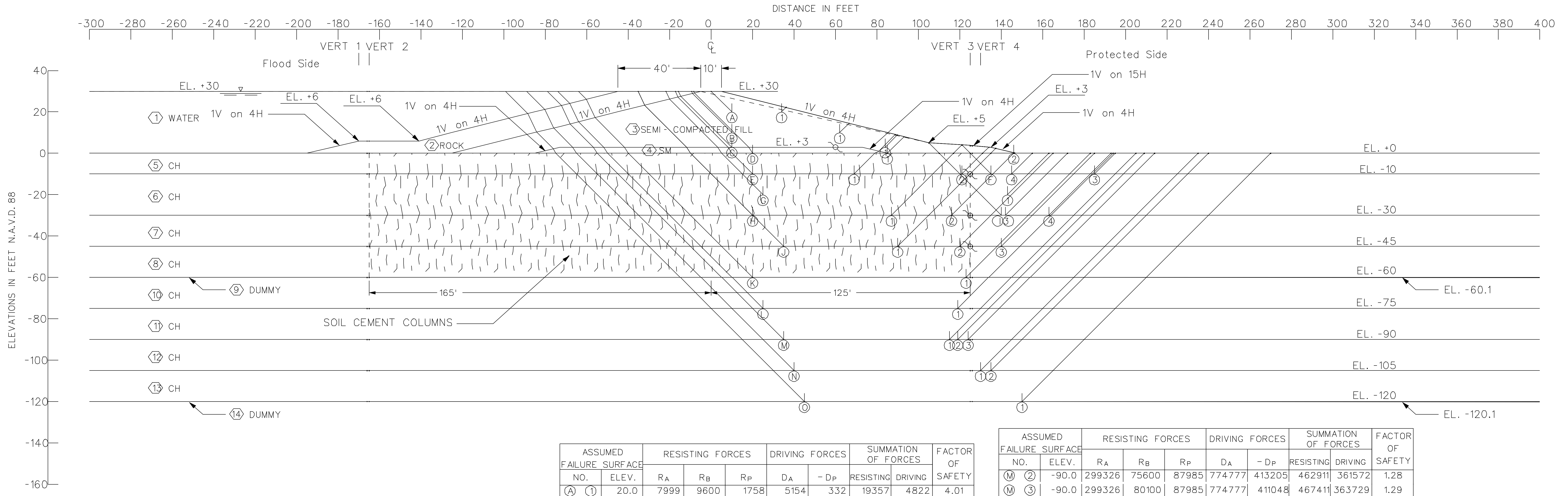
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"-5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

REACH 2 - SOIL CEMENT COLUMNS
F/S - CROWN EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 25



ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A	1	20.0	7999	9600	1758	5154	332	19357	4822	4.01
B	1	10.0	15227	20800	3679	21708	1454	39706	20254	1.96
C	1	3.0	19837	28359	4639	40065	2311	52835	37754	1.40
D	1	.0	23669	36325	6399	45991	4398	66393	41593	1.60
D	2	.0	23669	44388	160	45991	3	68217	45988	1.48
E	1	-10.0	62526	98000	47561	85484	25373	208087	60111	3.46
E	2	-10.0	62526	202000	6449	85484	9525	270975	75959	3.57
E	3	-10.0	62526	222880	4000	85484	5000	289406	80484	3.60
F	4	-10.0	7161	2000	4000	9473	5055	13161	4418	2.98
G	1	-20.0	101988	206230	10000	133135	20219	318218	112916	2.82
H	1	-30.0	140249	134000	123166	197673	69951	397415	127722	3.11
H	2	-30.0	140249	192000	16162	197673	54585	348411	143088	2.43
H	3	-30.0	140249	215931	16000	197673	45342	372180	152331	2.44
I	4	-30.0	56000	6900	16000	58561	44999	78900	13562	5.82
J	1	-45.0	200249	110000	145919	299176	133917	456168	165259	2.76
J	2	-45.0	200249	170000	27250	299176	109017	397499	190159	2.09
J	3	-45.0	200249	187507	27250	299176	101920	415006	197256	2.10
K	1	-60.0	256966	61800	43000	446582	186471	361766	260111	1.39
L	1	-75.0	275499	70500	63235	601602	289459	409234	312143	1.31
M	1	-90.0	299326	72000	87985	774777	422259	459311	352518	1.30

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
M	2	-90.0	299326	75600	87985	774777	413205	462911	361572	1.28
M	3	-90.0	299326	80100	87985	774777	411048	467411	363729	1.29
N	1	-105.0	326729	94500	117235	971201	554955	538464	416246	1.29
N	2	-105.0	326729	99750	117235	971201	553214	543714	417987	1.30
O	1	-120.0	358594	126000	150985	1188372	719980	635579	468392	1.36

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	WATER	62	62	62	62	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	300	2000	2000	300	300	2000	2000	300	0
7	CH	100	108	108	100	375	2000	2000	375	450	2000	2000	450	0
8	CH	100	108	108	100	525	2000	2000	525	600	2000	2000	600	0
9	DUMMY	100	100	100	100	600	600	600	600	600	600	600	600	0
10	CH	100	100	100	100	675	675	675	675	750	750	750	750	0
11	CH	100	100	100	100	825	825	825	825	900	900	900	900	0
12	CH	100	100	100	100	975	975	975	975	1050	1050	1050	1050	0
13	CH	100	100	100	100	1125	1125	1125	1125	1200	1200	1200	1200	0
14	DUMMY	100	100	100	100	1200	1200	1200	1200	1200	1200	1200	1200	0

NOTES

⬡ -- STRATUM NUMBER
○ -- WEDGE NUMBER
-○- -- CROSSOVER POINT
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

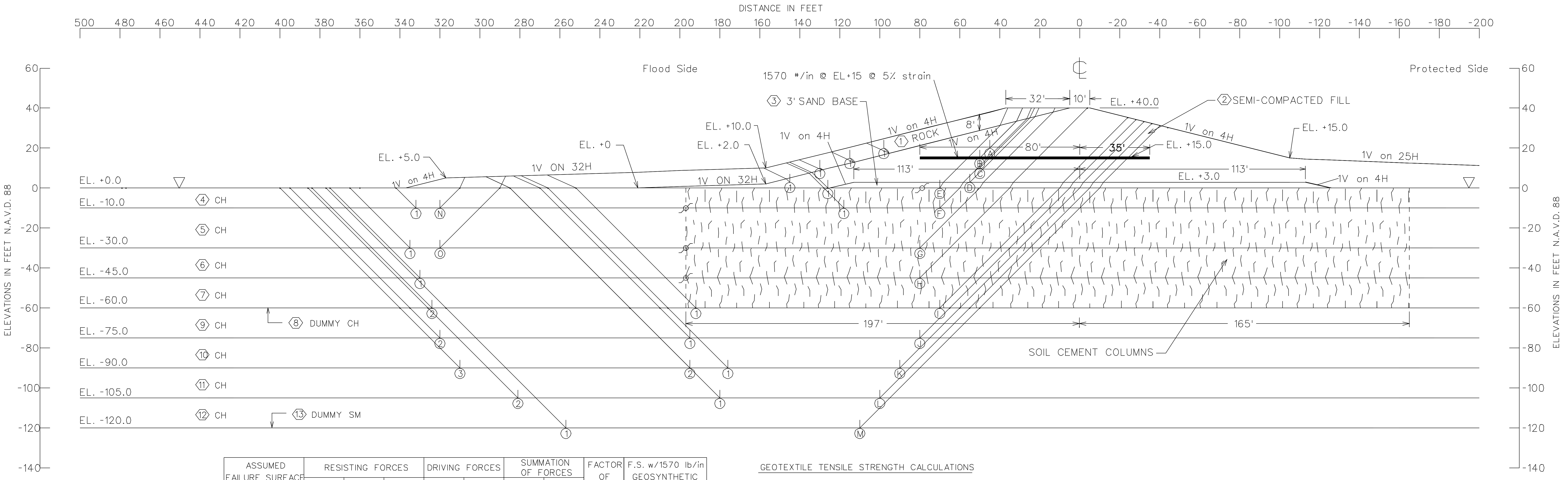
MARK | DESCRIPTION | DATE | APPR.

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 - SOIL CEMENT COLUMNS
P/S - CROWN EL. +30 WATER EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 26



ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/1570 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	20.0	12960	21200	7814	23872	468	41974	23404	1.79	
B	1	15.0	16960	26000	8294	35681	911	51254	34770	1.47	
C	1	10.0	21290	32000	9095	51447	1761	62385	49686	1.26	1.63
D	1	3.0	27101	36000	11196	76194	4620	74297	71574	1.04	1.30
E	1	.0	33388	94123	16135	78091	15166	143646	62925	2.28	
F	1	-10.0	74418	96000	55815	129930	41906	226233	88024	2.57	
G	1	-30.0	156341	275520	16000	254329	45065	447861	209264	2.14	
H	1	-45.0	218426	293959	27250	382164	102055	539635	280109	1.93	
I	1	-60.0	274355	73200	54002	536074	245872	401557	290202	1.38	
I	2	-60.0	274355	152400	43000	536074	182782	469755	353292	1.33	
J	1	-75.0	293760	86250	72561	699454	359233	452571	340221	1.33	
J	2	-75.0	293760	180000	63250	699454	286009	537010	413445	1.30	
K	1	-90.0	317710	77400	97674	882061	509214	492784	372847	1.32	
K	2	-90.0	317710	94500	96009	882061	494960	508219	387101	1.31	
K	3	-90.0	317710	198000	88000	882061	416304	603710	465757	1.30	
L	1	-105.0	346113	84000	125259	1083839	665972	555372	417867	1.33	
L	2	-105.0	346113	190050	117250	1083839	584257	653413	499582	1.31	
M	1	-120.0	378788	176400	151000	1304671	773592	706188	531079	1.33	
N	1	-10.0	5426	2400	4000	13372	5412	11826	7960	1.49	
O	1	-30.0	17789	3000	16000	68432	45807	36789	22625	1.63	

NOTES

- ◯ -- STRATUM NUMBER
- ◯ -- WEDGE NUMBER
- -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ∇ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

EL. +15.0 CONTROLLING FAILURE WEDGE D - 1

T = DRIVING(F.S.) - RESISTING

T = (71574)(1.3) - 74297 = 18750 LB/FT

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	300	2000	2000	300	300	2000	2000	300	0
6	CH	100	108	108	100	375	2000	2000	375	450	2000	2000	450	0
7	CH	100	108	108	100	525	2000	2000	525	600	2000	2000	600	0
8	DUMMY	100	100	100	100	600	600	600	600	600	600	600	600	0
9	CH	100	100	100	100	675	675	675	675	750	750	750	750	0
10	CH	100	100	100	100	825	825	825	825	900	900	900	900	0
11	CH	100	100	100	100	975	975	975	975	1050	1050	1050	1050	0
12	CH	100	100	100	100	1125	1125	1125	1125	1200	1200	1200	1200	0
13	DUMMY	100	100	100	100	1200	1200	1200	1200	1200	1200	1200	1200	0

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS.

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-X
SIZE: ANSI X
PLOT SCALE: 1"=5000'

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

REACH 2 - SOIL CEMENT COLUMNS
F/S - CROWN EL. +40
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 27

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
⟨1⟩	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
⟨2⟩	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
⟨3⟩	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
⟨4⟩	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
⟨5⟩	CH	100	108	108	100	200	2000	2000	200	200	2000	2000	200	0
⟨6⟩	CH	100	108	108	100	300	2000	2000	300	300	2000	2000	300	0
⟨7⟩	CH	100	108	108	100	375	2000	2000	375	450	2000	2000	450	0
⟨8⟩	CH	100	108	108	100	525	2000	2000	525	600	2000	2000	600	0
⟨9⟩	DUMMY	100	100	100	100	600	600	600	600	600	600	600	600	0
⟨10⟩	CH	100	100	100	100	675	675	675	675	750	750	750	750	0
⟨11⟩	CH	100	100	100	100	825	825	825	825	900	900	900	900	0
⟨12⟩	CH	100	100	100	100	975	975	975	975	1050	1050	1050	1050	0
⟨13⟩	CH	100	100	100	100	1125	1125	1125	1125	1200	1200	1200	1200	0
⟨14⟩	DUMMY	100	100	100	100	1200	1200	1200	1200	1200	1200	1200	1200	0

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/1570 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
(A) (1)	20.0	15252	20000	3999	21708	1718	39251	19990	1.96	
(B) (1)	10.0	22065	32000	5600	49647	3368	59665	46279	1.29	1.70
(C) (1)	3.0	27478	12000	17279	74550	32072	56757	42478	1.34	
(C) (2)	3.0	27478	22000	13280	74550	18943	62758	55607	1.13	1.47
(C) (3)	3.0	27478	32000	9538	74550	9286	69016	65264	1.06	1.35
(C) (4)	3.0	27478	41116	8771	74550	6875	77365	67675	1.14	1.42
(C) (5)	3.0	27478	51033	8003	74550	5724	86514	68826	1.26	1.53
(C) (6)	3.0	27478	61033	7226	74550	4667	95737	69883	1.37	
(D) (1)	.0	32359	46369	10892	88800	10603	89620	78197	1.15	1.39
(D) (2)	.0	32359	57168	10000	88800	8937	99527	79863	1.25	1.48
(D) (3)	.0	32359	67369	9076	88800	7362	108804	81438	1.34	
(E) (1)	-10.0	72760	100000	55069	129131	42521	227829	86610	2.63	
(F) (1)	-30.0	152049	312831	16000	263629	45673	480880	217956	2.21	
(G) (1)	-45.0	211777	313757	27250	383254	101921	552784	281333	1.96	
(H) (1)	-60.0	268503	156000	43000	534928	183968	467503	350960	1.33	
(I) (1)	-75.0	287821	161250	63235	697811	313793	512306	384018	1.33	
(I) (2)	-75.0	287821	183750	63235	697811	287896	534806	409915	1.30	
(I) (3)	-75.0	287821	206250	63235	697811	281243	557306	416568	1.34	
(J) (1)	-90.0	310335	184500	87985	882689	442434	582820	440255	1.32	
(J) (2)	-90.0	310335	211500	87985	882689	415010	609820	467679	1.30	

NOTE: REQUIRED STRENGTH OF GEOSYNTHETIC AT 5% STRAIN IS 1570 LB\IN.

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

CONTROLLING FAILURE WEDGE (C) - (3)

T = DRIVING(F.S.) - RESISTING

T = (65264)(1.3) - 69016 = 15827LB/FT

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
(J) (3)	-90.0	310335	238500	87985	882689	404988	636820	477701	1.33
(K) (1)	-105.0	338202	236250	117235	1084589	561256	691687	523333	1.32
(L) (1)	-120.0	370572	246000	150985	1305686	738511	767557	567175	1.35
(M) (1)	.0	6664	3478	160	3664	3	10302	3661	2.81
(N) (1)	-10.0	10831	5200	4000	17358	5014	20031	12344	1.62

NOTES

⬡ -- STRATUM NUMBER
◯ -- WEDGE NUMBER
⌀ -- CROSSOVER POINT
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

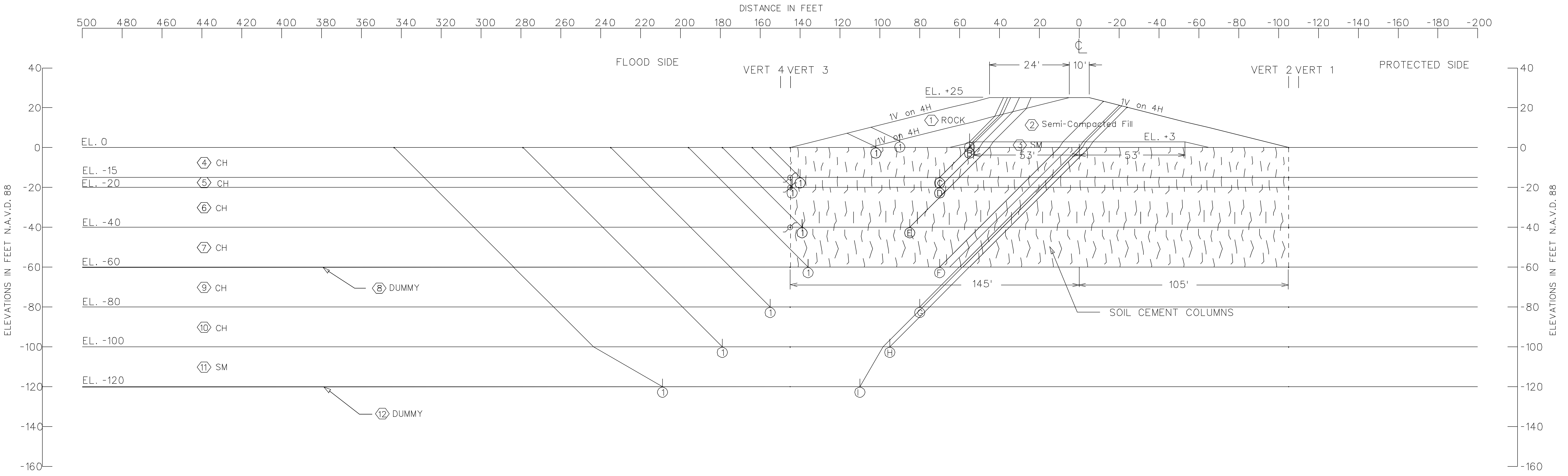
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 - SOIL CEMENT COLUMNS
P/S - CROWN EL.+40 WATER EL.+30
LOUISIANA

SHEET IDENTIFICATION NUMBER G 28



ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	3.0	14631	14000	15937	28964	5111	44568	23853	1.87
B	1	.0	16919	18800	15936	37302	5111	51655	32191	1.60
C	1	-15.0	79623	140000	6000	86700	11098	225623	75602	2.98
D	1	-20.0	99940	148000	9250	111122	19078	257190	92044	2.79
E	1	-40.0	180415	108000	27250	221815	78153	315665	143662	2.20
F	1	-60.0	261455	49500	53233	396070	177395	364188	218675	1.67
G	1	-80.0	293790	71250	87230	591923	314554	452270	277369	1.63
H	1	-100.0	334943	96600	129230	820098	493048	560773	327050	1.71
I	1	-120.0	417671	301111	300015	1078214	715940	1018797	362274	2.81

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	325	2000	2000	325	350	2000	2000	350	0
6	CH	100	108	108	100	450	2000	2000	450	550	2000	2000	550	0
7	CH	100	108	108	100	650	2000	2000	650	750	2000	2000	750	0
8	DUMMY	100	100	100	100	750	750	750	750	750	750	750	750	0
9	CH	100	100	100	100	850	850	850	850	950	950	950	950	0
10	CH	100	100	100	100	1050	1050	1050	1050	1150	1150	1150	1150	0
11	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
12	DUMMY	122	122	122	122	0	0	0	0	0	0	0	0	30

NOTES

- ⬡ -- STRATUM NUMBER
- ◯ -- WEDGE NUMBER
- ⌀ -- CROSSOVER POINT
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- ∇ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT,REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES

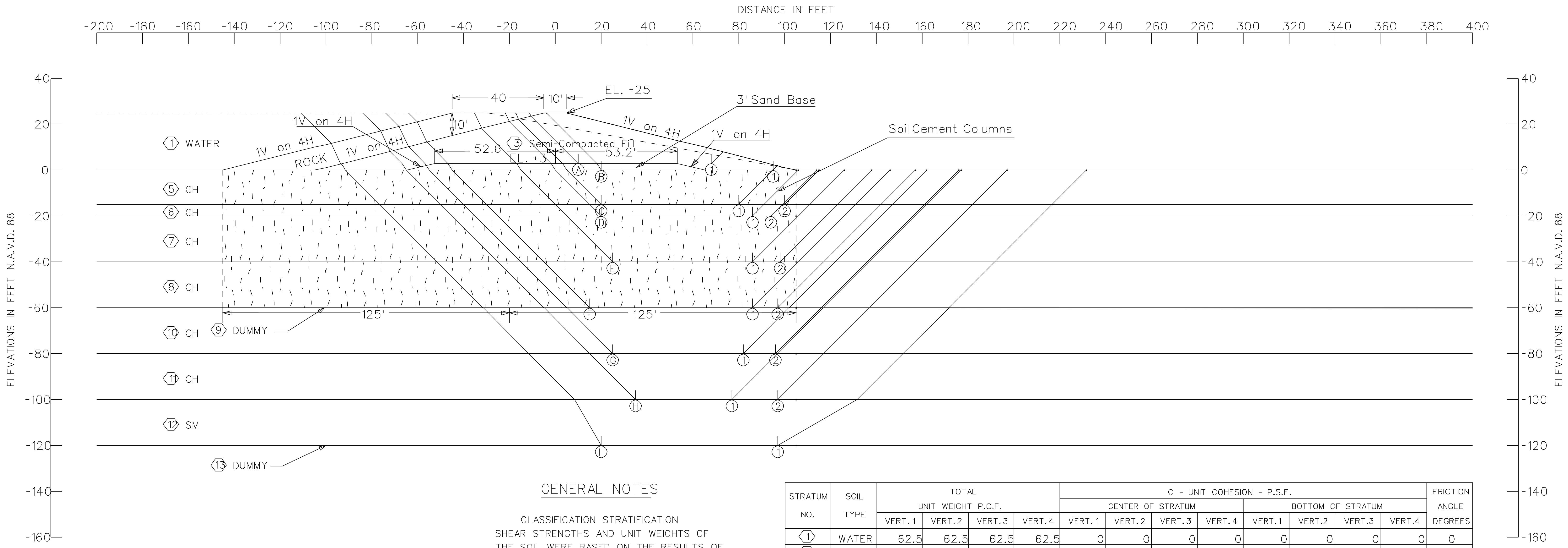
SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 - SOIL CEMENT COLUMNS
F/S CROWN EL.+25 WATER EL.+0
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 29



GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS.

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
2	RIPRAP	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	325	2000	2000	325	350	2000	2000	350	0
7	CH	100	108	108	100	450	2000	2000	450	550	2000	2000	550	0
8	CH	100	108	108	100	650	2000	2000	650	750	2000	2000	750	0
9	CH	100	100	100	100	750	750	750	750	750	750	750	750	0
10	CH	100	100	100	100	850	850	850	850	950	950	950	950	0
11	CH	100	100	100	100	1050	1050	1050	1050	1150	1150	1150	1150	0
12	SM	122	122	122	122	0	0	0	0	0	0	0	0	30

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A 1	3.0	16582	23144	3999	26381	1717	43725	24664	1.77
B 1	.0	20213	33383	1599	30836	274	55195	30562	1.81
C 1	-15.0	78831	120000	61599	85683	19639	260430	66044	3.94
C 2	-15.0	78831	160000	6000	85683	11030	244831	74653	3.28
D 1	-20.0	98139	132000	80000	109419	26559	310139	82860	3.74
D 2	-20.0	98139	148000	26000	109419	21799	272139	87620	3.11
E 1	-40.0	176136	122000	89250	229335	88820	387386	140515	2.76
E 2	-40.0	176136	146000	27250	229335	78233	349386	151102	2.31
F 1	-60.0	252527	53250	107250	400218	190517	413027	209701	1.97
F 2	-60.0	252527	61500	53250	400218	176936	367277	223282	1.64
G 1	-80.0	284670	54150	87230	600286	332922	426050	267364	1.59
G 2	-80.0	284670	67450	87230	600286	316221	439350	284065	1.55
H 1	-100.0	324833	48300	129230	836652	514922	502363	321730	1.56
H 2	-100.0	324833	71300	129230	836652	493928	525363	342724	1.53
I 1	-120.0	404199	0	299168	1123282	716448	703367	406834	1.73

NOTES

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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

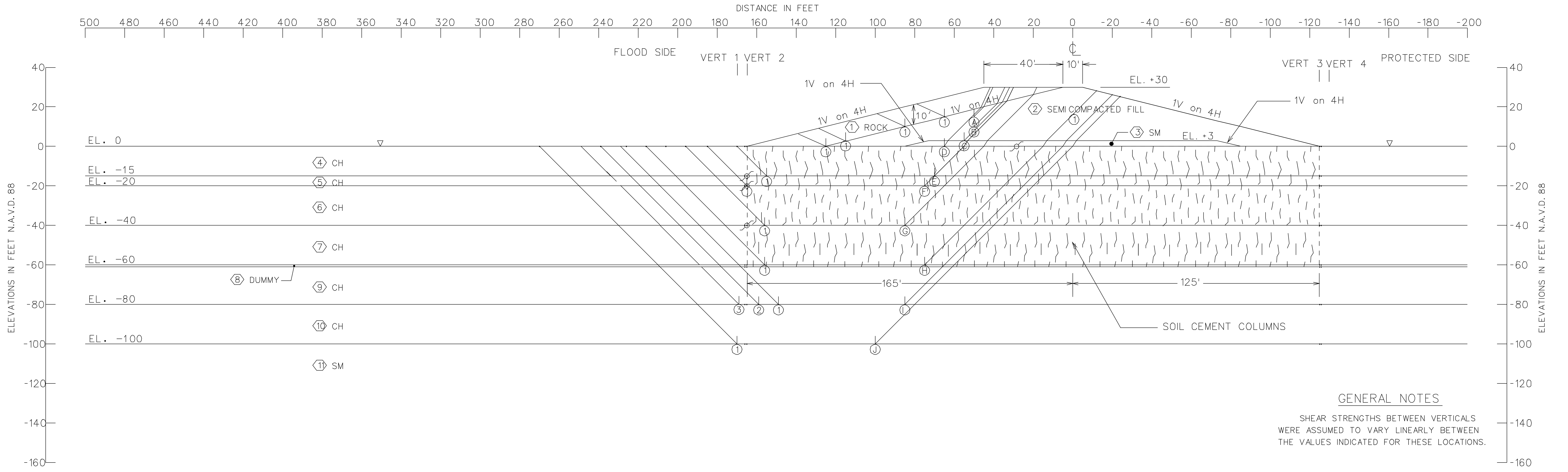
MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=500'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 - SOIL CEMENT COLUMNS
P/S CROWN EL. +25 WATER EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 30



GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
Ⓐ ①	15.0	9163	6000	15442	14226	4289	30605	9937	3.08
Ⓑ ①	10.0	12919	14000	15430	24859	4286	42349	20573	2.06
Ⓒ ①	3.0	18501	24000	15087	43371	3765	57588	39606	1.45
Ⓓ ①	.0	24481	74478	15400	48811	4279	114359	44532	2.57
Ⓔ ①	-15.0	84765	170000	60000	111329	13768	314765	97561	3.23
Ⓕ ①	-20.0	104764	179999	9250	134766	18999	294013	115767	2.54
Ⓖ ①	-40.0	186058	142000	27243	260140	77308	355301	182832	1.94
Ⓗ ①	-60.0	266609	60750	53230	441923	172307	380589	269616	1.41
Ⓘ ①	-80.0	298708	60800	87050	647504	323986	446558	323518	1.38
Ⓘ ②	-80.0	298708	70300	87050	647504	305567	456058	341937	1.33
Ⓘ ③	-80.0	298708	79800	87050	647504	304992	465558	342512	1.36
Ⓙ ①	-100.0	339907	80500	129050	884622	478987	549457	405635	1.35

NOTES

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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

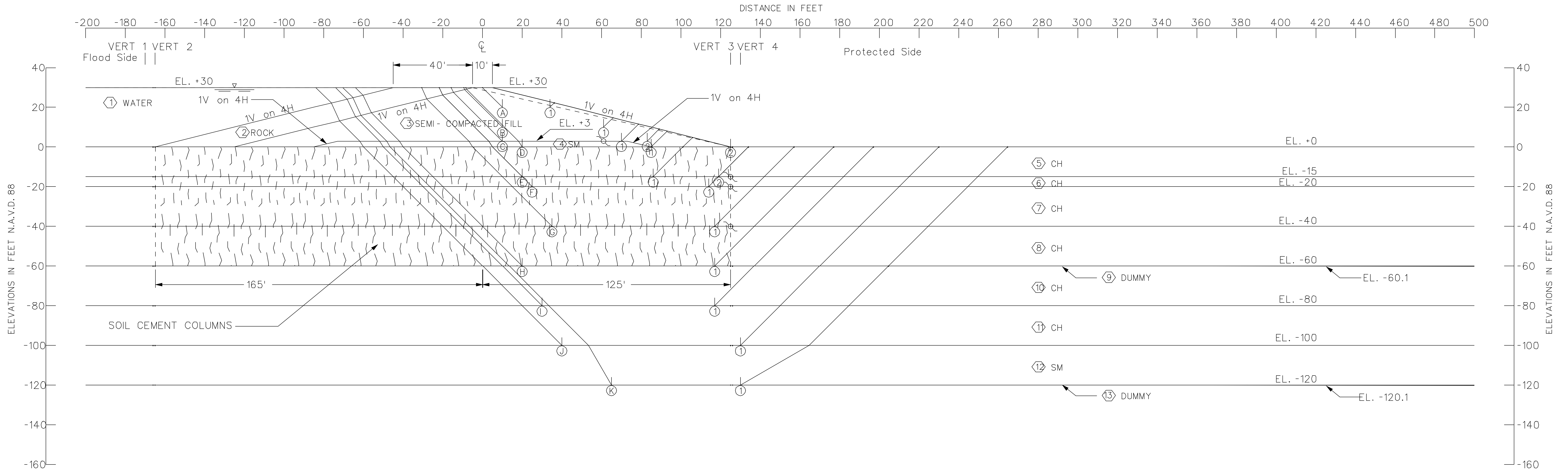
STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	CH	95	108	108	95	325	2000	2000	325	350	2000	2000	350	0
6	CH	95	108	108	95	450	2000	2000	450	550	2000	2000	550	0
7	CH	95	108	108	95	650	2000	2000	650	750	2000	2000	750	0
8	DUMMY	100	100	100	100	750	750	750	750	750	750	750	750	0
9	CH	100	100	100	100	850	850	850	850	950	950	950	950	0
10	CH	100	100	100	100	1050	1050	1050	1050	1150	1150	1150	1150	0
11	SM	122	122	122	122	0	0	0	0	0	0	0	0	30

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 - SOIL CEMENT COLUMNS
F/S CROWN EL. +30 WATER EL. +0
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 31



STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	WATER	62	62	62	62	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	325	2000	2000	325	350	2000	2000	350	0
7	CH	100	108	108	100	450	2000	2000	450	550	2000	2000	550	0
8	CH	100	108	108	100	650	2000	2000	650	750	2000	2000	750	0
9	DUMMY	100	100	100	100	750	750	750	750	750	750	750	750	0
10	CH	100	100	100	100	850	850	850	850	950	950	950	950	0
11	CH	100	100	100	100	1050	1050	1050	1050	1150	1150	1150	1150	0
12	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
13	DUMMY	122	122	122	122	0	0	0	0	0	0	0	0	30

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
A	1	20.0	7999	9600	1758	5154	332	19357	4822	4.01
B	1	10.0	15227	20400	3834	21708	1580	39461	20128	1.96
C	1	3.0	19837	23698	6872	40065	5074	50407	34991	1.44
C	2	3.0	19837	28133	4790	40065	2465	52760	37600	1.40
D	1	.0	23680	36780	6389	45991	4386	66849	41605	1.61
D	2	.0	23680	42787	0	45991	0	66467	45991	1.45
E	1	-15.0	81992	132000	63827	109414	26689	277819	82725	3.36
E	2	-15.0	81992	198000	6000	109414	11166	285992	98248	2.91
F	1	-20.0	101992	178000	26000	133135	21772	305992	111363	2.75
G	1	-40.0	180655	164000	27250	258825	78419	371905	180406	2.06
H	1	-60.0	256966	72750	53250	446583	176917	382966	269666	1.42
I	1	-80.0	289244	82650	87230	656335	315413	459124	340922	1.35
J	1	-100.0	329398	103500	129230	902288	493050	562128	409238	1.37
K	1	-120.0	408150	215774	300018	1160335	715944	923942	444391	2.08

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

NOTES

- ⬡ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ▽ -- STATIC WATER SURFACE
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- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

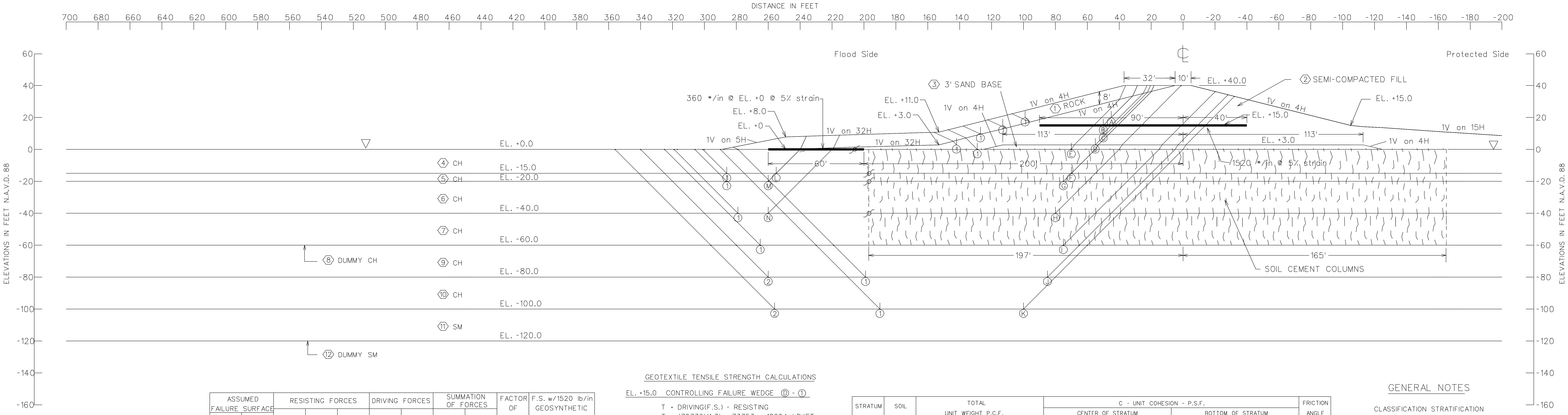
US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT PRELIMINARY TECHNICAL REPORT TO CONGRESS

REACH 3 - SOIL CEMENT COLUMNS P/S CROWN EL. +30 WATER EL. +30 LOUISIANA

SHEET IDENTIFICATION NUMBER G 32



NOTES

⬡-- STRATUM NUMBER
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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

ASSUMED FAILURE SURFACE NO.		ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY	F.S. w/1520 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	20.0	12960	21600	7654	23872	331	42214	23541	1.79	
B	1	15.0	16960	25200	8614	35682	1235	50774	34447	1.47	
C	1	10.0	21290	30800	9575	51448	2337	61665	49111	1.26	1.63
D	1	3.0	27101	34800	11852	76195	5459	73753	70736	1.04	1.30
E	1	.0	33388	97738	15656	78092	13914	146782	64178	2.29	
F	1	-15.0	95236	286102	6000	159539	10806	387338	148733	2.60	
G	1	-20.0	115236	288259	9250	187165	19181	412745	167984	2.46	
H	1	-40.0	198339	290618	27250	336981	78880	516207	258101	2.00	
I	1	-60.0	275210	142500	53250	534442	183660	470960	350782	1.34	
J	1	-80.0	307510	108300	87915	757406	391625	503725	365781	1.38	
J	2	-80.0	307510	166250	87250	757406	325653	561010	431753	1.30	F.S. w/360 lb/in GEOSYNTHETIC AT 5% STRAIN
K	1	-100.0	348710	103500	129250	1012027	593546	581460	418481	1.39	
K	2	-100.0	348710	179400	129250	1012027	507421	657360	504606	1.30	
L	1	-15.0	9585	6000	6000	30783	10898	21585	19885	1.09	1.30
M	1	-20.0	12835	7000	9250	43315	20131	29085	23184	1.25	1.44
N	1	-40.0	31352	9350	27250	124960	79461	67952	45499	1.49	

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

EL. +15.0 CONTROLLING FAILURE WEDGE (D) - (1)

T = DRIVING(F.S.) - RESISTING
T = (70736)(1.3) - 73753 = 18204 LB/FT

EL. +0.0 CONTROLLING FAILURE WEDGE (L) - (1)

T = DRIVING(F.S.) - RESISTING
T = (19885)(1.3) - 21585 = 4266 LB/FT

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F. VERT. 1	VERT. 2	VERT. 3	VERT. 4	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	BOTTOM OF STRATUM VERT. 1	VERT. 2	VERT. 3	VERT. 4	FRICTION ANGLE DEGREES
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	CH	100	108	108	100	325	2000	2000	325	350	2000	2000	350	0
6	CH	100	108	108	100	450	2000	2000	450	550	2000	2000	550	0
7	CH	100	108	108	100	650	2000	2000	650	750	2000	2000	750	0
8	DUMMY	100	100	100	100	750	750	750	750	750	750	750	750	0
9	CH	100	100	100	100	850	850	850	850	950	950	950	950	0
10	CH	100	100	100	100	1050	1050	1050	1050	1150	1150	1150	1150	0
11	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
12	DUMMY	122	122	122	122	0	0	0	0	0	0	0	0	30

GENERAL NOTES

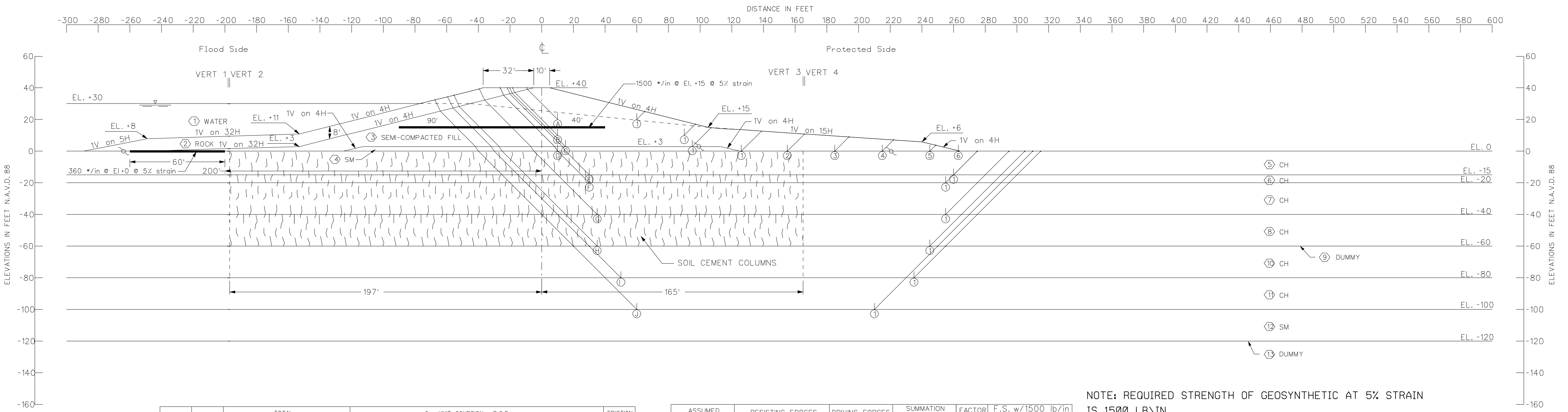
CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS.

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

REACH 3 - SOIL CEMENT COLUMNS
F/S CROWN EL. +40 WATER EL. +0

SHEET IDENTIFICATION NUMBER
G 33



STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F. CENTER OF STRATUM				C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM				FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	100	108	108	100	325	2000	2000	325	350	2000	2000	350	0
7	CH	100	108	108	100	450	2000	2000	450	550	2000	2000	550	0
8	CH	100	108	108	100	650	2000	2000	650	750	2000	2000	750	0
9	DUMMY	100	100	100	100	750	750	750	750	750	750	750	750	0
10	CH	100	100	100	100	850	850	850	850	950	950	950	950	0
11	CH	100	100	100	100	1050	1050	1050	1050	1150	1150	1150	1150	0
12	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
13	DUMMY	122	122	122	122	0	0	0	0	0	0	0	0	30

GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY	F.S. w/1500 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	20.0	15252	20000	3999	21708	1718	39251	19990	1.96	
B	1	10.0	22065	32000	5600	49647	3368	59665	46279	1.29	1.68
C	1	3.0	27478	32000	9500	74550	9280	68978	65270	1.06	1.33
D	1	.0	32359	46284	10200	88800	9536	88843	79264	1.12	1.35
D	2	.0	32359	56331	8750	88800	7017	97440	81783	1.19	1.41
D	3	.0	32359	65105	7249	88800	4817	104713	83983	1.25	1.46
D	4	.0	32359	72233	5749	88800	3029	110341	85771	1.29	1.50
D	5	.0	32359	77651	3039	88800	992	113049	87808	1.29	1.49
D	6	.0	32359	78884	160	88800	3	111403	88797	1.25	1.46
E	1	-15.0	92508	289880	6000	158591	10907	388388	147684	2.63	
F	1	-20.0	112359	302306	9250	190863	20175	423915	170688	2.48	
G	1	-40.0	191777	310209	27250	342594	78674	529236	263920	2.01	
H	1	-60.0	268503	157500	53250	534928	181020	479253	353908	1.35	
I	1	-80.0	301586	175750	87250	755293	325862	564586	429431	1.31	
J	1	-100.0	341350	172500	129250	1013095	524059	643100	489036	1.32	

NOTE: REQUIRED STRENGTH OF GEOSYNTHETIC AT 5% STRAIN IS 1500 LB\IN.

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

CONTROLLING FAILURE WEDGE (C) - (1)

T = DRIVING(F.S.) - RESISTING

T = (65270)(1.3) - 68978 = 15873LB/FT

NOTES

- ⬡ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- ∅ -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ∇ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT,REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

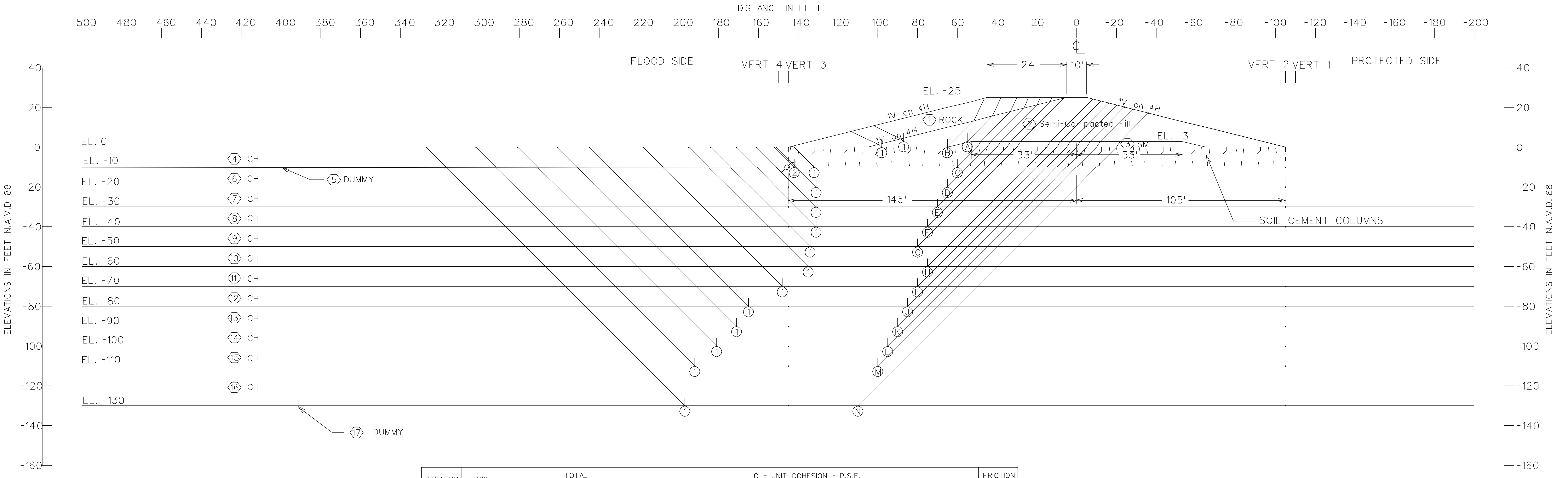
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: XXX | DWN BY: XXX | CKD BY: XXX | SUBMITTED BY: XXXXXXXXXXXXXXXXXX | DATE: MM/DD/YYYY | SOLICITATION NO.: W912P8-00-B-XXXX | CONTRACT NO.: W912P8-00-C-XXXX | FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN | FILE NUMBER: H-NN-NNNNN | SIZE: ANSI X | PLOT SCALE: 1"=500' | PLOT DATE: MM/DD/YYYY

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 - SOIL CEMENT COLUMNS
P/S CROWN EL. +40 WATER EL. +30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 34



ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
(A) (1)	3.0	14631	12800	16417	28964	5977	43848	22987	1.91
(B) (1)	.0	16510	37457	16576	32396	6277	70543	26119	2.70
(C) (1)	-10.0	59940	72000	40087	70689	8061	172027	62628	2.75
(C) (2)	-10.0	59940	82000	4000	70689	4898	145940	65791	2.22
(D) (1)	-20.0	80415	66000	24011	113473	23530	170426	89943	1.89
(E) (1)	-30.0	102893	67100	45990	168637	52526	215983	116111	1.86
(F) (1)	-40.0	128668	67200	70990	233450	90768	266858	142682	1.87
(G) (1)	-50.0	156730	70200	97990	308891	139260	324920	169631	1.92
(H) (1)	-60.0	185300	84000	126990	402578	200142	396290	202436	1.96
(I) (1)	-70.0	215445	102000	157990	500195	268623	475435	231572	2.05
(J) (1)	-80.0	247600	128000	190990	608081	352850	566590	255231	2.22
(K) (1)	-90.0	281800	137700	225990	726258	448577	645490	277681	2.32
(L) (1)	-100.0	317953	154800	262989	854667	555803	735742	298864	2.46
(M) (1)	-110.0	355878	174800	301989	993195	674530	832667	318665	2.61
(N) (1)	-130.0	433729	174000	381989	1300967	946482	989718	354485	2.79

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	DUMMY	95	95	95	95	1000	1000	1000	1000	1000	1000	1000	1000	0
6	CH	115	115	115	115	1050	1050	1050	1050	1100	1100	1100	1100	0
7	CH	115	115	115	115	1150	1150	1150	1150	1200	1200	1200	1200	0
8	CH	115	115	115	115	1250	1250	1250	1250	1300	1300	1300	1300	0
9	CH	115	115	115	115	1350	1350	1350	1350	1400	1400	1400	1400	0
10	CH	115	115	115	115	1450	1450	1450	1450	1500	1500	1500	1500	0
11	CH	115	115	115	115	1550	1550	1550	1550	1600	1600	1600	1600	0
12	CH	115	115	115	115	1650	1650	1650	1650	1700	1700	1700	1700	0
13	CH	115	115	115	115	1750	1750	1750	1750	1800	1800	1800	1800	0
14	CH	115	115	115	115	1850	1850	1850	1850	1900	1900	1900	1900	0
15	CH	115	115	115	115	1950	1950	1950	1950	2000	2000	2000	2000	0
16	CH	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0
17	DUMMY	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0

NOTES

- ⬡ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
- ▽ -- STATIC WATER SURFACE
- D -- HORIZONTAL DRIVING FORCE IN POUNDS
- R -- HORIZONTAL RESISTING FORCE IN POUNDS
- A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
- B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES

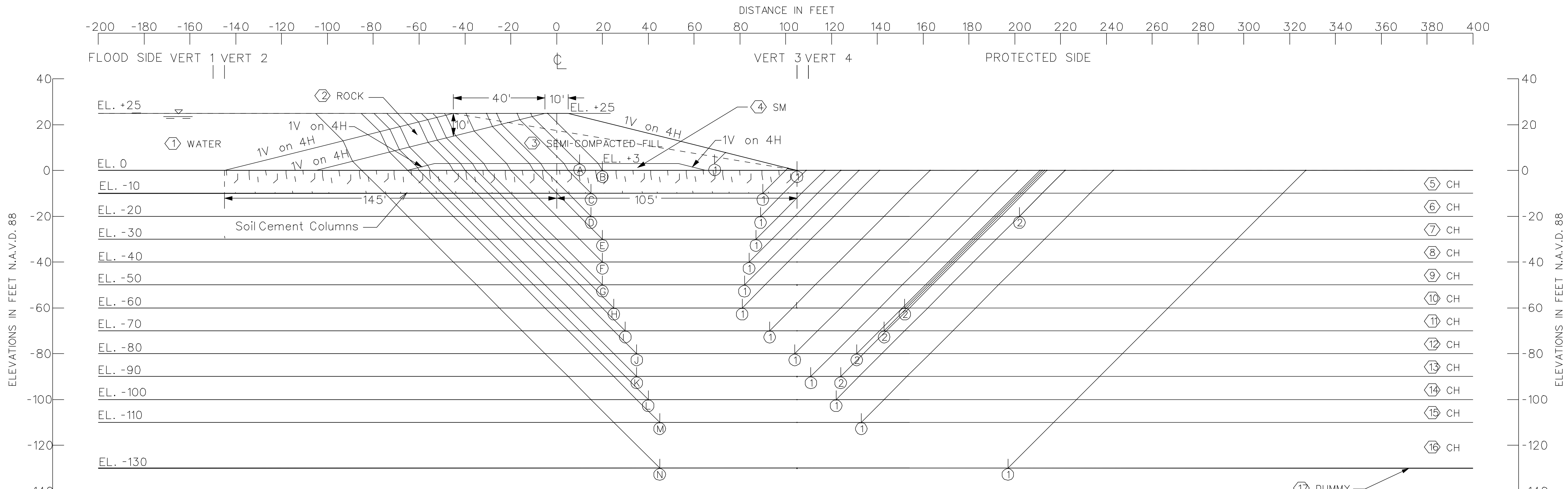
SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - SOIL CEMENT COLUMNS
F/S CROWN EL.+25 WATER EL.+0
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 35



GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	115	115	115	115	1050	1050	1050	1050	1100	1100	1100	1100	0
7	CH	115	115	115	115	1150	1150	1150	1150	1200	1200	1200	1200	0
8	CH	115	115	115	115	1250	1250	1250	1250	1300	1300	1300	1300	0
9	CH	115	115	115	115	1350	1350	1350	1350	1400	1400	1400	1400	0
10	CH	115	115	115	115	1450	1450	1450	1450	1500	1500	1500	1500	0
11	CH	115	115	115	115	1550	1550	1550	1550	1600	1600	1600	1600	0
12	CH	115	115	115	115	1650	1650	1650	1650	1700	1700	1700	1700	0
13	CH	115	115	115	115	1750	1750	1750	1750	1800	1800	1800	1800	0
14	CH	115	115	115	115	1850	1850	1850	1850	1900	1900	1900	1900	0
15	CH	115	115	115	115	1950	1950	1950	1950	2000	2000	2000	2000	0
16	CH	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0
17	DUMMY	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	3.0	16581	23600	3839	26381	1583	44020	24798	1.78
B	1	.0	20426	36433	0	30836	0	56859	30836	1.84
C	1	-10.0	59085	82500	40799	66723	8216	182384	58507	3.12
D	1	-20.0	79019	81400	61000	111962	25466	221419	86496	2.56
D	2	-20.0	79019	205700	24999	111962	19999	309718	91963	3.37
E	1	-30.0	101529	80400	48000	166763	53800	229929	112963	2.04
F	1	-40.0	125415	83200	73000	235725	93657	281615	142068	1.98
G	1	-50.0	151109	86800	100000	316418	144615	337909	171803	1.97
H	1	-60.0	179238	84000	129000	404812	206510	392238	198302	1.98
H	2	-60.0	179238	190500	128999	404812	195994	498737	208818	2.39
I	1	-70.0	209389	100800	160000	503766	272020	470189	231746	2.03
I	2	-70.0	209389	180800	160000	503766	268742	550189	235024	2.34
J	1	-80.0	241528	117300	193000	613281	353004	551828	260277	2.12
J	2	-80.0	241528	163200	192999	613281	352989	597727	260292	2.30
K	1	-90.0	274652	136800	228000	736966	448737	639452	288229	2.22
K	2	-90.0	274652	160200	228000	736966	448737	662852	288229	2.30
L	1	-100.0	310718	155800	265000	867794	555984	731518	311810	2.35
M	1	-110.0	348839	176000	303999	1009147	674730	828838	334417	2.48
N	1	-130.0	425638	304000	383999	1331810	946720	1113637	385090	2.89

NOTES

⬡ -- STRATUM NUMBER
◯ -- WEDGE NUMBER
-- CROSSOVER POINT
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

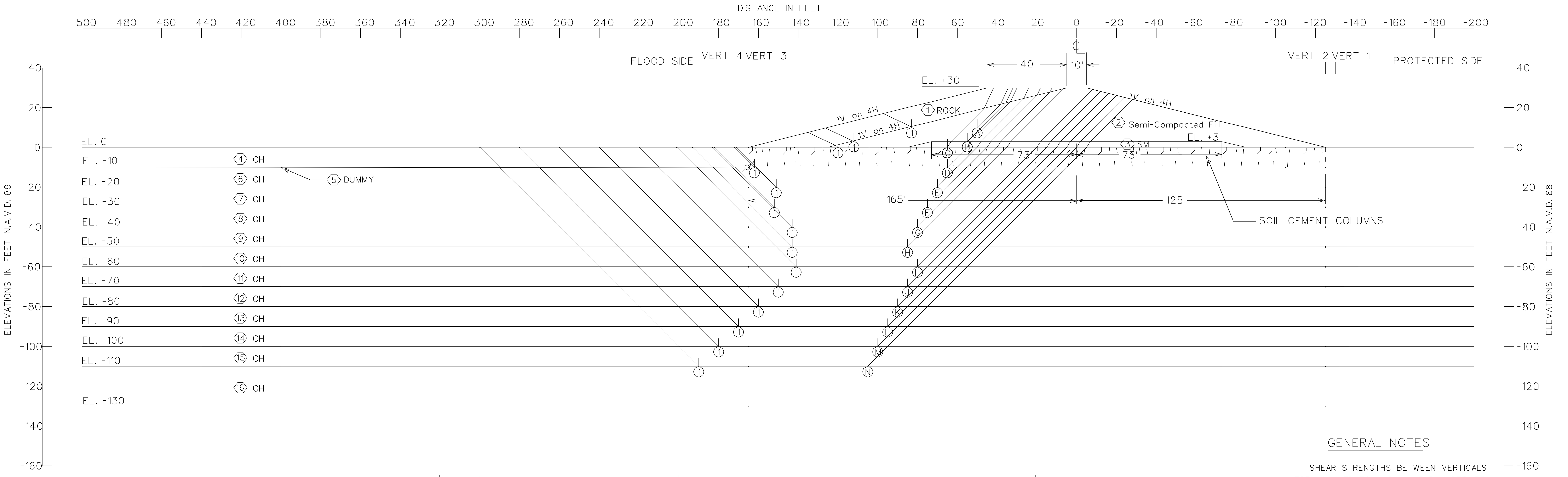
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - SOIL CEMENT COLUMNS
P/S CROWN EL. +25 WATER EL. +25
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 36



GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
(A) (1)	10.0	12919	13200	15780	24859	4833	41899	20026	2.09
(B) (1)	3.0	18501	22800	15617	43373	4561	56918	38812	1.47
(C) (1)	.0	24483	70518	16255	48817	5683	111256	43134	2.58
(D) (1)	-10.0	64765	97000	4000	89904	4898	165765	85006	1.95
(E) (1)	-20.0	86287	89100	24999	138660	24510	200386	114150	1.76
(F) (1)	-30.0	110048	92400	47990	198003	50794	250438	147209	1.70
(G) (1)	-40.0	135823	81900	72990	267740	95517	290713	172223	1.69
(H) (1)	-50.0	163884	81200	99990	348032	145246	345074	202786	1.70
(I) (1)	-60.0	192455	91500	128990	447868	207992	412945	239876	1.72
(J) (1)	-70.0	222600	104000	159990	550336	274931	486590	275405	1.77
(K) (1)	-80.0	254745	119000	192990	663027	354562	566735	308465	1.84
(L) (1)	-90.0	288900	135000	227990	785988	448578	651890	337410	1.93
(M) (1)	-100.0	325100	152000	264990	919242	555805	742090	363437	2.04
(N) (1)	-110.0	363253	170000	303990	1062722	674532	837243	388190	2.16

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	DUMMY	95	95	95	95	1000	1000	1000	1000	1000	1000	1000	1000	0
6	CH	115	115	115	115	1050	1050	1050	1050	1100	1100	1100	1100	0
7	CH	115	115	115	115	1150	1150	1150	1150	1200	1200	1200	1200	0
8	CH	115	115	115	115	1250	1250	1250	1250	1300	1300	1300	1300	0
9	CH	115	115	115	115	1350	1350	1350	1350	1400	1400	1400	1400	0
10	CH	115	115	115	115	1450	1450	1450	1450	1500	1500	1500	1500	0
11	CH	115	115	115	115	1550	1550	1550	1550	1600	1600	1600	1600	0
12	CH	115	115	115	115	1650	1650	1650	1650	1700	1700	1700	1700	0
13	CH	115	115	115	115	1750	1750	1750	1750	1800	1800	1800	1800	0
14	CH	115	115	115	115	1850	1850	1850	1850	1900	1900	1900	1900	0
15	CH	115	115	115	115	1950	1950	1950	1950	2000	2000	2000	2000	0
16	CH	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0

NOTES

⬡ -- STRATUM NUMBER
○ -- WEDGE NUMBER
-ơ- -- CROSSOVER POINT
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT,REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

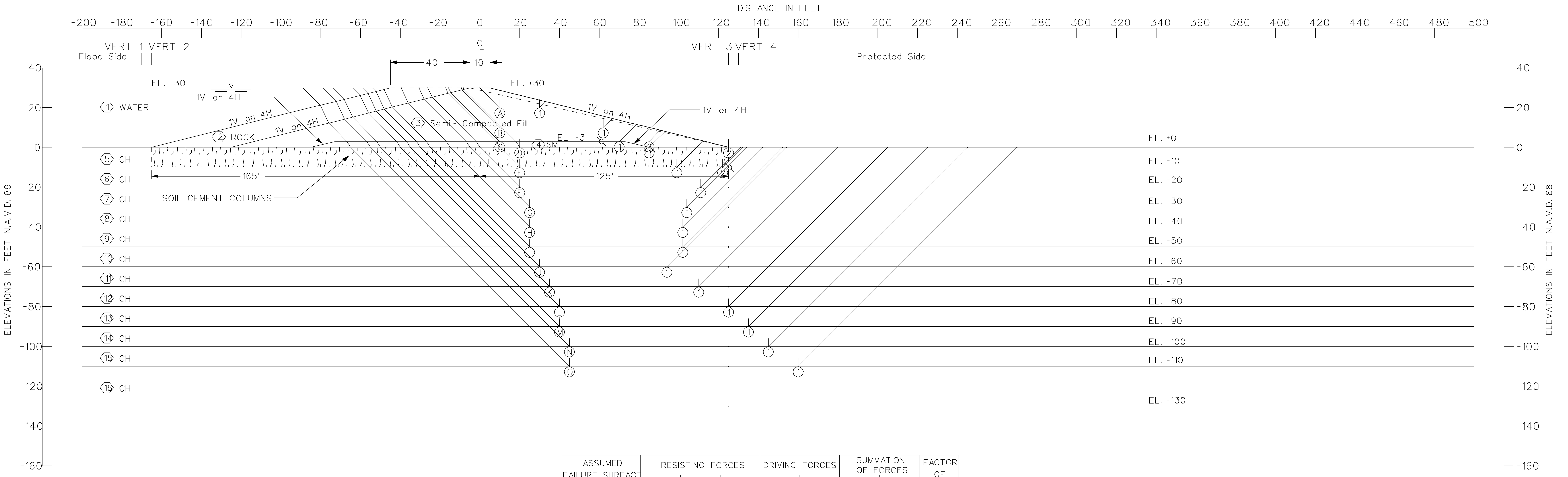
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - SOIL CEMENT COLUMNS
F/S CROWN EL.+30 WATER EL.+0
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 37



STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F.								FRICTION ANGLE DEGREES
						CENTER OF STRATUM				BOTTOM OF STRATUM				
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62	62	62	62	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	CH	115	115	115	115	1050	1050	1050	1050	1100	1100	1100	1100	0
7	CH	115	115	115	115	1150	1150	1150	1150	1200	1200	1200	1200	0
8	CH	115	115	115	115	1250	1250	1250	1250	1300	1300	1300	1300	0
9	CH	115	115	115	115	1350	1350	1350	1350	1400	1400	1400	1400	0
10	CH	115	115	115	115	1450	1450	1450	1450	1500	1500	1500	1500	0
11	CH	115	115	115	115	1550	1550	1550	1550	1600	1600	1600	1600	0
12	CH	115	115	115	115	1650	1650	1650	1650	1700	1700	1700	1700	0
13	CH	115	115	115	115	1750	1750	1750	1750	1800	1800	1800	1800	0
14	CH	115	115	115	115	1850	1850	1850	1850	1900	1900	1900	1900	0
15	CH	115	115	115	115	1950	1950	1950	1950	2000	2000	2000	2000	0
16	CH	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	20.0	7999	8000	2398	5154	618	18397	4536	4.06
B	1	10.0	15227	20800	3679	21708	1454	39706	20254	1.96
C	1	3.0	19837	23701	6879	40065	5083	50417	34982	1.44
C	2	3.0	19837	28927	4479	40065	2155	53243	37910	1.40
D	1	.0	23680	36796	6399	45991	4398	66875	41593	1.61
D	2	.0	23680	42834	0	45991	0	66514	45991	1.45
E	1	-10.0	62532	86900	42560	85483	11877	191992	73606	2.61
E	2	-10.0	62532	112200	4000	85483	4874	178732	80609	2.22
F	1	-20.0	82279	100100	25011	136360	23994	207390	112366	1.85
G	1	-30.0	104655	94800	48000	195944	55411	247455	140533	1.76
H	1	-40.0	128898	100100	73000	270406	94870	301998	175536	1.72
I	1	-50.0	155196	107800	100000	356598	144619	362996	211979	1.71
J	1	-60.0	183463	96000	129000	449795	213106	408463	236689	1.73
K	1	-70.0	213714	120000	160000	553557	274436	493714	279121	1.77
L	1	-80.0	245966	144500	193000	667891	352992	583466	314899	1.85
M	1	-90.0	279264	171000	228000	797240	448739	678264	348501	1.95
N	1	-100.0	315341	190000	265000	933053	555987	770341	377066	2.04
O	1	-110.0	352494	230000	304001	1083871	674734	886495	409137	2.17

NOTES

- ⬡ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- ⌀ -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
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- P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES

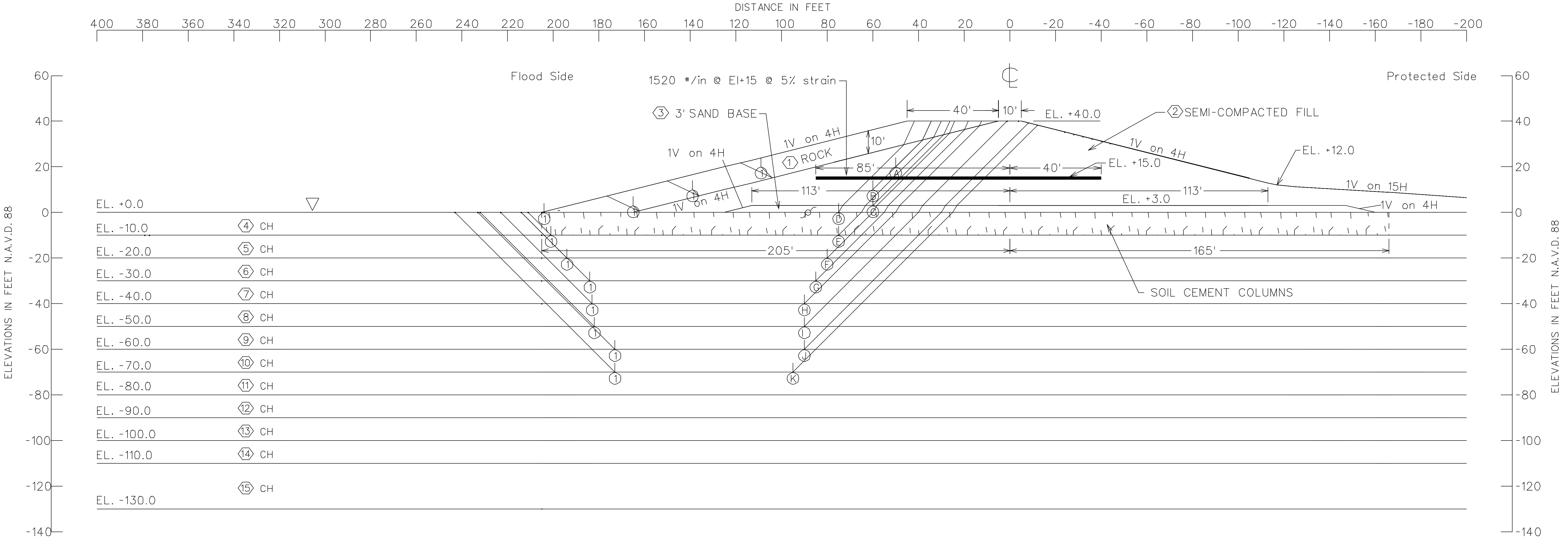
SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - SOIL CEMENT COLUMNS
P/S CROWN EL.+30 WATER EL.+30
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 38



ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY	F.S. w/1520 lb/in GEOSYNTHETIC AT 5% STRAIN
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING		
(A) (1)	20.0	12918	23600	11620	24859	-457	48138	25316	1.90	
(B) (1)	10.0	20919	31600	13219	51805	1138	65738	50667	1.30	
(C) (1)	3.0	26658	42000	13536	78703	1524	82194	77179	1.06	1.30
(D) (1)	.0	34133	147614	10	82290	3	181757	82287	2.21	
(E) (1)	-10.0	74415	138600	4001	134377	5014	217016	129363	1.68	
(F) (1)	-20.0	95946	125400	25000	192778	23296	246346	169482	1.45	
(G) (1)	-30.0	119764	118800	48000	261805	56624	286564	205181	1.40	
(H) (1)	-40.0	145869	120900	73000	341465	95582	339769	245883	1.38	
(I) (1)	-50.0	174480	128800	100000	437120	146073	403280	291047	1.39	
(J) (1)	-60.0	202775	124500	129000	543807	216787	456275	327020	1.40	
(K) (1)	-70.0	232920	124800	160000	656059	289535	517720	366524	1.41	

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

EL. +15.0 CONTROLLING FAILURE WEDGE (C) - (1)

T = DRIVING(F.S.) - RESISTING
T = (77179)(1.3) - 82194 = 18140 LB/FT

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F. CENTER OF STRATUM				C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM				FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
2	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
3	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
4	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
5	CH	115	115	115	115	1050	1050	1050	1050	1100	1100	1100	1100	0
6	CH	115	115	115	115	1150	1150	1150	1150	1200	1200	1200	1200	0
7	CH	115	115	115	115	1250	1250	1250	1250	1300	1300	1300	1300	0
8	CH	115	115	115	115	1350	1350	1350	1350	1400	1400	1400	1400	0
9	CH	115	115	115	115	1450	1450	1450	1450	1500	1500	1500	1500	0
10	CH	115	115	115	115	1550	1550	1550	1550	1600	1600	1600	1600	0
11	CH	115	115	115	115	1650	1650	1650	1650	1700	1700	1700	1700	0
12	CH	115	115	115	115	1750	1750	1750	1750	1800	1800	1800	1800	0
13	CH	115	115	115	115	1850	1850	1850	1850	1900	1900	1900	1900	0
14	CH	115	115	115	115	1950	1950	1950	1950	2000	2000	2000	2000	0
15	CH	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0

NOTES

- ◇ -- STRATUM NUMBER
- ○ -- WEDGE NUMBER
- ∅ -- CROSSOVER POINT
- ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
- C -- UNIT COHESION, P.S.F.
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$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS.

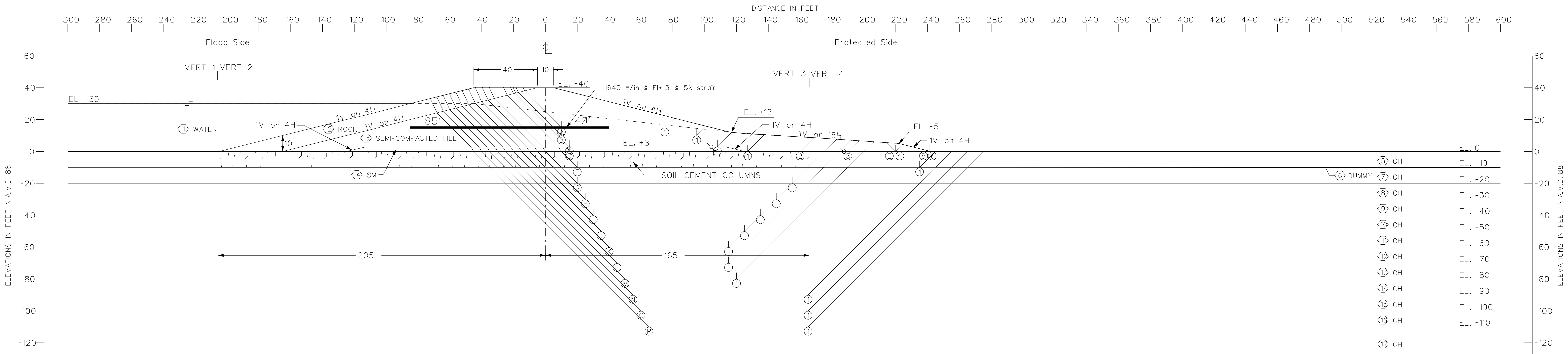
SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - SOIL CEMENT COLUMNS
F/S CROWN EL. +40 WATER EL. +0
LOUISIANA

SHEET IDENTIFICATION NUMBER
G 39



GENERAL NOTES

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	TOTAL UNIT WEIGHT P.C.F.				C - UNIT COHESION - P.S.F. CENTER OF STRATUM				C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM				FRICTION ANGLE DEGREES
		VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	VERT. 1	VERT. 2	VERT. 3	VERT. 4	
1	WATER	62.5	62.5	62.5	62.5	0	0	0	0	0	0	0	0	0
2	ROCK	132	132	132	132	0	0	0	0	0	0	0	0	40
3	CH	110	110	110	110	400	400	400	400	400	400	400	400	0
4	SM	122	122	122	122	0	0	0	0	0	0	0	0	30
5	CH	95	108	108	95	200	2000	2000	200	200	2000	2000	200	0
6	DUMMY	115	115	115	115	1050	1050	1050	1050	1050	1050	1050	1050	0
7	CH	115	115	115	115	1050	1050	1050	1050	1100	1100	1100	1100	0
8	CH	115	115	115	115	1150	1150	1150	1150	1200	1200	1200	1200	0
9	CH	115	115	115	115	1250	1250	1250	1250	1300	1300	1300	1300	0
10	CH	115	115	115	115	1350	1350	1350	1350	1400	1400	1400	1400	0
11	CH	115	115	115	115	1450	1450	1450	1450	1500	1500	1500	1500	0
12	CH	115	115	115	115	1550	1550	1550	1550	1600	1600	1600	1600	0
13	CH	115	115	115	115	1650	1650	1650	1650	1700	1700	1700	1700	0
14	CH	115	115	115	115	1750	1750	1750	1750	1800	1800	1800	1800	0
15	CH	115	115	115	115	1850	1850	1850	1850	1900	1900	1900	1900	0
16	CH	115	115	115	115	1950	1950	1950	1950	2000	2000	2000	2000	0
17	CH	115	115	115	115	2000	2000	2000	2000	2000	2000	2000	2000	0

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY	F.S. w/1640 lb/in GEOSYNTHETIC AT 5% STRAIN
A	1	15.0	18607	26000	4799	34248	2473	49406	31775	1.55	
B	1	10.0	22065	34000	4799	49648	2473	60864	47175	1.29	1.71
C	1	3.0	27477	37109	7200	74551	5567	71786	68984	1.04	1.32
D	1	.0	32590	43934	8500	87126	6622	85024	80504	1.06	1.30
D	2	.0	32590	53194	6850	87126	4301	92634	82825	1.12	1.36
D	3	.0	32590	59884	5349	87126	2623	97823	84503	1.16	1.39
D	4	.0	32590	64927	3519	87126	1290	101036	85836	1.18	1.41
D	5	.0	32590	66571	160	87126	3	99321	87123	1.14	1.36
E	6	.0	4398	1644	160	1552	3	6202	1549	4.00	
F	1	-10.0	72434	166897	4000	135806	5423	243331	130383	1.87	
G	1	-20.0	93110	148500	31099	198122	44068	272709	154054	1.77	
H	1	-30.0	115999	144000	54099	268927	82896	314098	186031	1.69	
I	1	-40.0	141036	136500	79100	350681	133958	356636	216723	1.65	
J	1	-50.0	167867	126000	106099	442962	197252	399966	245710	1.63	
K	1	-60.0	196068	112500	135100	545099	272970	443668	272129	1.63	
L	1	-70.0	226193	112000	165599	657480	353760	503792	303720	1.66	
M	1	-80.0	258269	119000	197849	780120	442049	575118	338071	1.70	
N	1	-90.0	292296	198000	228000	913025	497491	718296	415534	1.73	
O	1	-100.0	328275	199500	265000	1056192	604738	792775	451454	1.76	
P	1	-110.0	366159	200000	304001	1209581	723485	870160	486096	1.79	

NOTE: REQUIRED STRENGTH OF GEOSYNTHETIC AT 5% STRAIN IS 1640 LB\IN.

GEOTEXTILE TENSILE STRENGTH CALCULATIONS

CONTROLLING FAILURE WEDGE D - 1

T = DRIVING(F.S.) - RESISTING
T = (80504)(1.3) - 85024 = 19631LB/FT

NOTES

- ⬡ -- STRATUM NUMBER
- ◯ -- WEDGE NUMBER
- -- CROSSOVER POINT
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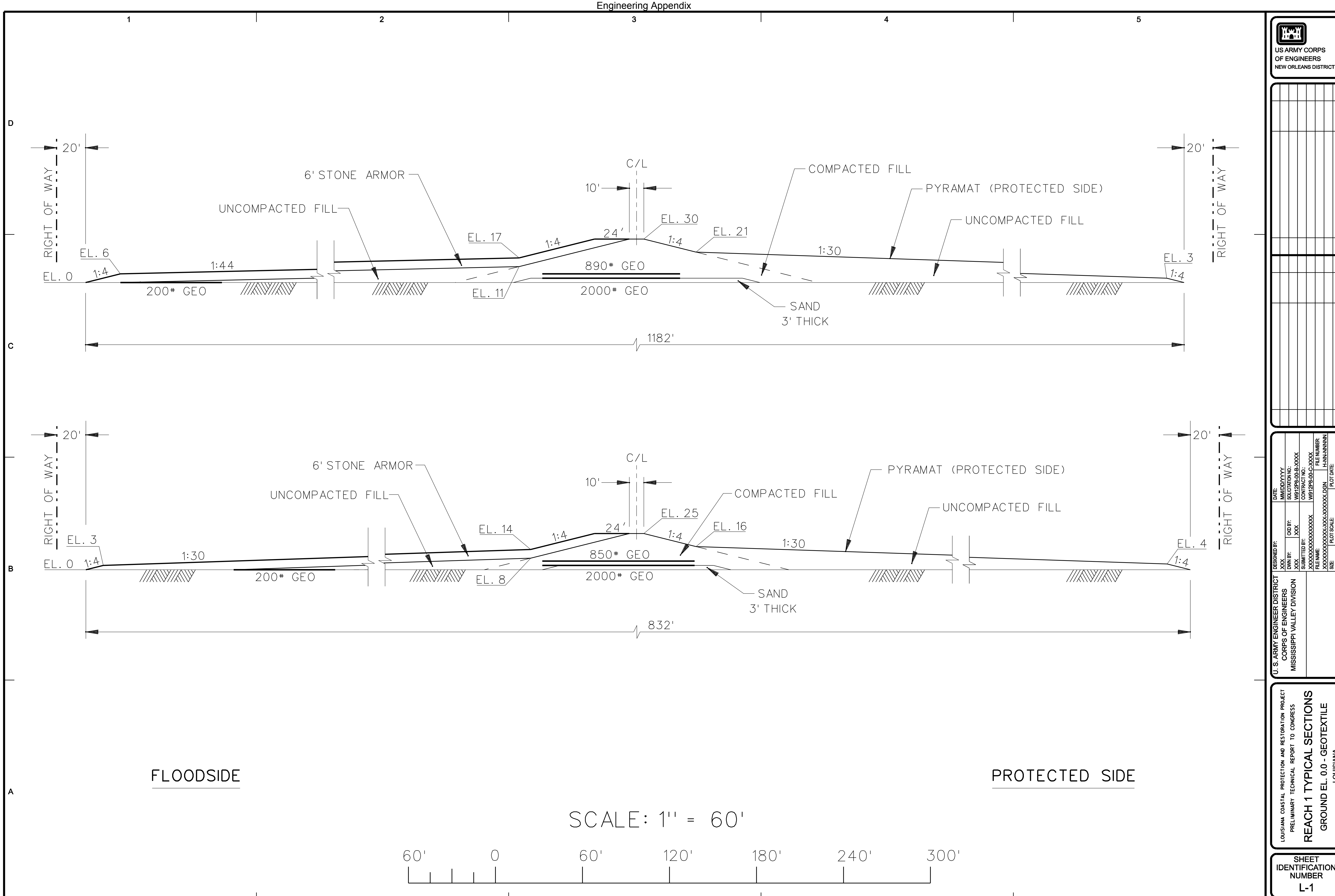
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

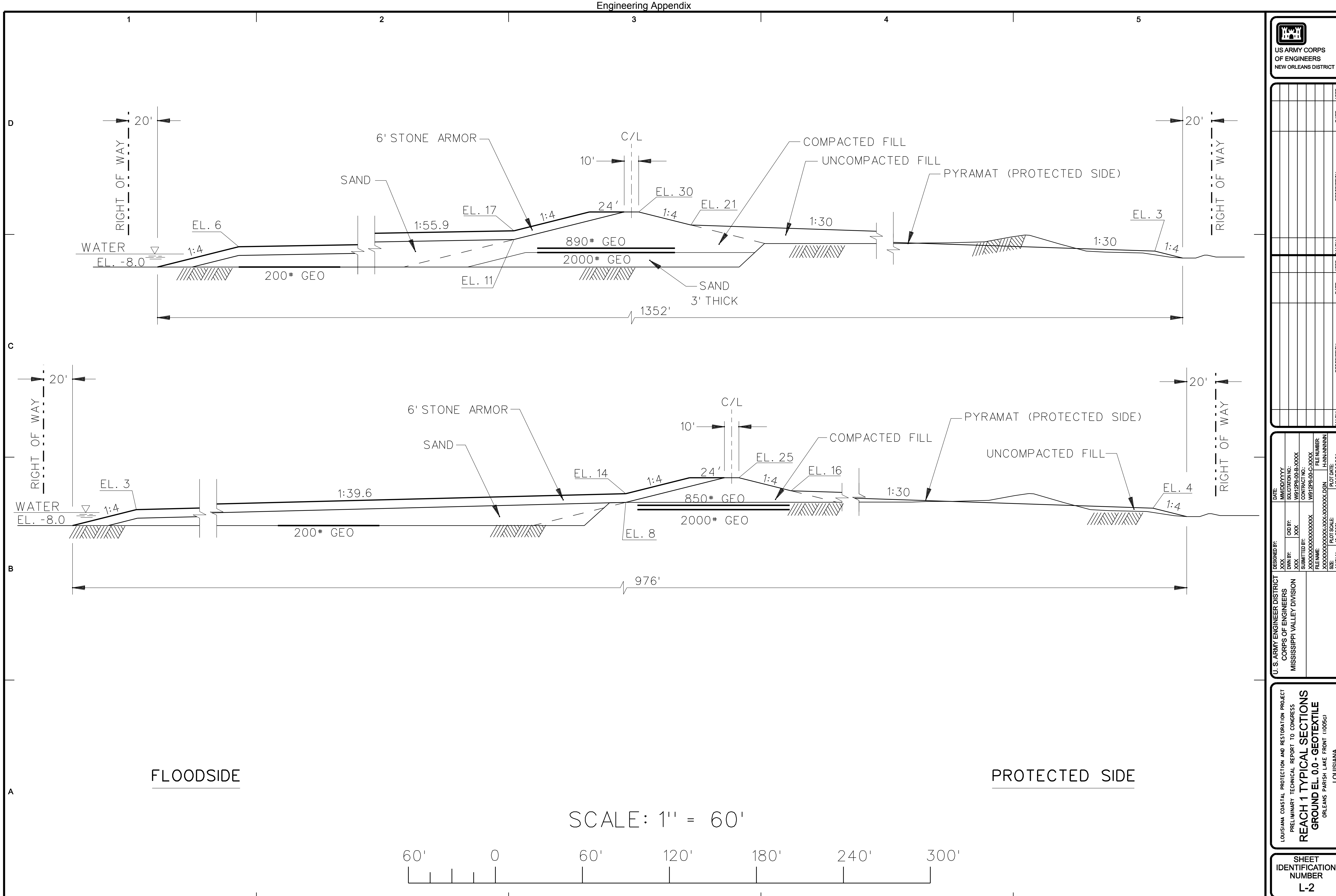
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

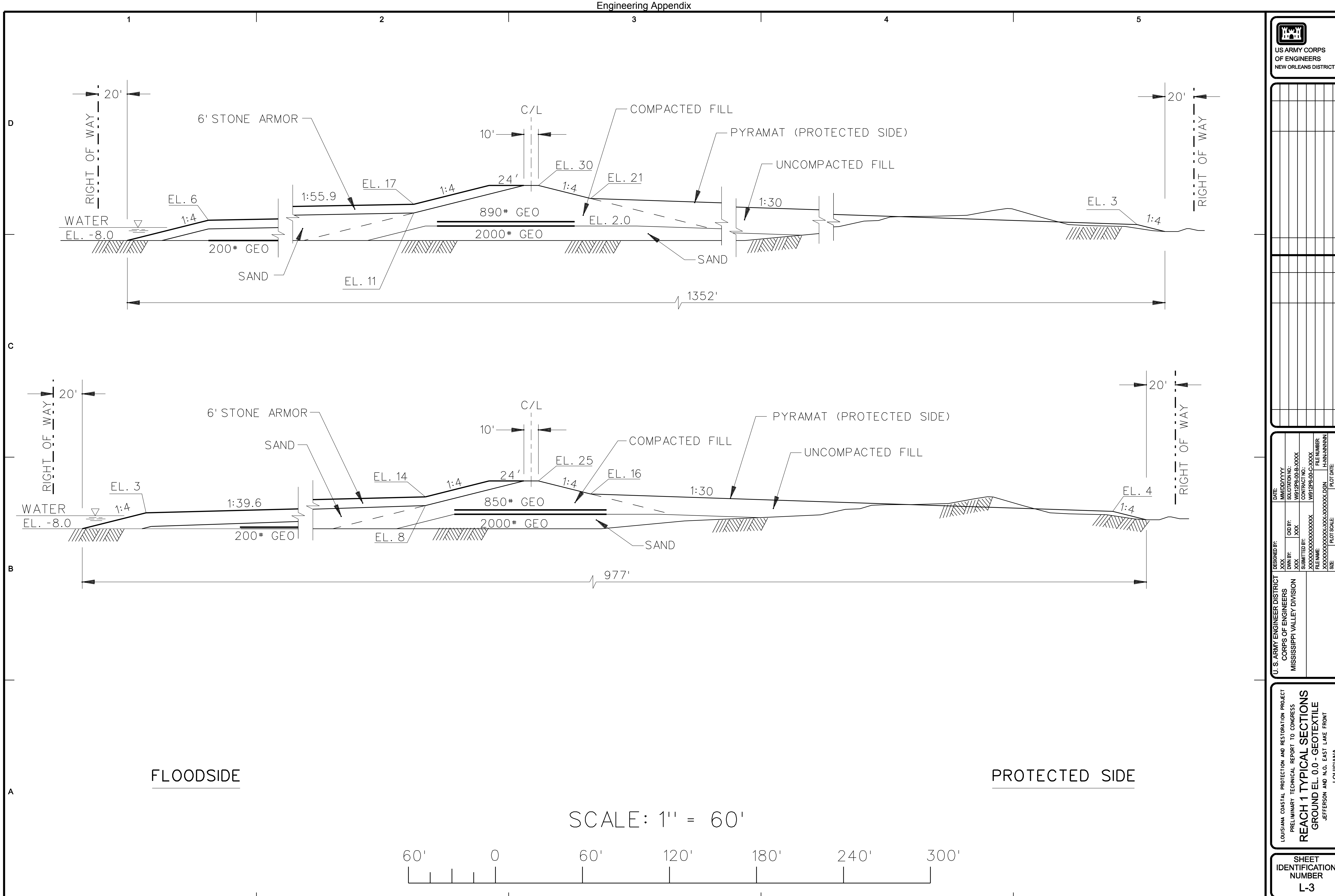
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

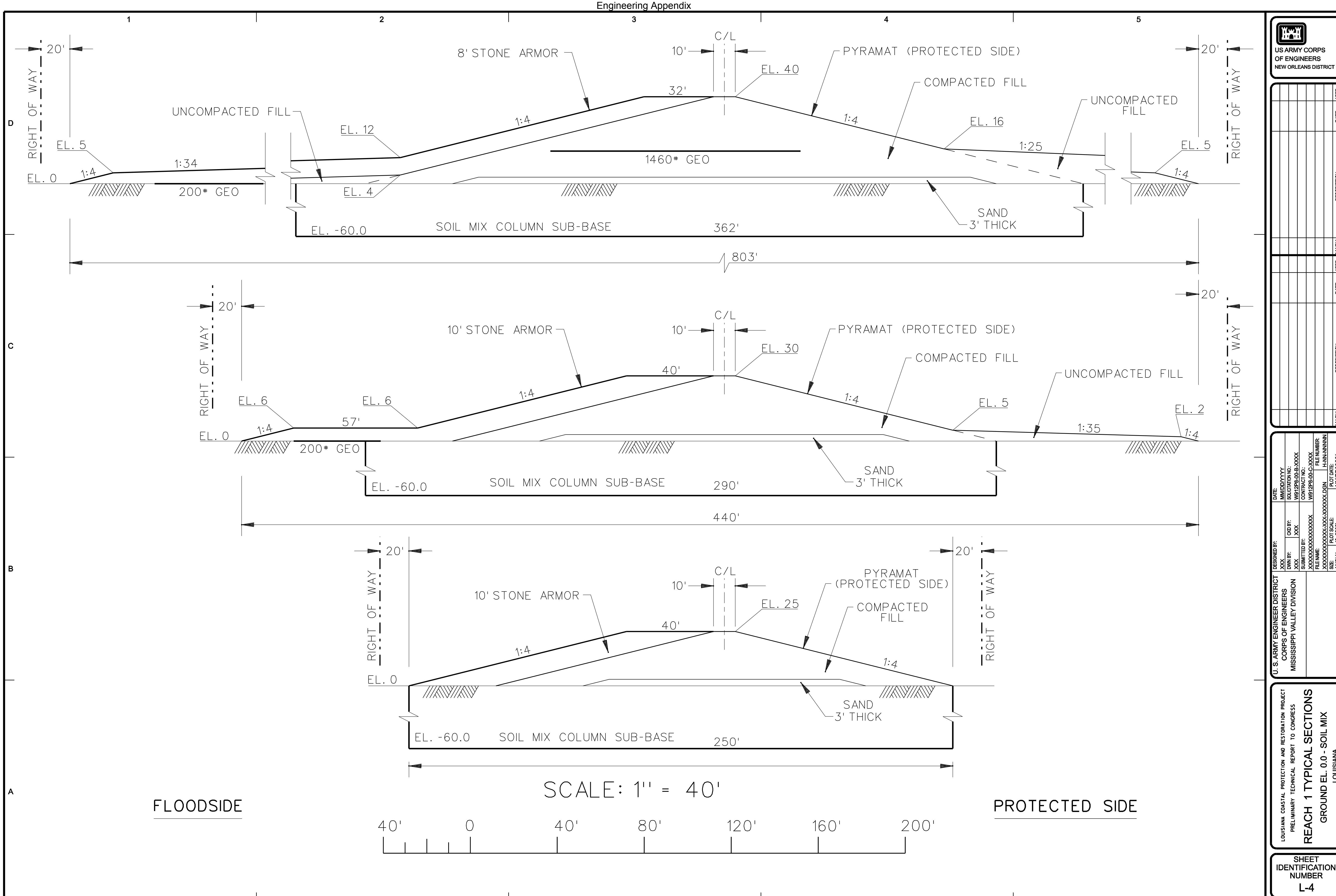
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 - SOIL CEMENT COLUMNS
P/S CROWN EL.+40 WATER EL.+30
LOUISIANA

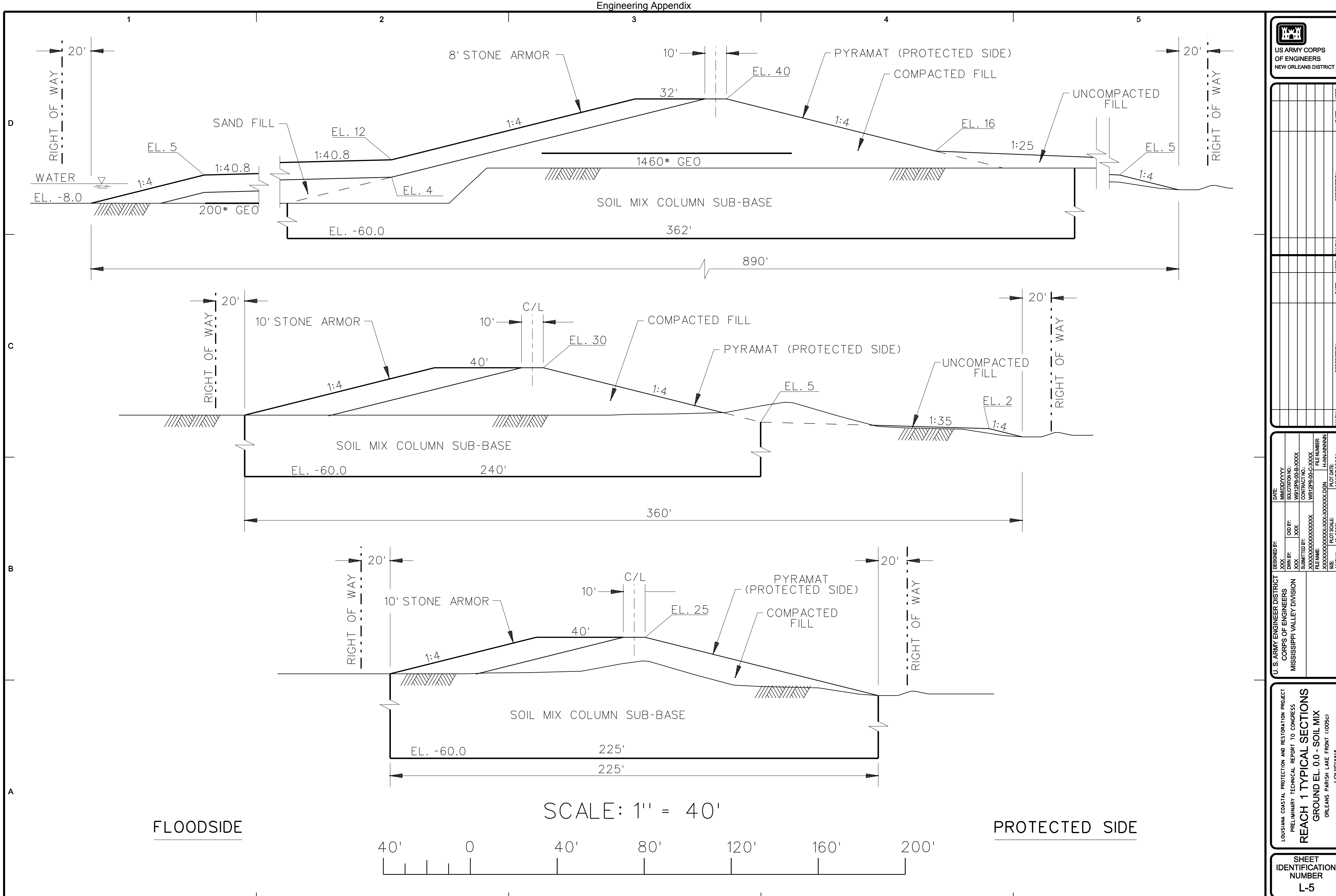
SHEET IDENTIFICATION NUMBER
G 40

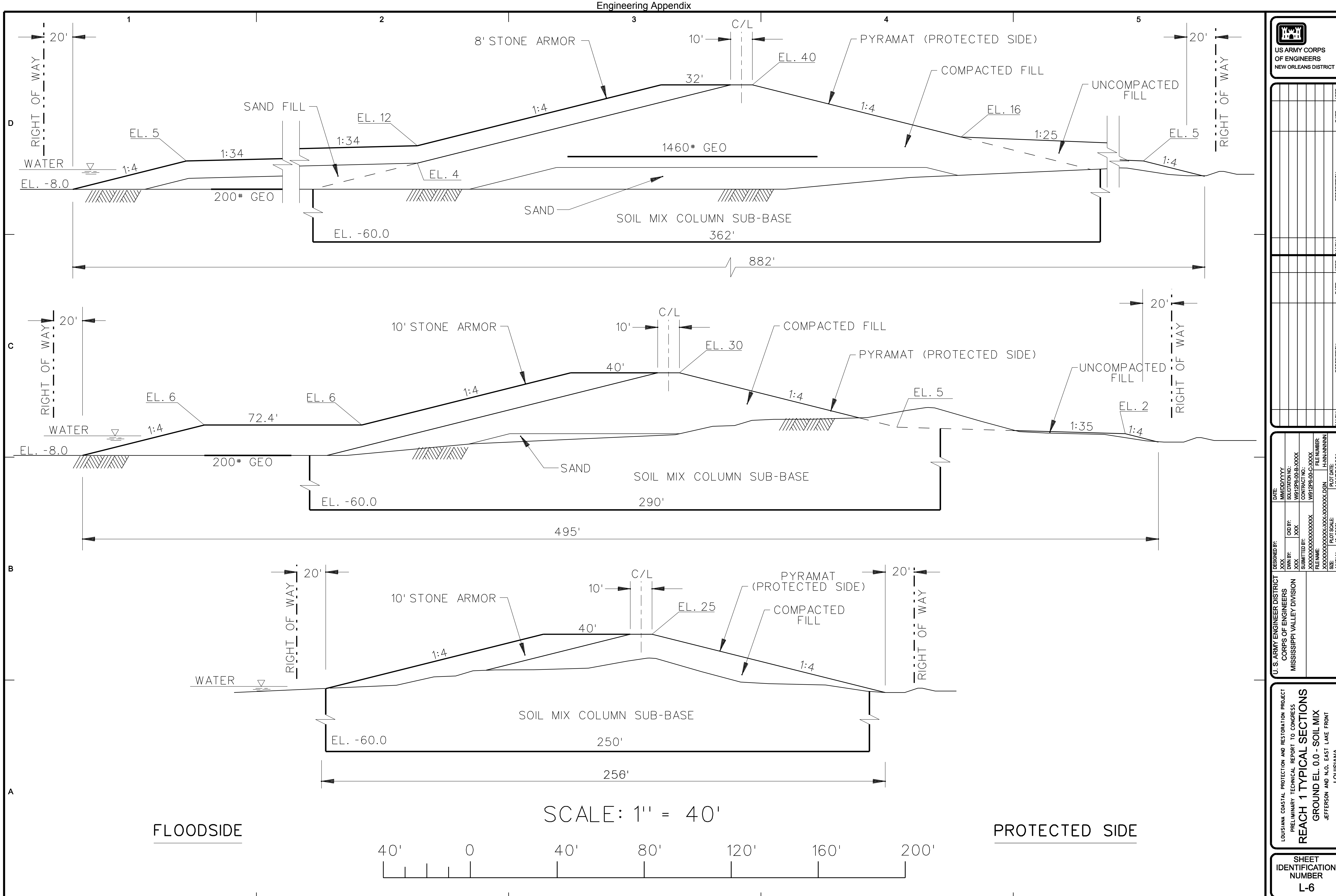

RIGHT OF WAY
20'
C/L
10'
6' STONE ARMOR
UNCOMPACTED FILL
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
EL. 30
EL. 21
EL. 17
EL. 6
EL. 0
EL. 11
EL. 3
24'
1:4
1:44
1:30
890# GEO
200# GEO
2000# GEO
SAND
3' THICK
1182'
EL. 25
EL. 16
EL. 14
EL. 8
EL. 4
850# GEO
832'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 60'
60' 0 60' 120' 180' 240' 300'
US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 0.0 - GEOTEXTILE
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-1

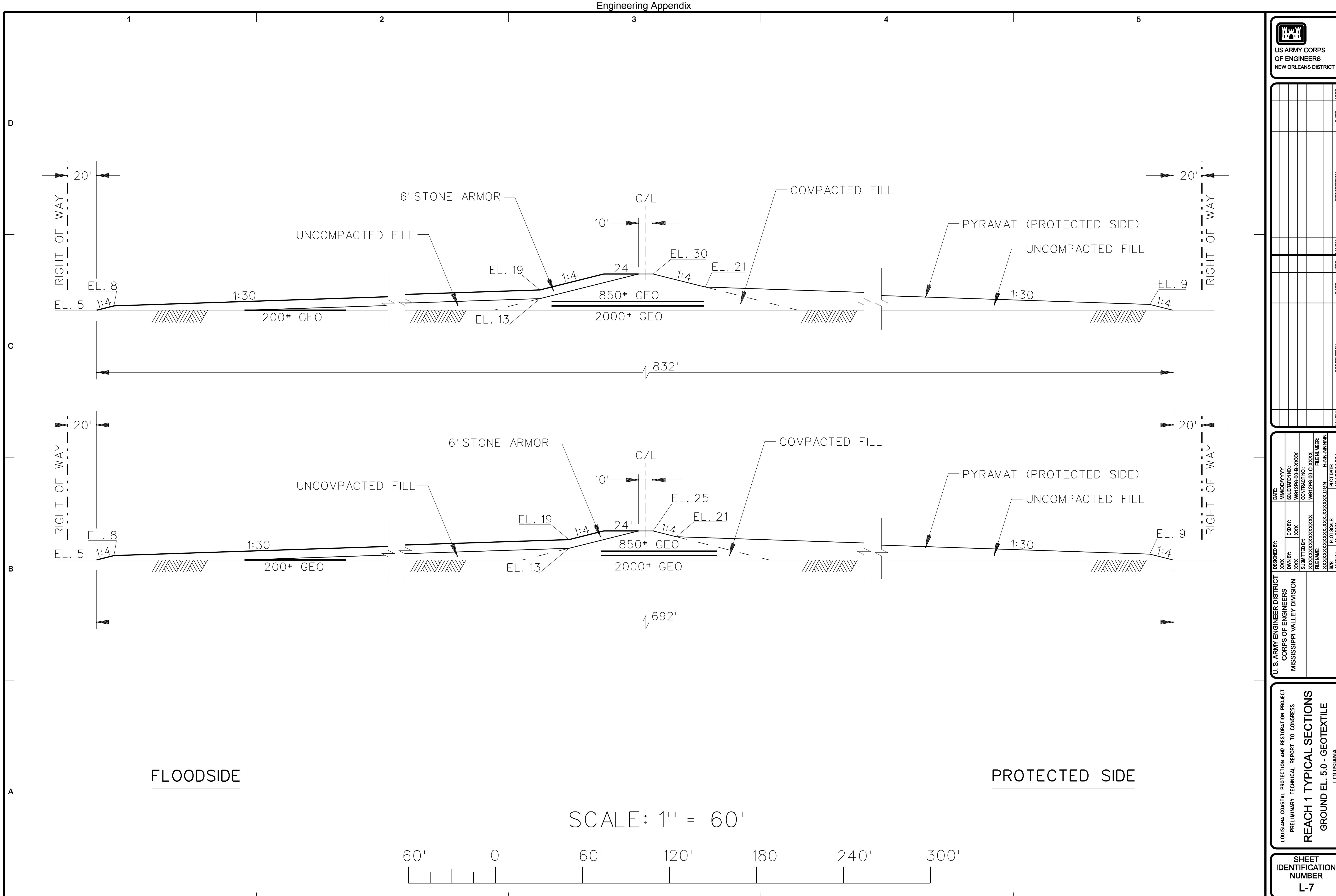

RIGHT OF WAY
20'
6' STONE ARMOR
C/L
10'
COMPACTED FILL
UNCOMPACTED FILL
PYRAMAT (PROTECTED SIDE)
SAND
EL. 30
EL. 21
EL. 17
24'
1:4
1:55.9
1:30
EL. 3
EL. 6
WATER
EL. -8.0
890# GEO
2000# GEO
200# GEO
EL. 11
SAND
3' THICK
1352'
EL. 25
EL. 16
EL. 14
1:39.6
850# GEO
EL. 8
EL. 4
976'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 60'
60' 0 60' 120' 180' 240' 300'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 0.0 - GEOTEXTILE
ORLEANS PARISH LAKE FRONT (100sc)
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-2

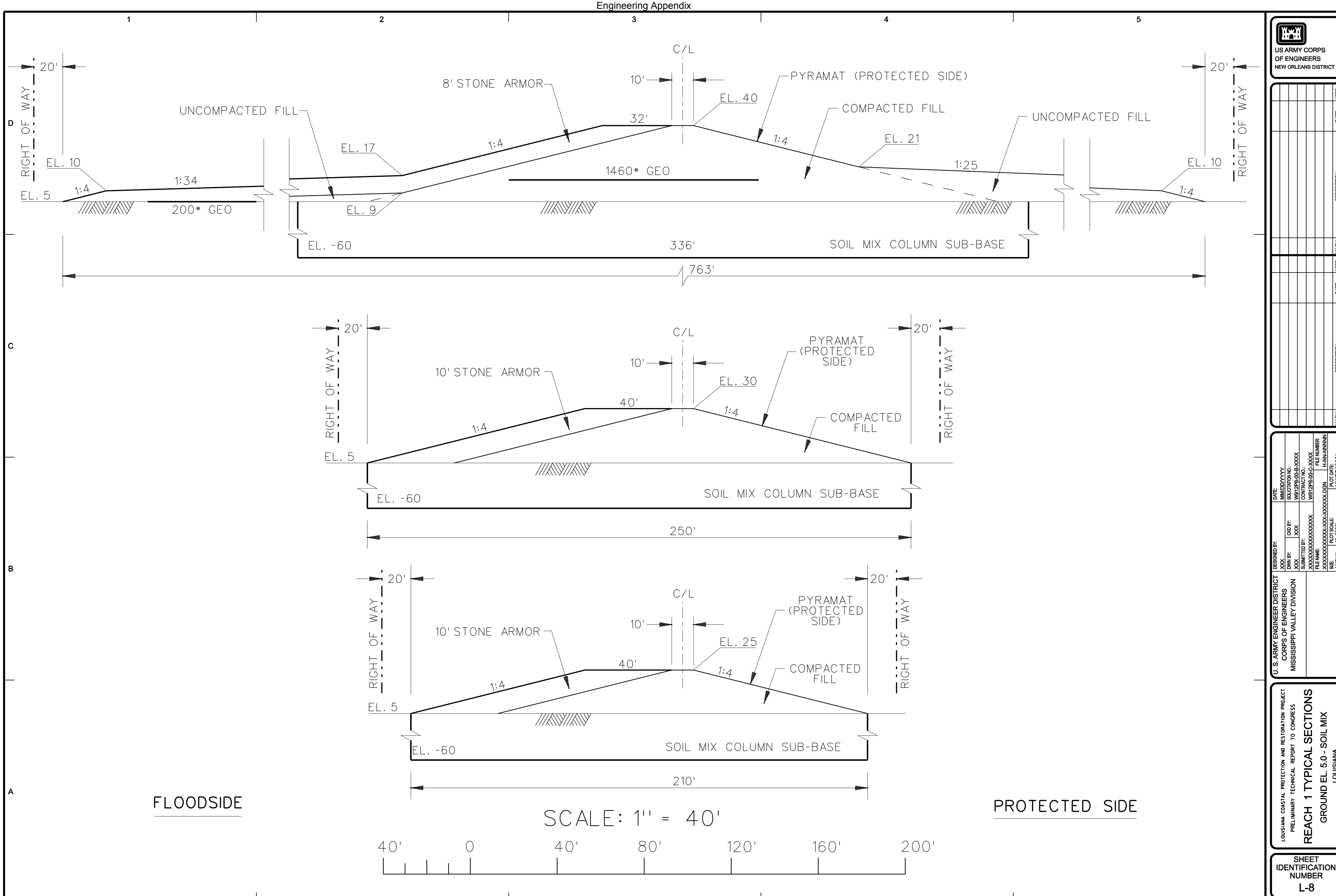

RIGHT OF WAY
20'
6' STONE ARMOR
C/L
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
10'
EL. 30
UNCOMPACTED FILL
24'
EL. 21
EL. 17
1:4
1:4
1:55.9
EL. 6
1:30
EL. 3
WATER
1:4
890# GEO
EL. -8.0
EL. 2.0
2000# GEO
1:4
200# GEO
SAND
SAND
EL. 11
1352'
RIGHT OF WAY
20'
6' STONE ARMOR
C/L
SAND
PYRAMAT (PROTECTED SIDE)
10'
COMPACTED FILL
UNCOMPACTED FILL
EL. 25
EL. 14
EL. 16
EL. 3
1:4
24'
1:4
1:30
EL. 4
1:39.6
850# GEO
WATER
1:4
1:4
EL. -8.0
2000# GEO
200# GEO
EL. 8
SAND
977'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 60'
60' 0 60' 120' 180' 240' 300'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 0.0 - GEOTEXTILE
JEFFERSON AND N.O. EAST LAKE FRONT
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-3

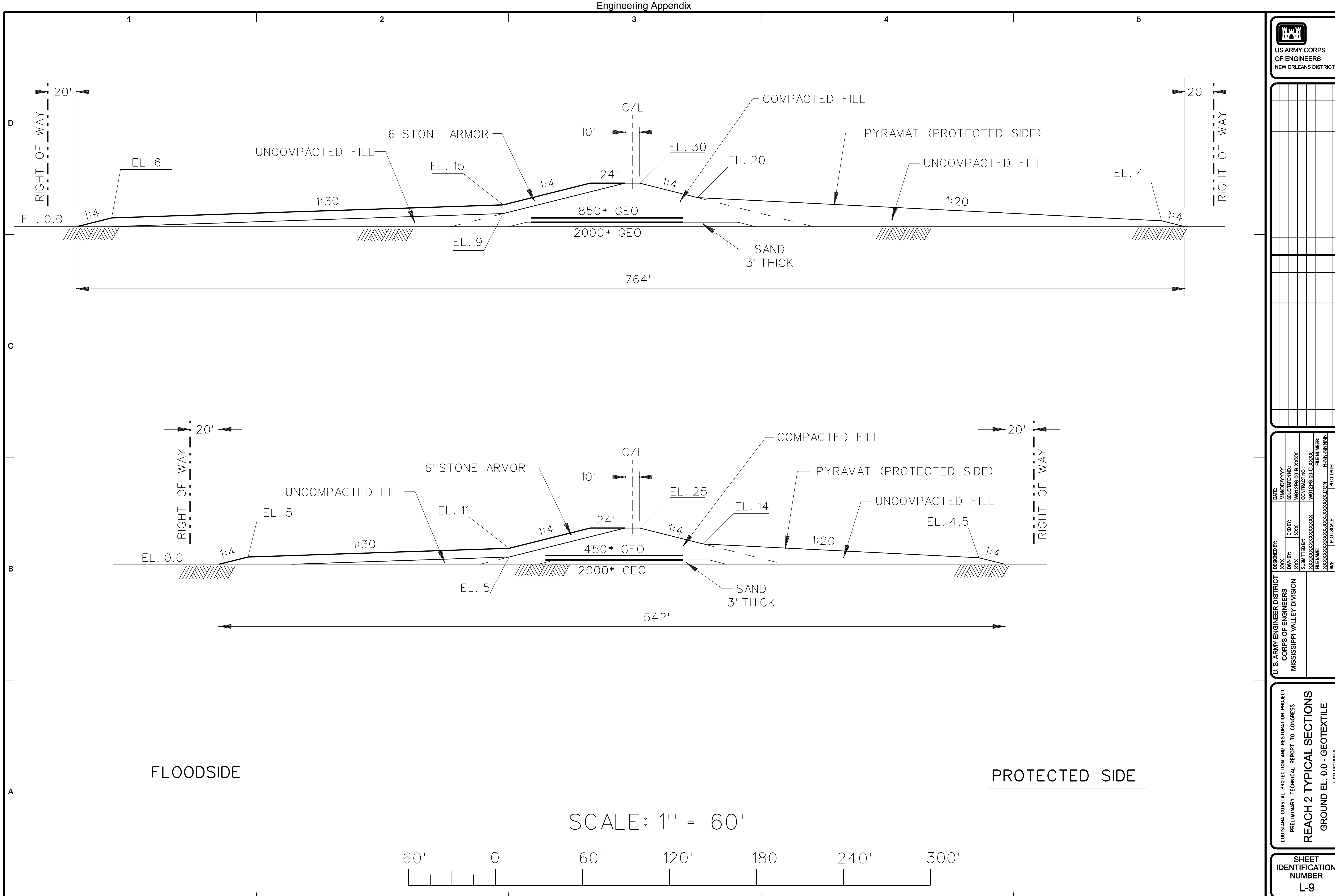

8' STONE ARMOR
C/L
10'
EL. 40
32'
PYRAMAT (PROTECTED SIDE)
COMPACTED FILL
UNCOMPACTED FILL
EL. 12
1:4
EL. 16
1:25
EL. 5
1:34
1460# GEO
EL. 0
200# GEO
EL. 4
SAND
3' THICK
EL. -60.0
SOIL MIX COLUMN SUB-BASE
362'
803'
RIGHT OF WAY
20'
10' STONE ARMOR
EL. 30
40'
EL. 6
57'
1:35
EL. 2
290'
440'
EL. 25
250'
SCALE: 1" = 40'
FLOODSIDE
PROTECTED SIDE
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 0.0 - SOIL MIX
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-4

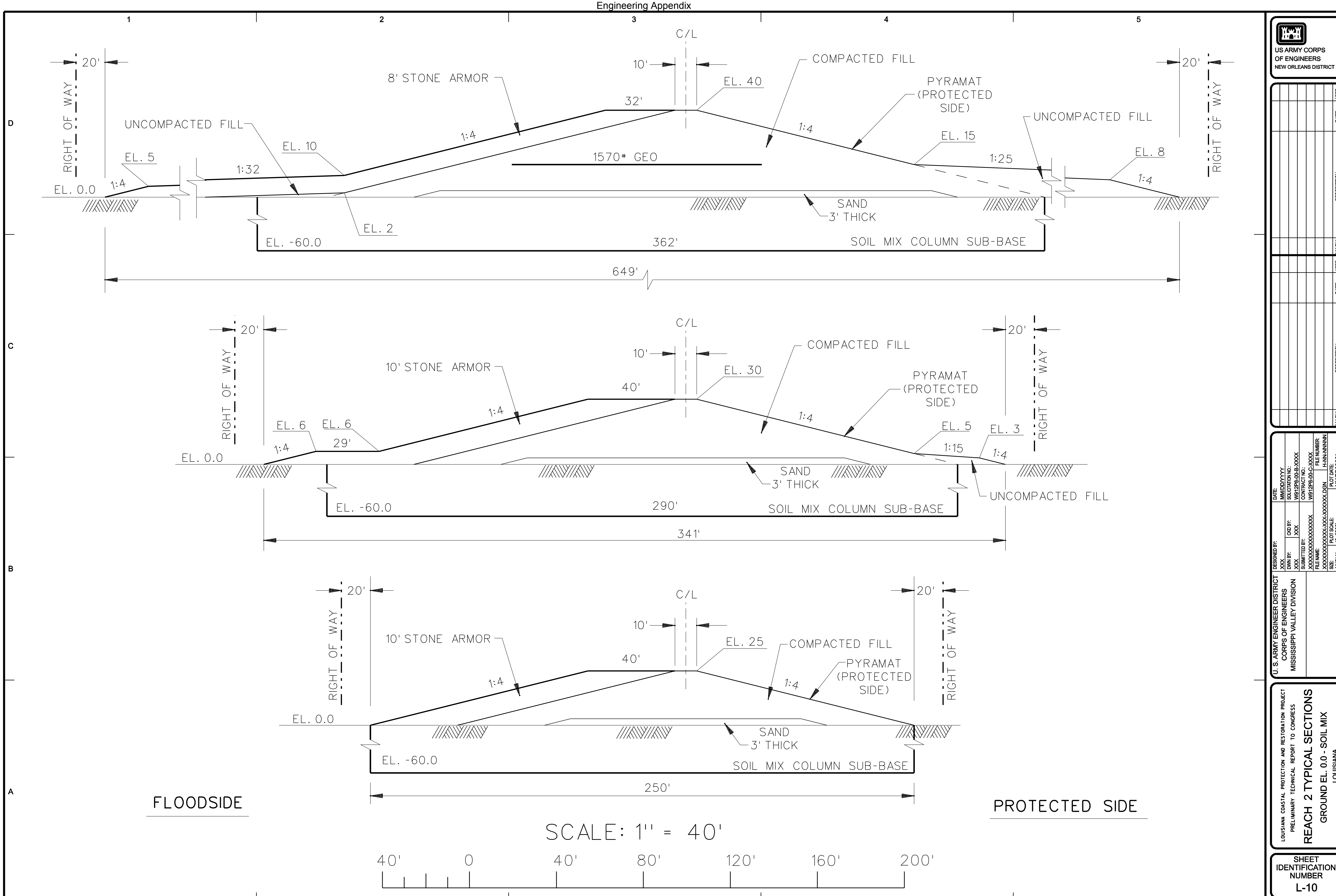

RIGHT OF WAY
20'
8' STONE ARMOR
10'
EL. 40
PYRAMAT (PROTECTED SIDE)
COMPACTED FILL
32'
UNCOMPACTED FILL
SAND FILL
EL. 12
1:4
EL. 16
1:25
EL. 5
1:40.8
1460# GEO
WATER
EL. -8.0
200# GEO
EL. 4
SOIL MIX COLUMN SUB-BASE
EL. -60.0
362'
890'
10' STONE ARMOR
C/L
EL. 30
40'
EL. 2
1:35
240'
360'
EL. 25
225'
SCALE: 1" = 40'
FLOODSIDE
PROTECTED SIDE
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT
MARK DESCRIPTION DATE APPR.
DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 0.0 - SOIL MIX
ORLEANS PARISH LAKE FRONT (1005c)
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-5

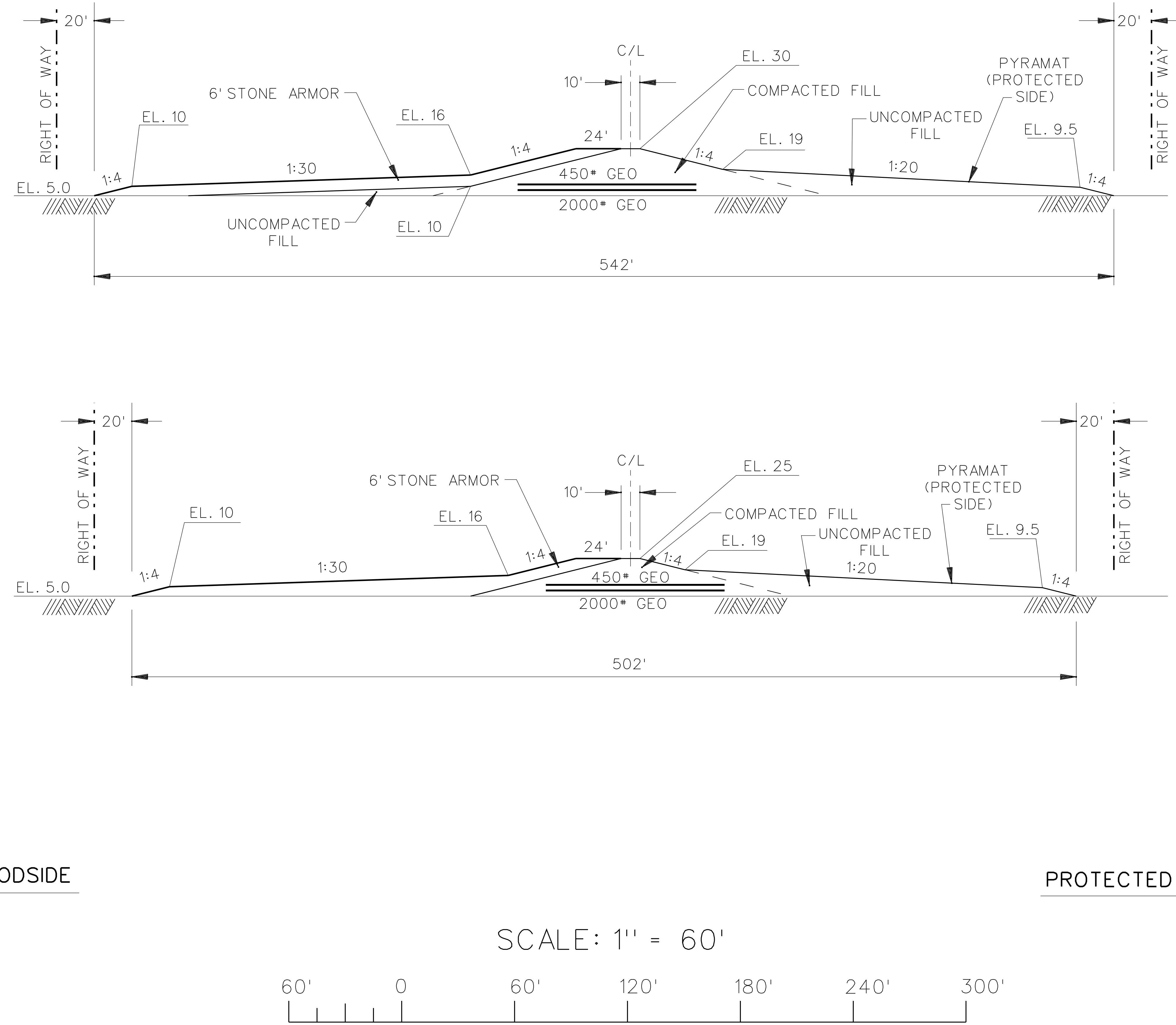

RIGHT OF WAY
20'
8' STONE ARMOR
10'
C/L
EL. 40
32'
PYRAMAT (PROTECTED SIDE)
COMPACTED FILL
UNCOMPACTED FILL
SAND FILL
EL. 12
1:4
EL. 16
1:25
EL. 5
1:34
1460# GEO
WATER
EL. -8.0
200# GEO
EL. 4
SAND
SOIL MIX COLUMN SUB-BASE
EL. -60.0
362'
882'
10' STONE ARMOR
EL. 30
40'
EL. 6
72.4'
1:35
EL. 2
290'
495'
EL. 25
250'
256'
SCALE: 1" = 40'
FLOODSIDE
PROTECTED SIDE
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 0.0 - SOIL MIX
JEFFERSON AND N.O. EAST LAKE FRONT
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-6


RIGHT OF WAY
20'
6' STONE ARMOR
C/L
COMPACTED FILL
10'
UNCOMPACTED FILL
EL. 30
EL. 19
24'
1:4
EL. 21
PYRAMAT (PROTECTED SIDE)
UNCOMPACTED FILL
EL. 8
1:30
850# GEO
EL. 9
EL. 5
1:4
200# GEO
EL. 13
2000# GEO
832'
EL. 25
692'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 60'
60' 0 60' 120' 180' 240' 300'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 5.0 - GEOTEXTILE
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-7


C/L
20'
RIGHT OF WAY
10'
8' STONE ARMOR
PYRAMAT (PROTECTED SIDE)
EL. 40
32'
COMPACTED FILL
UNCOMPACTED FILL
UNCOMPACTED FILL
EL. 17
1:4
1:4
EL. 21
EL. 10
1:25
EL. 10
1:34
1460# GEO
1:4
1:4
EL. 5
200# GEO
EL. 9
EL. -60
336'
SOIL MIX COLUMN SUB-BASE
763'
C/L
20'
RIGHT OF WAY
10'
10' STONE ARMOR
PYRAMAT (PROTECTED SIDE)
EL. 30
40'
1:4
1:4
COMPACTED FILL
EL. 5
EL. -60
SOIL MIX COLUMN SUB-BASE
250'
C/L
20'
RIGHT OF WAY
10'
10' STONE ARMOR
PYRAMAT (PROTECTED SIDE)
EL. 25
40'
1:4
1:4
COMPACTED FILL
EL. 5
EL. -60
SOIL MIX COLUMN SUB-BASE
210'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 40'
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK DESCRIPTION DATE APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 1 TYPICAL SECTIONS
GROUND EL. 5.0 - SOIL MIX
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-8


RIGHT OF WAY
20'
C/L
10'
6' STONE ARMOR
UNCOMPACTED FILL
EL. 6
EL. 15
EL. 30
24'
1:4
1:30
EL. 0.0
COMPACTED FILL
EL. 20
PYRAMAT (PROTECTED SIDE)
UNCOMPACTED FILL
EL. 4
1:20
850# GEO
2000# GEO
EL. 9
SAND
3' THICK
764'
EL. 5
EL. 11
EL. 25
450# GEO
EL. 14
EL. 4.5
542'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 60'
60'
0
60'
120'
180'
240'
300'
US ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 TYPICAL SECTIONS
GROUND EL. 0.0 - GEOTEXTILE
LOUISIANA
SHEET
IDENTIFICATION
NUMBER
L-9


C/L
10'
20'
RIGHT OF WAY
8' STONE ARMOR
COMPACTED FILL
EL. 40
32'
PYRAMAT (PROTECTED SIDE)
UNCOMPACTED FILL
1:4
EL. 15
EL. 10
EL. 5
1:32
1570# GEO
1:25
EL. 8
EL. 0.0
SAND 3' THICK
EL. 2
EL. -60.0
362'
SOIL MIX COLUMN SUB-BASE
649'
10' STONE ARMOR
EL. 30
40'
EL. 6
29'
EL. 5
EL. 3
1:15
290'
341'
EL. 25
250'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 40'
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 TYPICAL SECTIONS
GROUND EL. 0.0 - SOIL MIX
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-10



US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

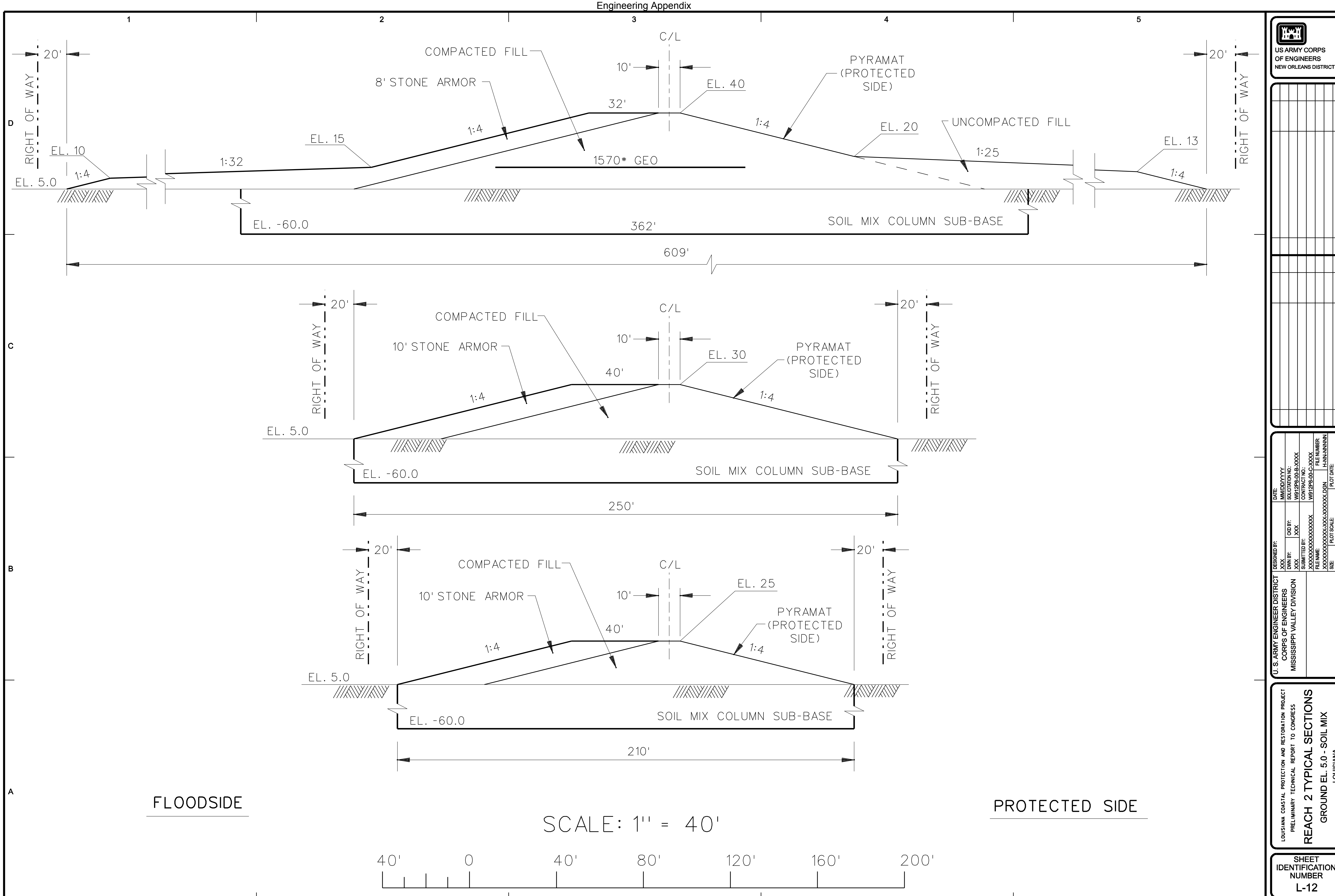
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

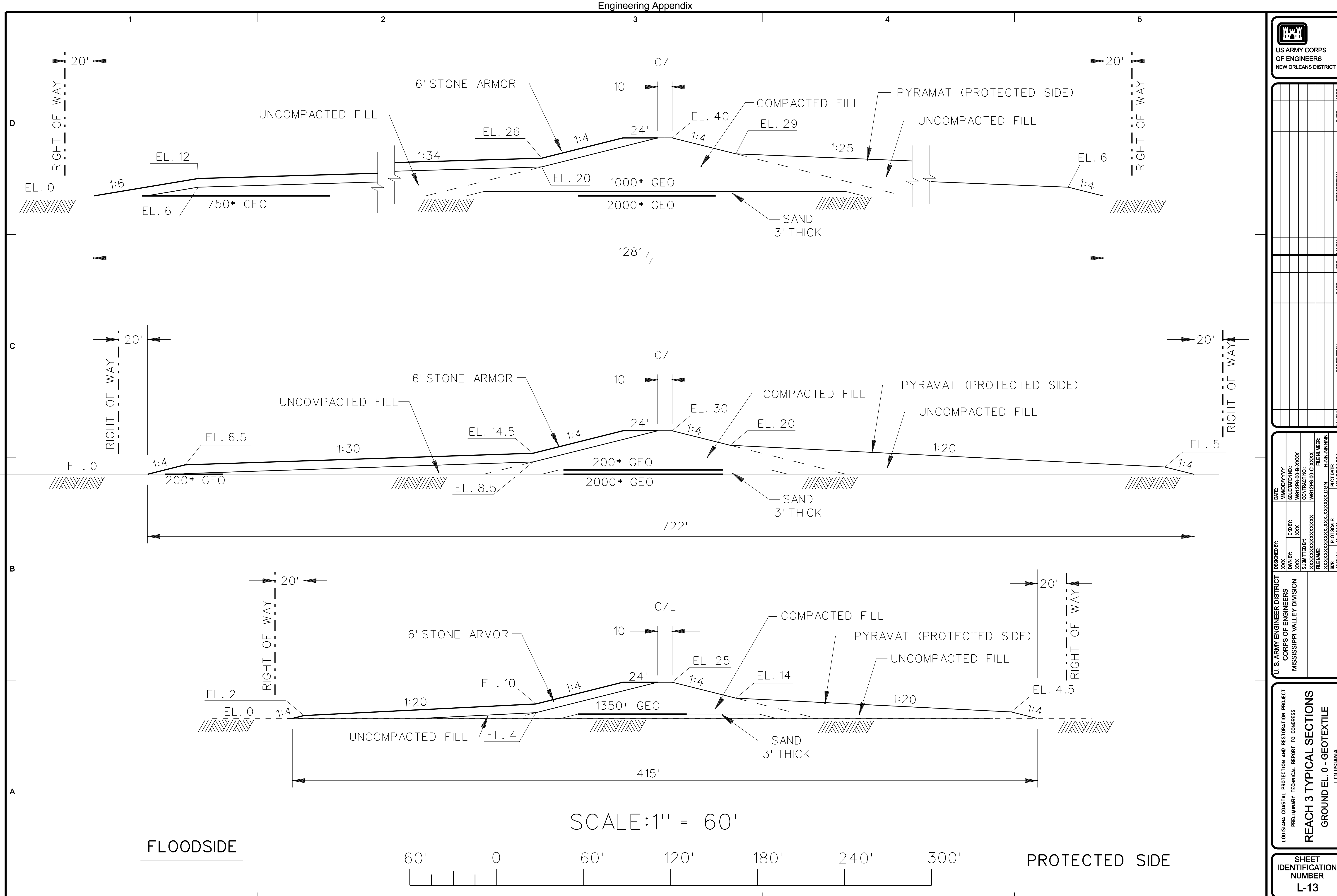
DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY

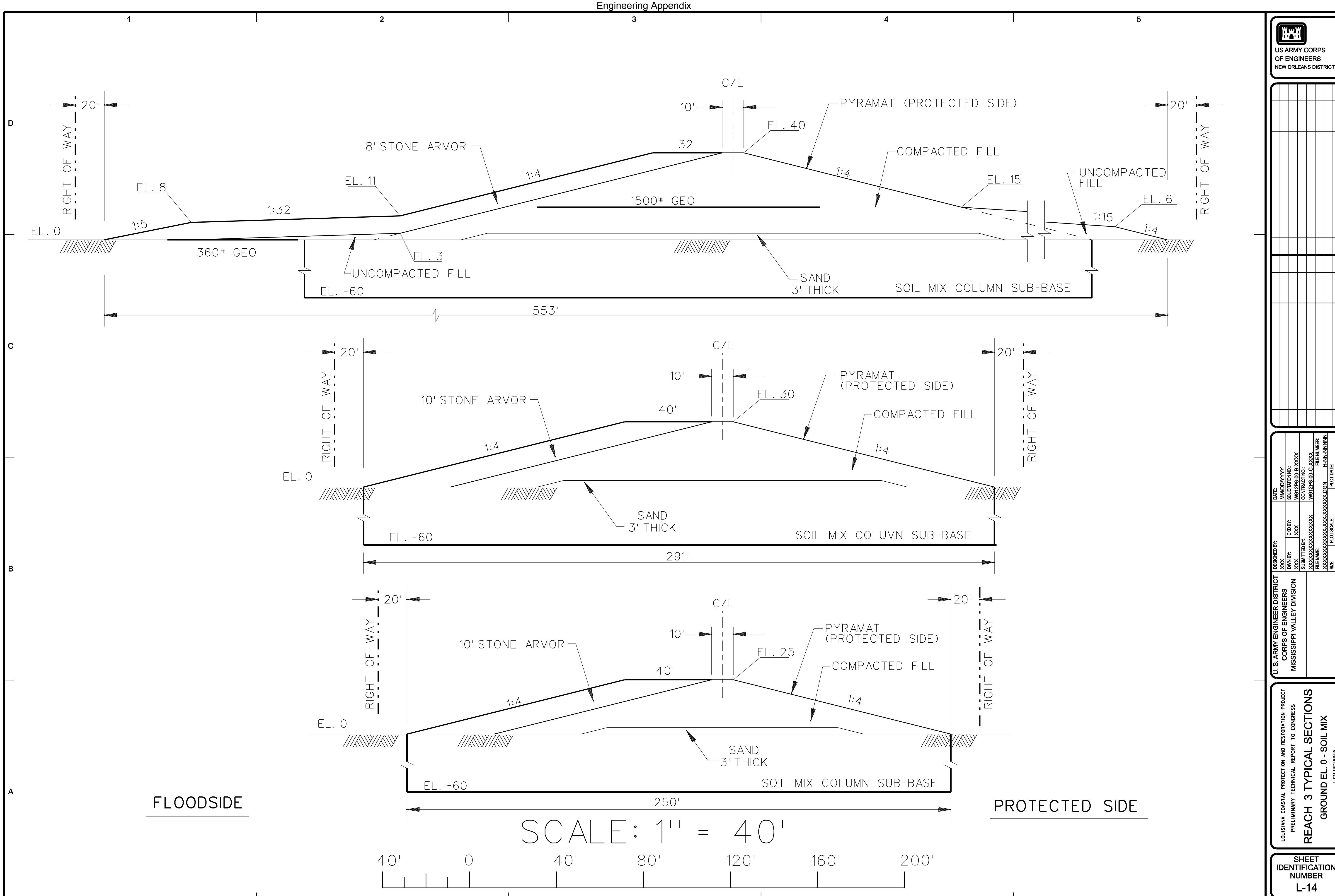
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

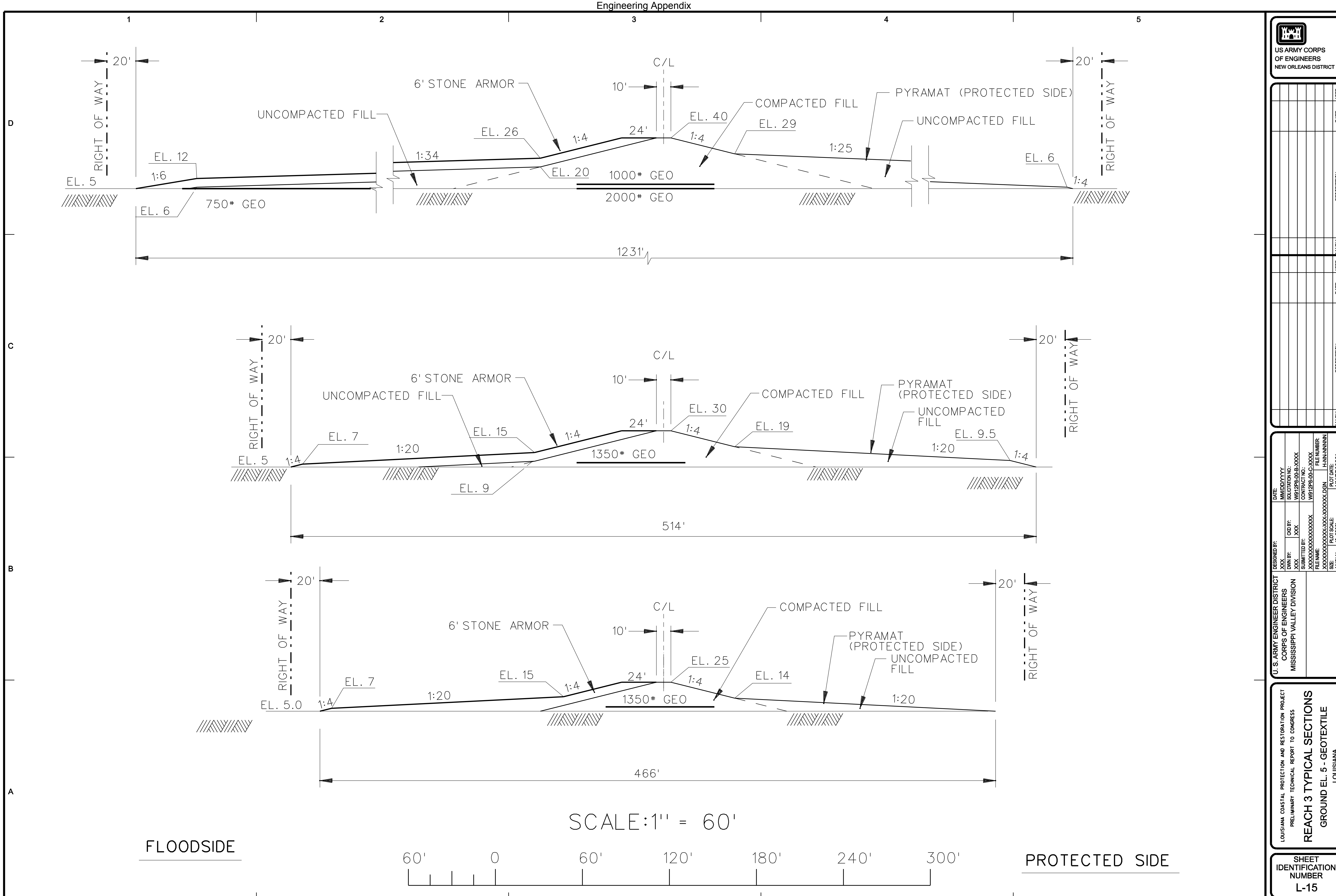
REACH 2 TYPICAL SECTIONS
GROUND EL. 5.0 - GEOTEXTILE
LOUISIANA

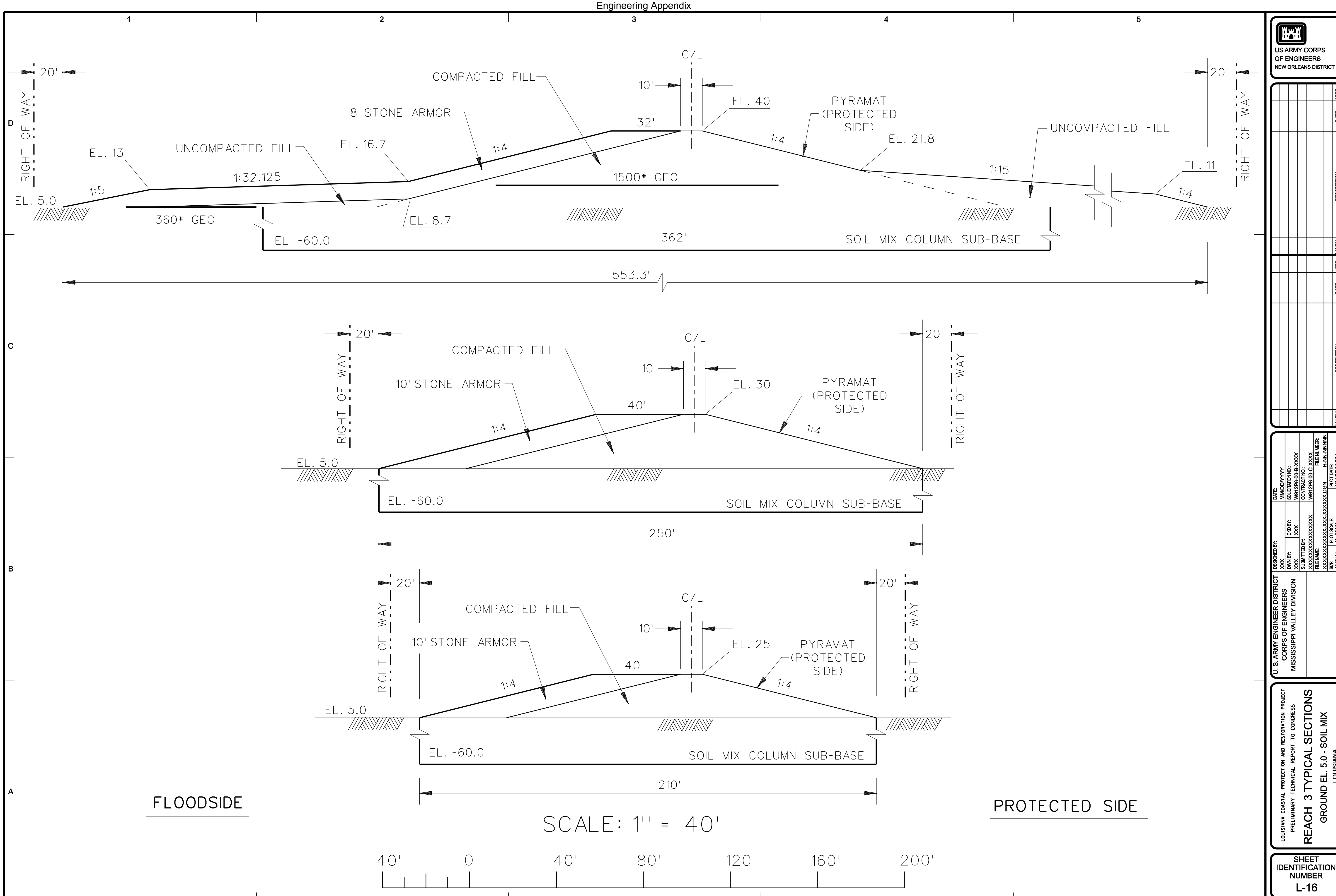
SHEET IDENTIFICATION NUMBER
L-11

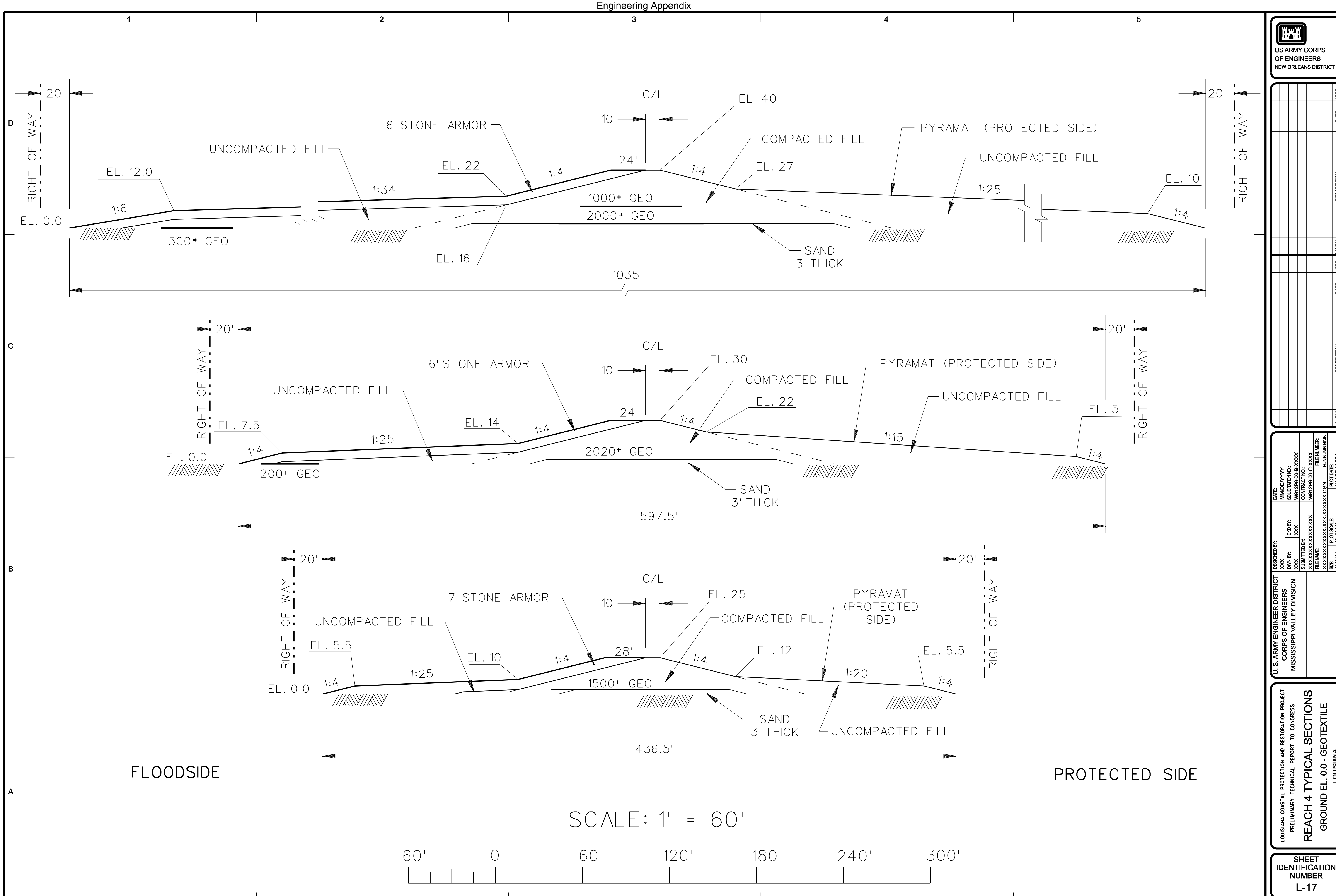

C/L
COMPACTED FILL
8' STONE ARMOR
10'
EL. 40
32'
PYRAMAT (PROTECTED SIDE)
1:4
EL. 20
UNCOMPACTED FILL
1:25
EL. 13
RIGHT OF WAY
20'
EL. 10
EL. 15
1:32
1570# GEO
EL. 5.0
EL. -60.0
362'
SOIL MIX COLUMN SUB-BASE
609'
10' STONE ARMOR
EL. 30
40'
250'
EL. 25
210'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 40'
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 2 TYPICAL SECTIONS
GROUND EL. 5.0 - SOIL MIX
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-12

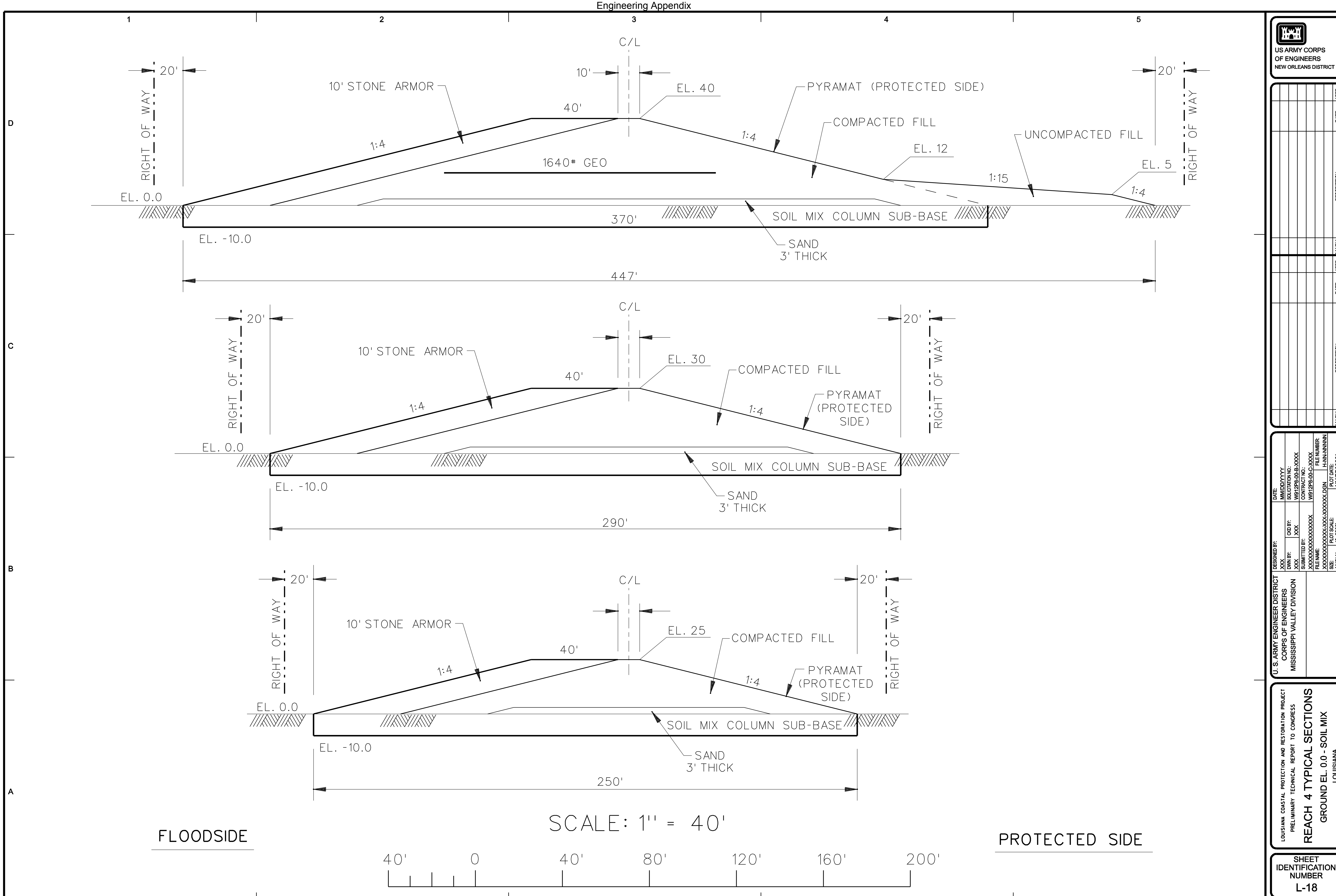

RIGHT OF WAY
20'
C/L
10'
6' STONE ARMOR
UNCOMPACTED FILL
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
UNCOMPACTED FILL
EL. 0
EL. 12
EL. 6
1:6
750# GEO
EL. 26
1:34
EL. 20
1:4
24'
EL. 40
1:4
EL. 29
1:25
1000# GEO
2000# GEO
SAND
3' THICK
EL. 6
1:4
1281'
EL. 0
1:4
EL. 6.5
1:30
200# GEO
EL. 14.5
EL. 8.5
EL. 30
EL. 20
200# GEO
2000# GEO
1:20
EL. 5
722'
EL. 2
EL. 0
1:20
EL. 10
UNCOMPACTED FILL
EL. 4
EL. 25
EL. 14
1350# GEO
EL. 4.5
415'
SCALE:1" = 60'
60' 0 60' 120' 180' 240' 300'
FLOODSIDE
PROTECTED SIDE
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK DESCRIPTION DATE APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 TYPICAL SECTIONS
GROUND EL. 0 - GEOTEXTILE
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-13

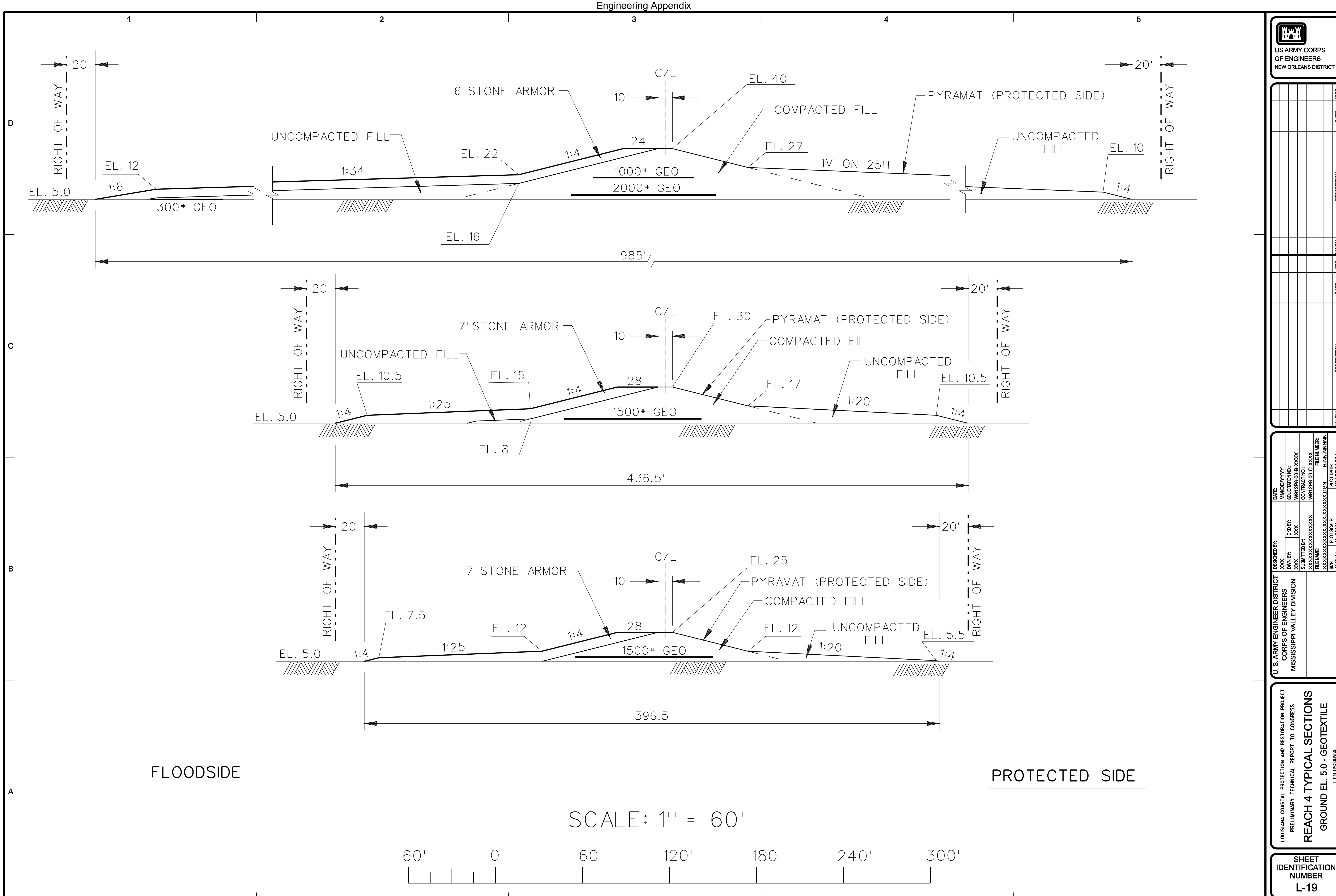

C/L
10'
EL. 40
32'
PYRAMAT (PROTECTED SIDE)
8' STONE ARMOR
COMPACTED FILL
20'
RIGHT OF WAY
EL. 8
EL. 11
1:4
1:4
EL. 15
UNCOMPACTED FILL
1:5
1:32
1500# GEO
1:15
EL. 6
EL. 0
360# GEO
EL. 3
UNCOMPACTED FILL
SAND 3' THICK
SOIL MIX COLUMN SUB-BASE
EL. -60
553'
C/L
10'
EL. 30
40'
PYRAMAT (PROTECTED SIDE)
10' STONE ARMOR
COMPACTED FILL
1:4
1:4
EL. 0
SAND 3' THICK
EL. -60
SOIL MIX COLUMN SUB-BASE
291'
C/L
10'
EL. 25
40'
PYRAMAT (PROTECTED SIDE)
10' STONE ARMOR
COMPACTED FILL
1:4
1:4
EL. 0
SAND 3' THICK
EL. -60
SOIL MIX COLUMN SUB-BASE
250'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 40'
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 TYPICAL SECTIONS
GROUND EL. 0 - SOIL MIX
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-14

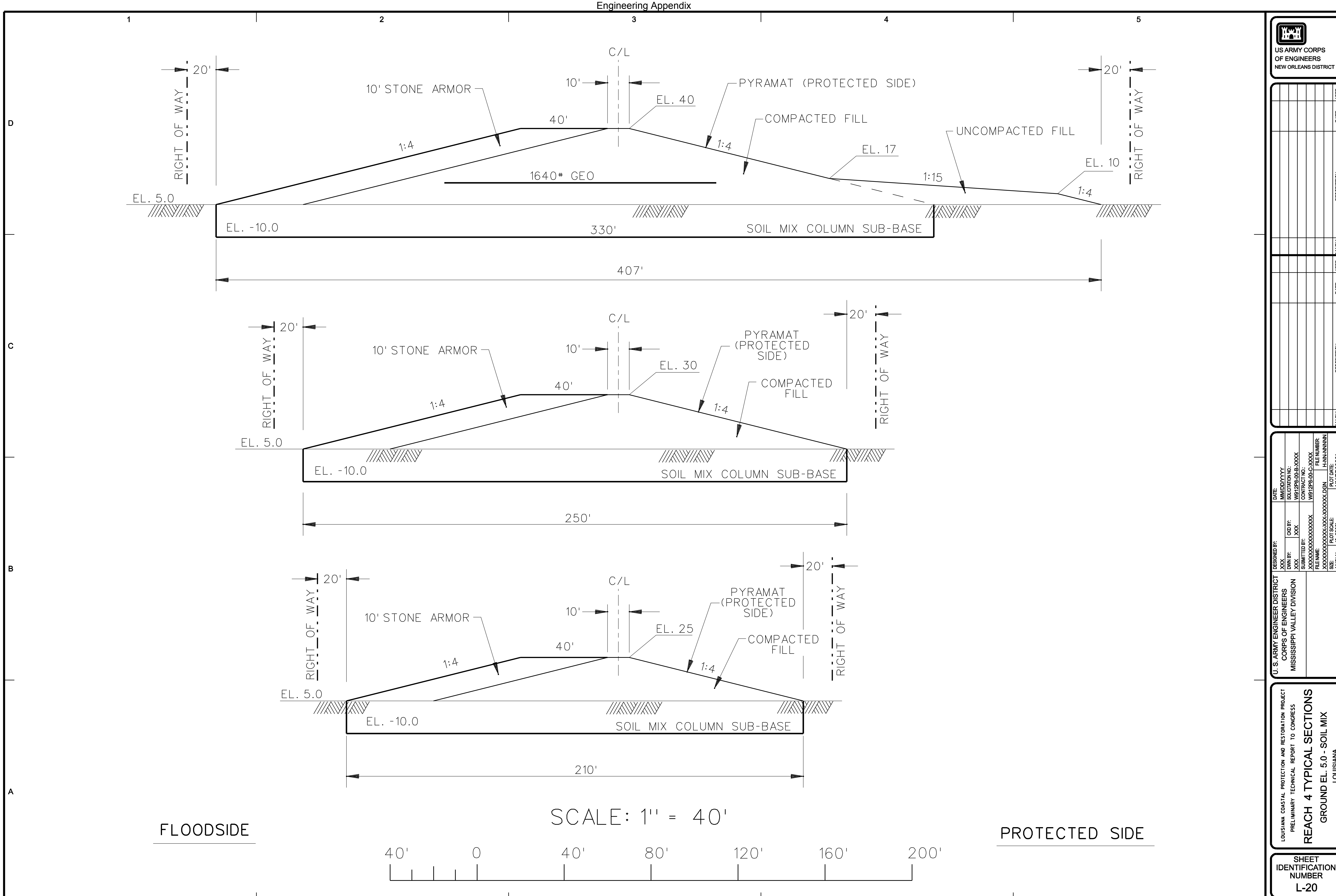

RIGHT OF WAY
20'
C/L
10'
6' STONE ARMOR
UNCOMPACTED FILL
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
EL. 5
EL. 12
1:6
EL. 6
750# GEO
1:34
EL. 26
1:4
24'
EL. 40
EL. 29
1:25
EL. 20
1000# GEO
2000# GEO
1:4
1231'
EL. 7
1:20
EL. 15
EL. 30
EL. 19
EL. 9.5
EL. 9
1350# GEO
514'
EL. 5.0
EL. 25
EL. 14
466'
SCALE:1" = 60'
FLOODSIDE
60' 0 60' 120' 180' 240' 300'
PROTECTED SIDE
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 TYPICAL SECTIONS
GROUND EL. 5 - GEOTEXTILE
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-15

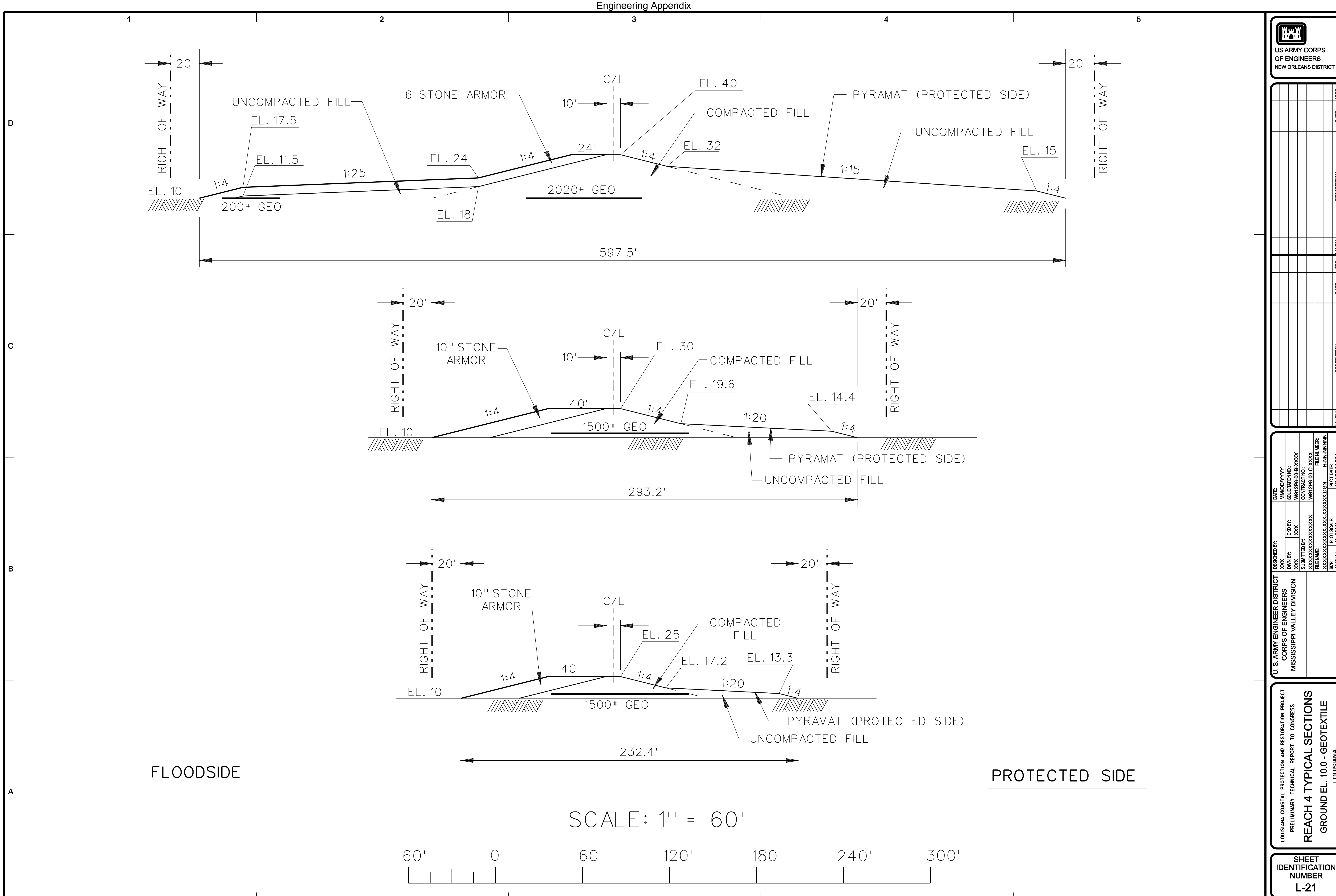

C/L
COMPACTED FILL
10'
EL. 40
8' STONE ARMOR
PYRAMAT (PROTECTED SIDE)
32'
UNCOMPACTED FILL
EL. 13
UNCOMPACTED FILL
EL. 16.7
1:4
EL. 21.8
1:4
EL. 11
1:32.125
1500# GEO
1:15
RIGHT OF WAY
20'
1:5
EL. 5.0
360# GEO
EL. 8.7
EL. -60.0
362'
SOIL MIX COLUMN SUB-BASE
553.3'
COMPACTED FILL
10' STONE ARMOR
EL. 30
40'
EL. 5.0
250'
EL. 25
210'
FLOODSIDE
PROTECTED SIDE
SCALE: 1'' = 40'
40' 0 40' 80' 120' 160' 200'
US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 3 TYPICAL SECTIONS
GROUND EL. 5.0 - SOIL MIX
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-16

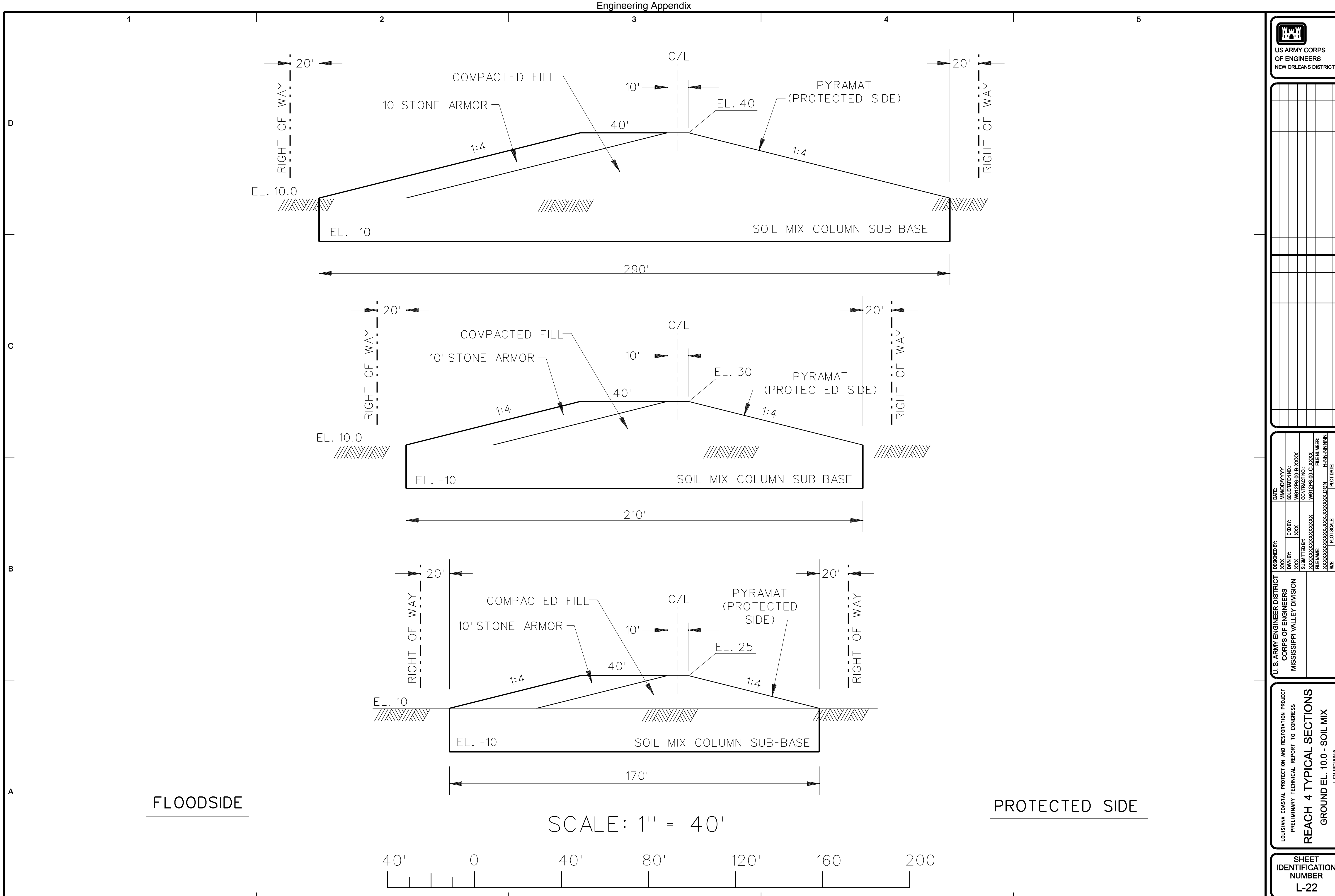

RIGHT OF WAY
20'
C/L
10'
EL. 40
6' STONE ARMOR
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
UNCOMPACTED FILL
EL. 22
24'
1:4
EL. 27
EL. 12.0
1:34
1:25
EL. 10
1:6
1000# GEO
2000# GEO
EL. 0.0
300# GEO
EL. 16
SAND
3' THICK
1035'
EL. 30
EL. 14
EL. 7.5
1:25
EL. 5
1:15
2020# GEO
200# GEO
597.5'
7' STONE ARMOR
EL. 25
PYRAMAT
(PROTECTED
SIDE)
EL. 5.5
EL. 10
28'
EL. 12
1:20
1500# GEO
436.5'
FLOODSIDE
PROTECTED SIDE
SCALE: 1'' = 60'
60'
0
60'
120'
180'
240'
300'
US ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DATE
DESCRIPTION
APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
DESIGNED BY:
XXX
DWN BY:
XXX
CKD BY:
XXX
SUBMITTED BY:
XXXXXXXXXXXXXXXXX
FILE NAME:
XXXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE:
ANSI X
PLOT SCALE:
1"=5000'
DATE:
MM/DD/YYYY
SOLICITATION NO.:
W912P8-00-B-XXXX
CONTRACT NO.:
W912P8-00-C-XXXX
FILE NUMBER:
H-NN-NNNNN
PLOT DATE:
MM/DD/YYYY
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 0.0 - GEOTEXTILE
LOUISIANA
SHEET
IDENTIFICATION
NUMBER
L-17

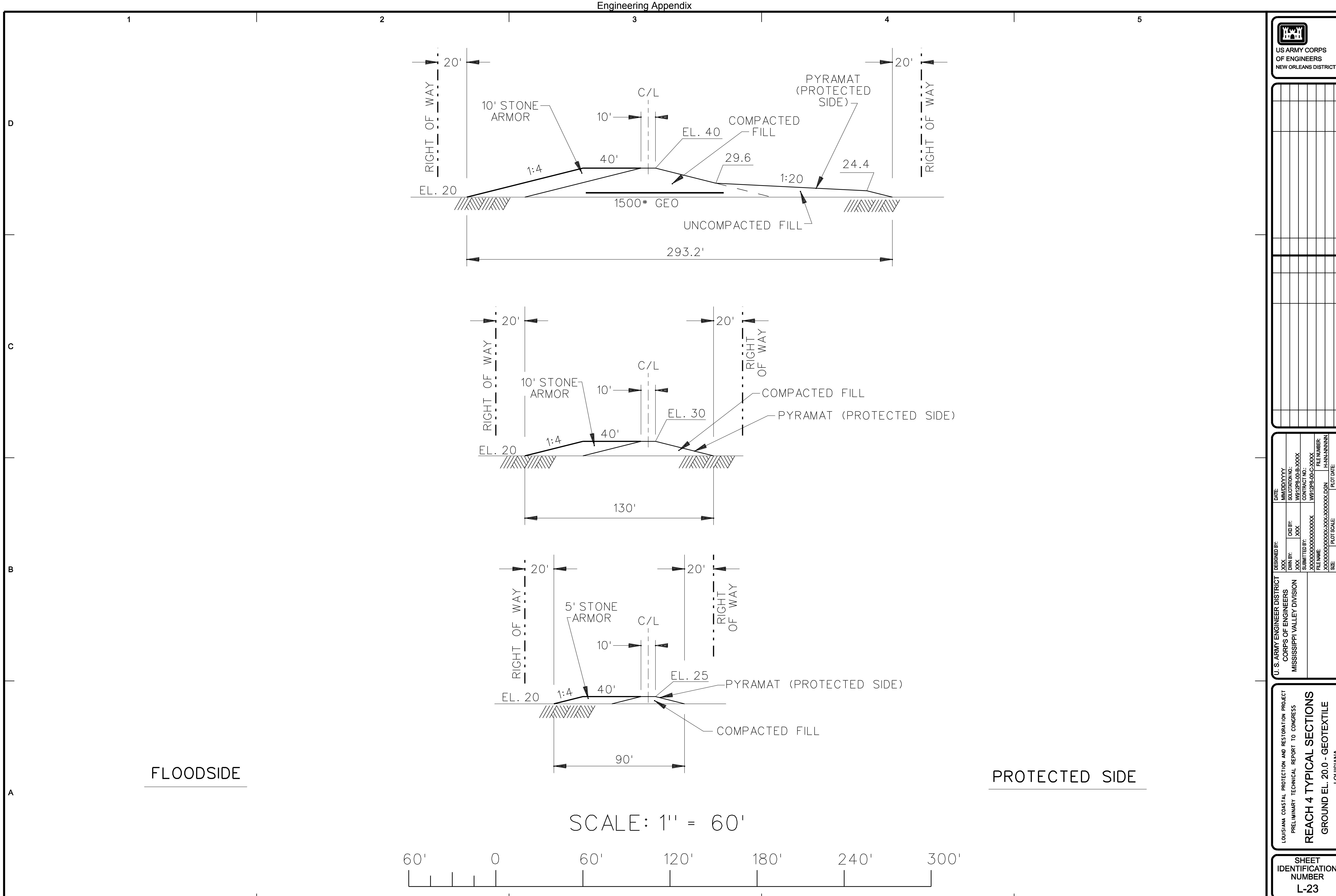

C/L
20'
10'
RIGHT OF WAY
10' STONE ARMOR
EL. 40
40'
PYRAMAT (PROTECTED SIDE)
COMPACTED FILL
1:4
1:4
EL. 12
UNCOMPACTED FILL
1640# GEO
1:15
EL. 5
1:4
EL. 0.0
370'
SOIL MIX COLUMN SUB-BASE
EL. -10.0
SAND
3' THICK
447'
EL. 30
PYRAMAT
(PROTECTED
SIDE)
290'
EL. 25
250'
SCALE: 1" = 40'
40' 0 40' 80' 120' 160' 200'
FLOODSIDE
PROTECTED SIDE
US ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 0.0 - SOIL MIX
LOUISIANA
SHEET
IDENTIFICATION
NUMBER
L-18

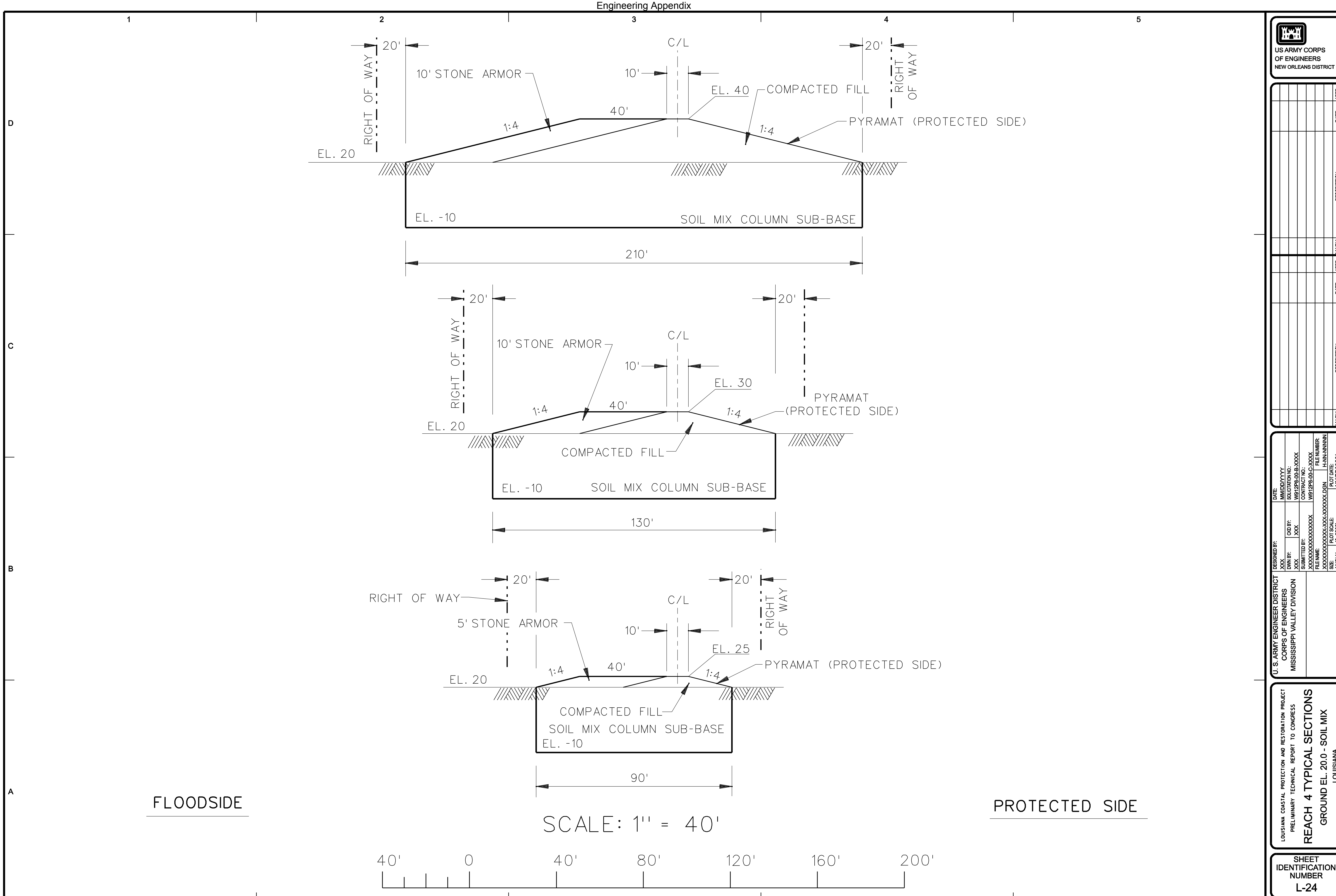

RIGHT OF WAY
20'
C/L
10'
6' STONE ARMOR
EL. 40
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
UNCOMPACTED FILL
EL. 22
1:4
24'
EL. 27
1V ON 25H
EL. 10
EL. 12
1:34
1000# GEO
2000# GEO
EL. 5.0
1:6
300# GEO
EL. 16
985'
7' STONE ARMOR
EL. 30
EL. 10.5
EL. 15
28'
EL. 17
1:20
1:25
1500# GEO
EL. 8
436.5'
EL. 25
EL. 7.5
EL. 12
EL. 5.5
396.5
FLOODSIDE
PROTECTED SIDE
SCALE: 1'' = 60'
60' 0 60' 120' 180' 240' 300'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 5.0 - GEOTEXTILE
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-19

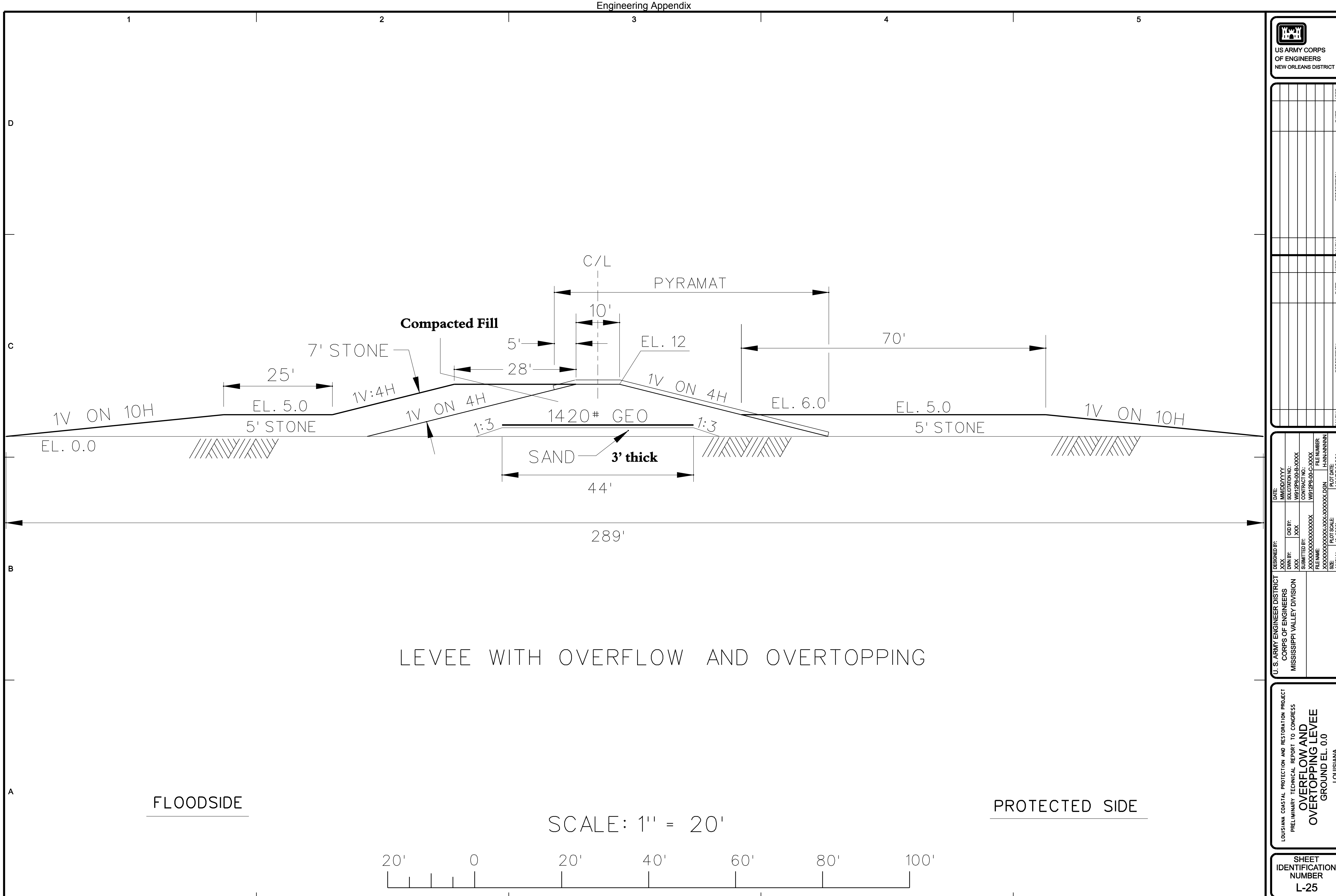

C/L
20'
RIGHT OF WAY
10' STONE ARMOR
10'
40'
EL. 40
PYRAMAT (PROTECTED SIDE)
COMPACTED FILL
UNCOMPACTED FILL
1:4
EL. 17
1:15
EL. 10
1640# GEO
EL. 5.0
EL. -10.0
330'
SOIL MIX COLUMN SUB-BASE
407'
EL. 30
PYRAMAT (PROTECTED SIDE)
250'
EL. 25
210'
SCALE: 1" = 40'
40' 0 40' 80' 120' 160' 200'
FLOODSIDE
PROTECTED SIDE
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 5.0 - SOIL MIX
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-20

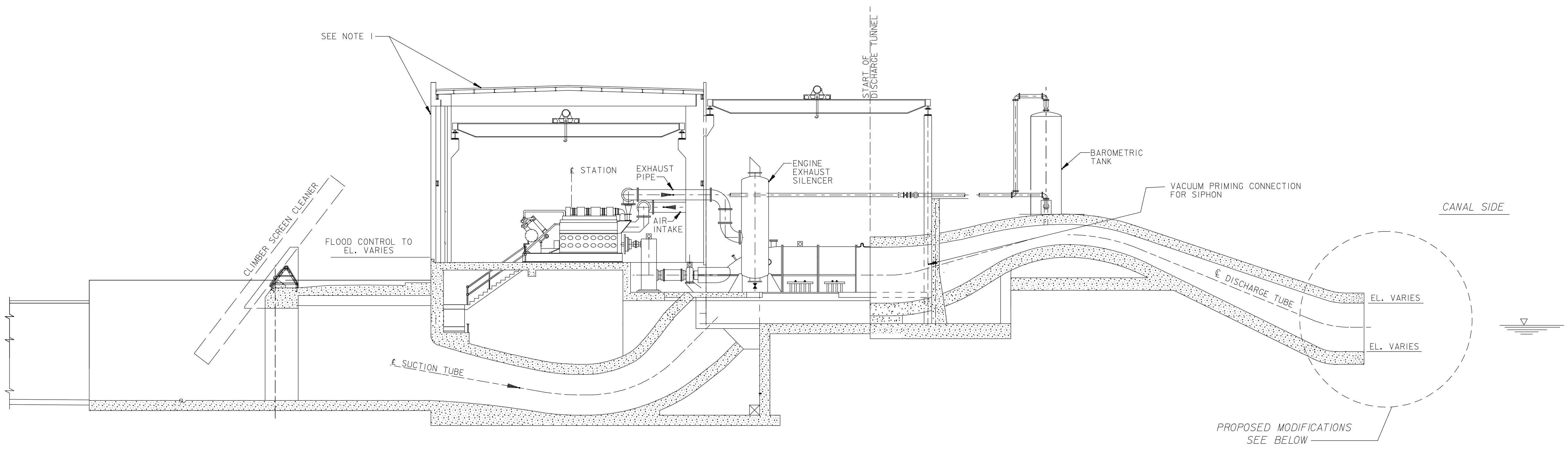

RIGHT OF WAY
20'
C/L
10'
6' STONE ARMOR
UNCOMPACTED FILL
EL. 17.5
EL. 11.5
EL. 24
1:4
24'
EL. 40
COMPACTED FILL
EL. 32
PYRAMAT (PROTECTED SIDE)
UNCOMPACTED FILL
EL. 15
1:25
1:15
EL. 10
200# GEO
2020# GEO
EL. 18
597.5'
10'' STONE ARMOR
EL. 30
EL. 19.6
EL. 14.4
40'
1:20
1500# GEO
293.2'
EL. 25
EL. 17.2
EL. 13.3
232.4'
FLOODSIDE
PROTECTED SIDE
SCALE: 1'' = 60'
60' 0 60' 120' 180' 240' 300'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK DESCRIPTION DATE APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 10.0 - GEOTEXTILE
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-21


C/L
20'
RIGHT OF WAY
COMPACTED FILL
10' STONE ARMOR
10'
EL. 40
PYRAMAT
(PROTECTED SIDE)
40'
1:4
1:4
EL. 10.0
EL. -10
SOIL MIX COLUMN SUB-BASE
290'
EL. 30
EL. 10.0
210'
EL. 25
EL. 10
170'
FLOODSIDE
PROTECTED SIDE
SCALE: 1'' = 40'
40'
0
40'
80'
120'
160'
200'
US ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 10.0 - SOIL MIX
LOUISIANA
SHEET
IDENTIFICATION
NUMBER
L-22


RIGHT OF WAY
20'
10' STONE ARMOR
C/L
10'
EL. 40
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
40'
1:4
29.6
24.4
1:20
EL. 20
1500# GEO
UNCOMPACTED FILL
293.2'
10' STONE ARMOR
EL. 30
COMPACTED FILL
PYRAMAT (PROTECTED SIDE)
130'
5' STONE ARMOR
EL. 25
PYRAMAT (PROTECTED SIDE)
COMPACTED FILL
90'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 60'
60' 0 60' 120' 180' 240' 300'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
DESIGNED BY: XXX
DWN BY: XXX
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXXX
FILE NAME: XXXXXXXXXXXX-XXX-XXXXXX.DGN
SIZE: ANSI X
PLOT SCALE: 1"=5000'
DATE: MM/DD/YYYY
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NUMBER: H-NN-NNNNN
PLOT DATE: MM/DD/YYYY
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 20.0 - GEOTEXTILE
LOUISIANA
SHEET IDENTIFICATION NUMBER
L-23


20'
C/L
20'
RIGHT OF WAY
10' STONE ARMOR
10'
EL. 40
COMPACTED FILL
RIGHT OF WAY
40'
1:4
1:4
PYRAMAT (PROTECTED SIDE)
EL. 20
EL. -10
SOIL MIX COLUMN SUB-BASE
210'
20'
20'
RIGHT OF WAY
10' STONE ARMOR
C/L
10'
EL. 30
PYRAMAT
(PROTECTED SIDE)
1:4
40'
1:4
EL. 20
COMPACTED FILL
EL. -10
SOIL MIX COLUMN SUB-BASE
130'
20'
20'
RIGHT OF WAY
C/L
RIGHT OF WAY
5' STONE ARMOR
10'
EL. 25
PYRAMAT (PROTECTED SIDE)
1:4
40'
1:4
EL. 20
COMPACTED FILL
SOIL MIX COLUMN SUB-BASE
EL. -10
90'
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 40'
40'
0
40'
80'
120'
160'
200'
US ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
REACH 4 TYPICAL SECTIONS
GROUND EL. 20.0 - SOIL MIX
LOUISIANA
SHEET
IDENTIFICATION
NUMBER
L-24


C/L
PYRAMAT
10'
Compacted Fill
5'
EL. 12
70'
7' STONE
28'
25'
1V:4H
1V ON 4H
1V ON 4H
EL. 6.0
1V ON 10H
EL. 5.0
EL. 5.0
1V ON 10H
5' STONE
1420# GEO
1:3
1:3
5' STONE
EL. 0.0
SAND
3' thick
44'
289'
LEVEE WITH OVERFLOW AND OVERTOPPING
FLOODSIDE
PROTECTED SIDE
SCALE: 1" = 20'
20' 0 20' 40' 60' 80' 100'
US ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
OVERFLOW AND
OVERTOPPING LEVEE
GROUND EL. 0.0
LOUISIANA
SHEET
IDENTIFICATION
NUMBER
L-25



EXISTING CONDITIONS

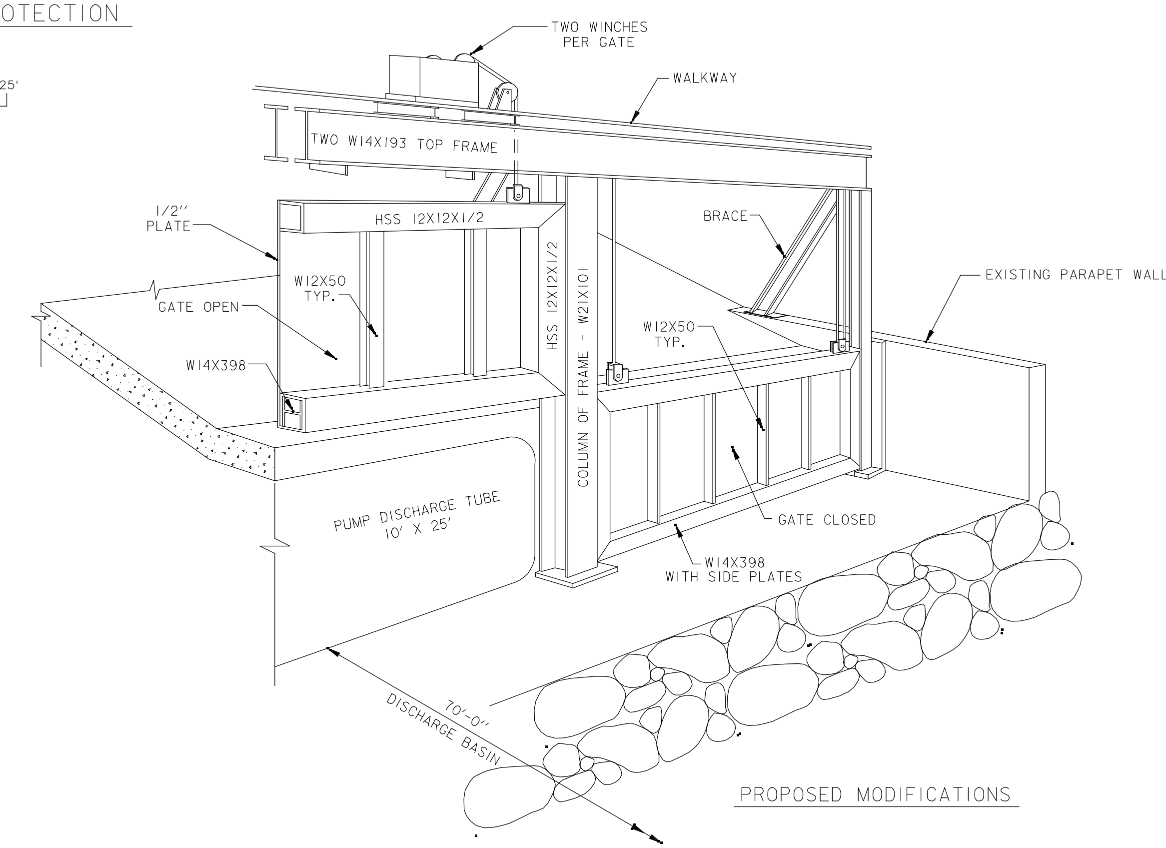
TYPICAL EXISTING HORIZONTAL PUMPING STATION WITH ADDED FRONTING PROTECTION

SCALE: 1/8" = 1'- 0"

0 5' 10' 15' 20' 25'

NOTES:

1. HARDEN BUILDING TO WITHSTAND HURRICANE FORCE WINDS.
2. PUMP DISCHARGE FLOOD PROTECTION WALL CONSIST OF TWO (2) STEEL FABRICATED CLOSURE GATES IN A STRUCTURAL STEEL GUIDED FRAME FOR A TYPICAL HORIZONTAL PUMP.
3. CLOSURE GATE WILL REMAIN NORMALLY IN THE UP POSITION. LOWERING WILL OCCUR DURING EXTREME WEATHER CONDITIONS.



PROPOSED MODIFICATIONS

US ARMY CORPS OF ENGINEERS

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS

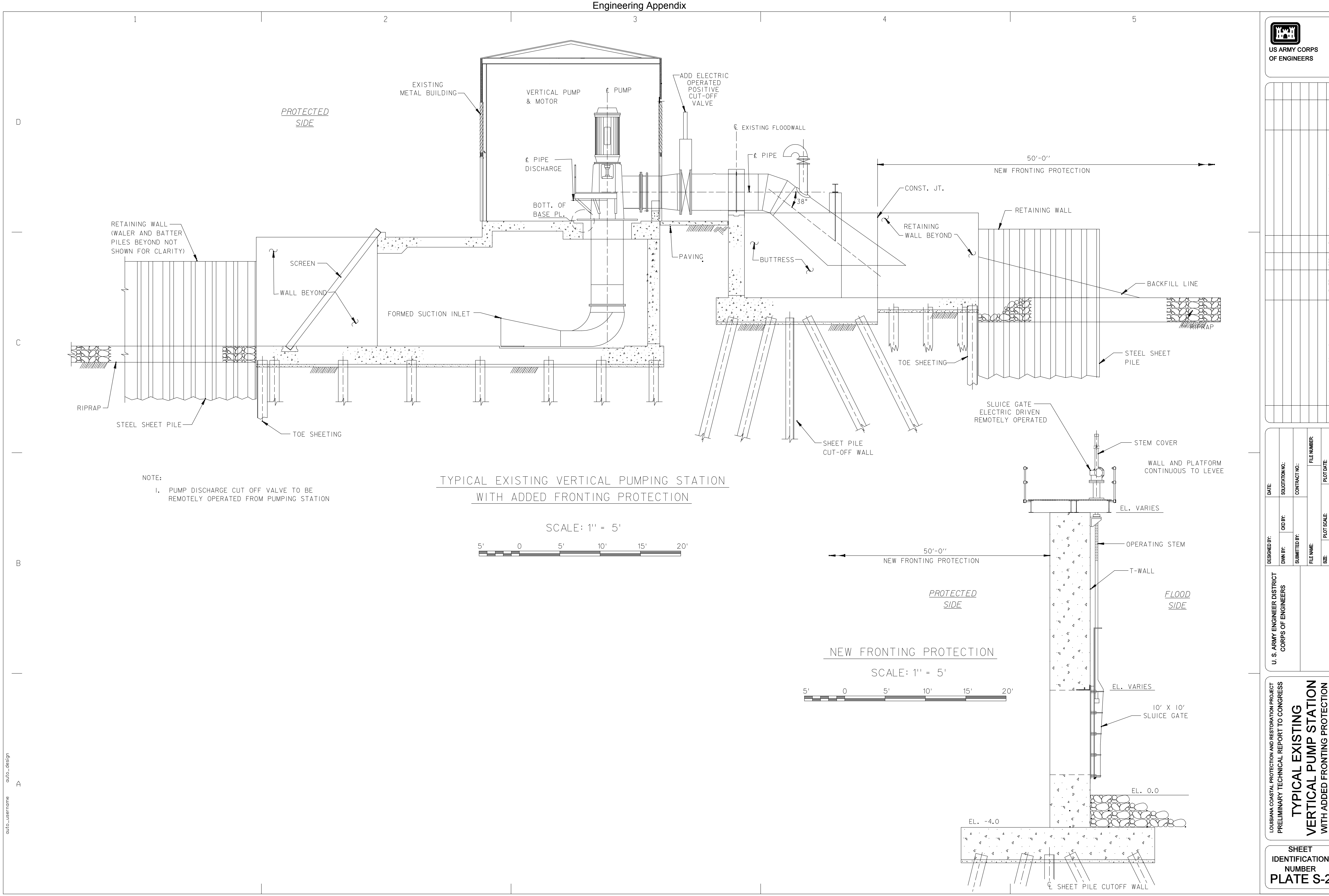
DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
FILE NAME: | FILE NUMBER:
SIZE: | PLOT SCALE: | PLOT DATE:

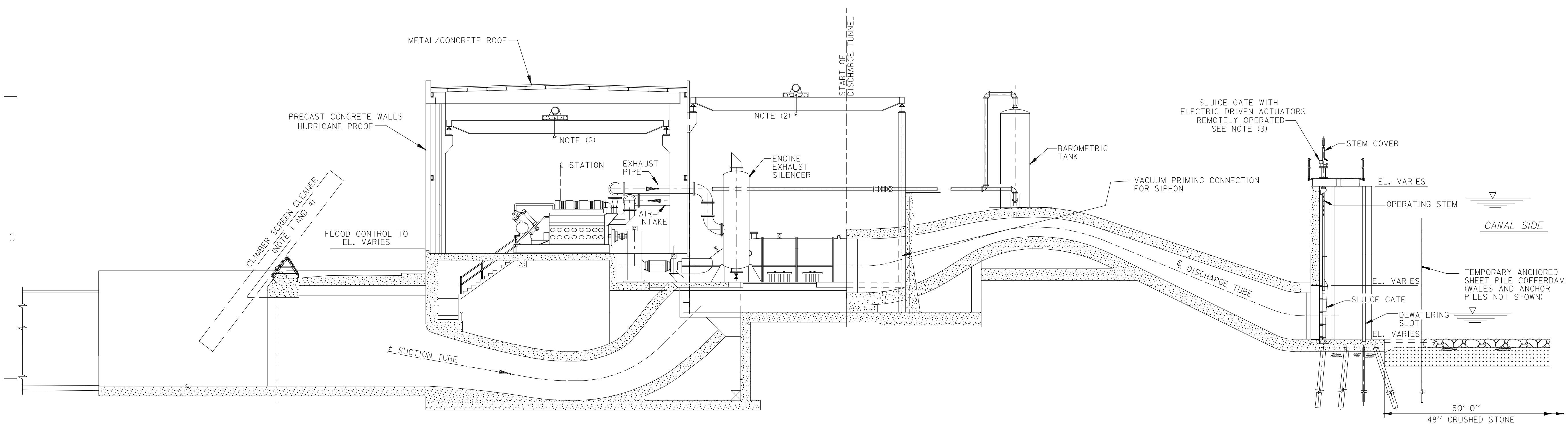
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

TYPICAL EXISTING HORIZONTAL PUMP STATION WITH ADDED FRONTING PROTECTION

SHEET IDENTIFICATION NUMBER

PLATE S-1


PROTECTED SIDE
EXISTING METAL BUILDING
VERTICAL PUMP & MOTOR
℄ PUMP
ADD ELECTRIC OPERATED POSITIVE CUT-OFF VALVE
℄ EXISTING FLOODWALL
℄ PIPE DISCHARGE
℄ PIPE
50'-0" NEW FRONTING PROTECTION
CONST. JT.
BOTT. OF BASE PL.
38°
RETAINING WALL
RETAINING WALL BEYOND
RETAINING WALL (WALER AND BATTER PILES BEYOND NOT SHOWN FOR CLARITY)
SCREEN
PAVING
BUTTRESS
BACKFILL LINE
WALL BEYOND
FORMED SUCTION INLET
RIPRAP
STEEL SHEET PILE
TOE SHEETING
SHEET PILE CUT-OFF WALL
RIPRAP
STEEL SHEET PILE
TOE SHEETING
NOTE:
1. PUMP DISCHARGE CUT OFF VALVE TO BE REMOTELY OPERATED FROM PUMPING STATION
TYPICAL EXISTING VERTICAL PUMPING STATION WITH ADDED FRONTING PROTECTION
SCALE: 1" = 5'
5' 0 5' 10' 15' 20'
SLUICE GATE ELECTRIC DRIVEN REMOTELY OPERATED
STEM COVER
WALL AND PLATFORM CONTINUOUS TO LEVEE
EL. VARIES
OPERATING STEM
50'-0" NEW FRONTING PROTECTION
T-WALL
PROTECTED SIDE
FLOOD SIDE
NEW FRONTING PROTECTION
SCALE: 1" = 5'
5' 0 5' 10' 15' 20'
EL. VARIES
10' X 10' SLUICE GATE
EL. 0.0
EL. -4.0
℄ SHEET PILE CUTOFF WALL
US ARMY CORPS OF ENGINEERS
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
TYPICAL EXISTING VERTICAL PUMP STATION WITH ADDED FRONTING PROTECTION
SHEET IDENTIFICATION NUMBER
PLATE S-2



TYPICAL NEW HORIZONTAL PUMPING STATION WITH FRONTING PROTECTION

SCALE: 1/8" = 1'- 0"

0 5' 10' 15' 20' 25'

NOTES:

1. SIZE CLIMBER SCREEN CLEANER IN ACCORDANCE WITH DESIGN PUMPING CAPACITY.
2. OVERHEAD CRANE OF SUFFICIENT CAPACITY TO HANDLE LIFTING AND SETTING MAJOR EQUIPMENT.
3. SLUICE GATE ACTUATORS WILL BE ELECTRIC DRIVEN REMOTELY ACTIVATED FROM THE PUMPING STATION CONTROL ROOM.
4. FURNISH SCREEN CLEANERS WITH REMOTE CONTROLS TO ALLOW OPERATION FROM THE PUMPING STATION CONTROL ROOM AND LOCALLY AS WELL.
5. SLUICE GATES WILL BE RUN BETWEEN STEEL RAIL GUIDES IMBEDDED IN CONCRETE WALLS.

US ARMY CORPS OF ENGINEERS
district_name

MARK | DATE | DESCRIPTION | APPR.

DESIGNED BY: | DATE: | DWN BY: | CKD BY: | SOLICITATION NO.: solicitation_num | SUBMITTED BY: | CONTRACT NO.: contract_num | FILE NAME: | FILE NUMBER: | SIZE: | PLOT SCALE: | PLOT DATE:

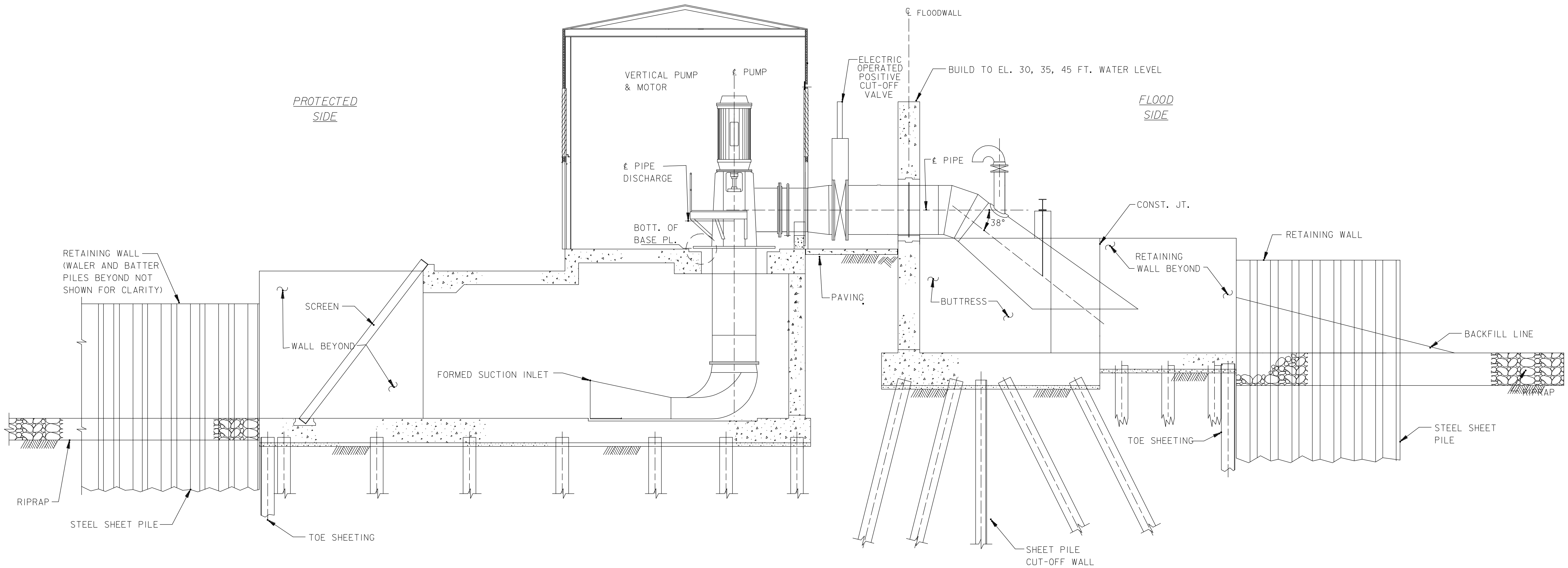
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

TYPICAL NEW HORIZONTAL PUMP STATION WITH FRONTING PROTECTION

SHEET IDENTIFICATION NUMBER
PLATE S-3

set_id auto_username auto_design



NOTE:

1. PUMP DISCHARGE CUT OFF VALVE TO BE REMOTELY OPERATED FROM PUMPING STATION CONTROL ROOM.

TYPICAL NEW VERTICAL PUMPING STATION
WITH FRONTING PROTECTION

SCALE: 1'' = 5'

5' 0 5' 10' 15' 20'

US ARMY CORPS OF ENGINEERS
district_name

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS

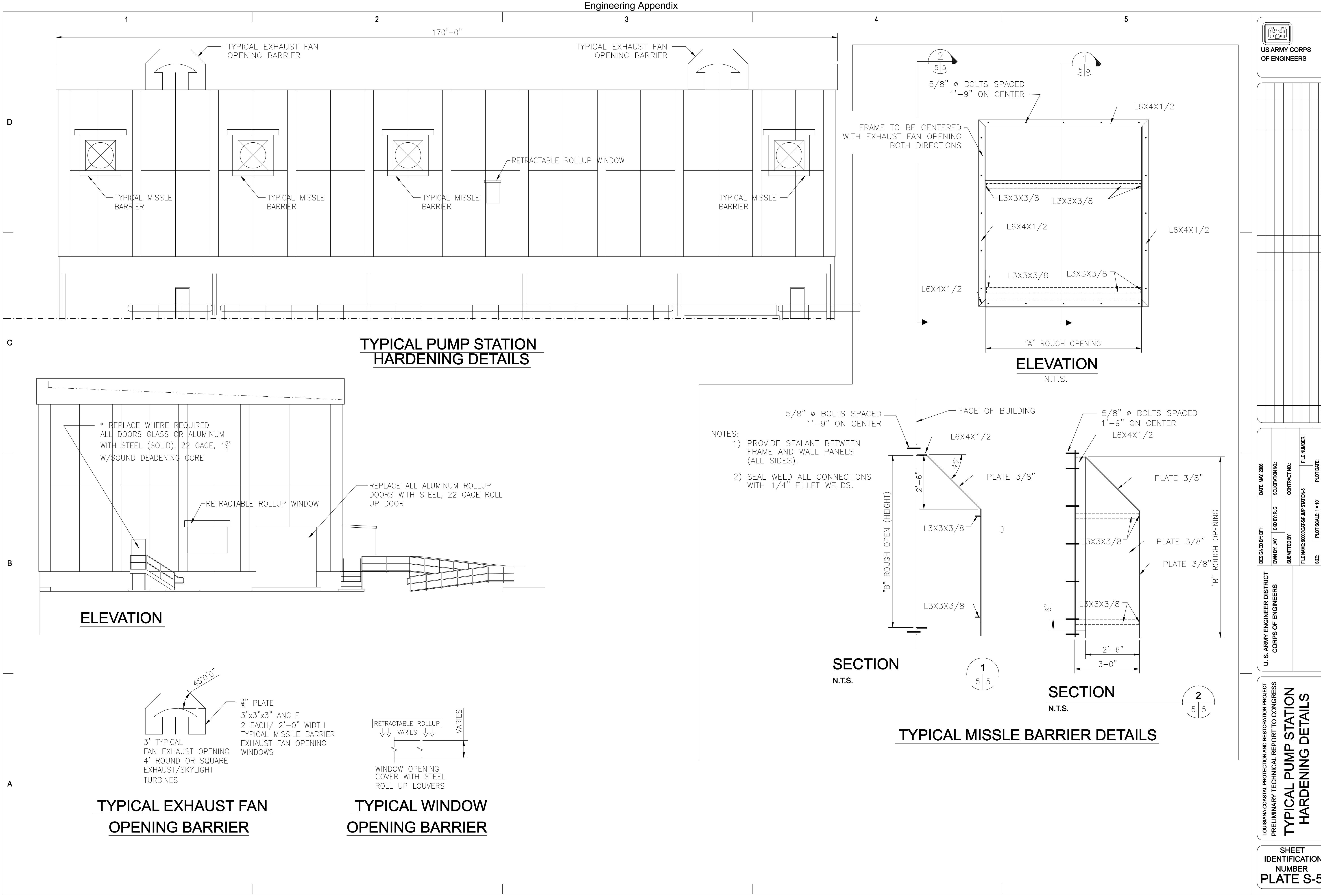
DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.: solicitation_num
SUBMITTED BY: | CONTRACT NO.: contract_num
FILE NAME: | FILE NUMBER:
SIZE: | PLOT SCALE: | PLOT DATE:

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

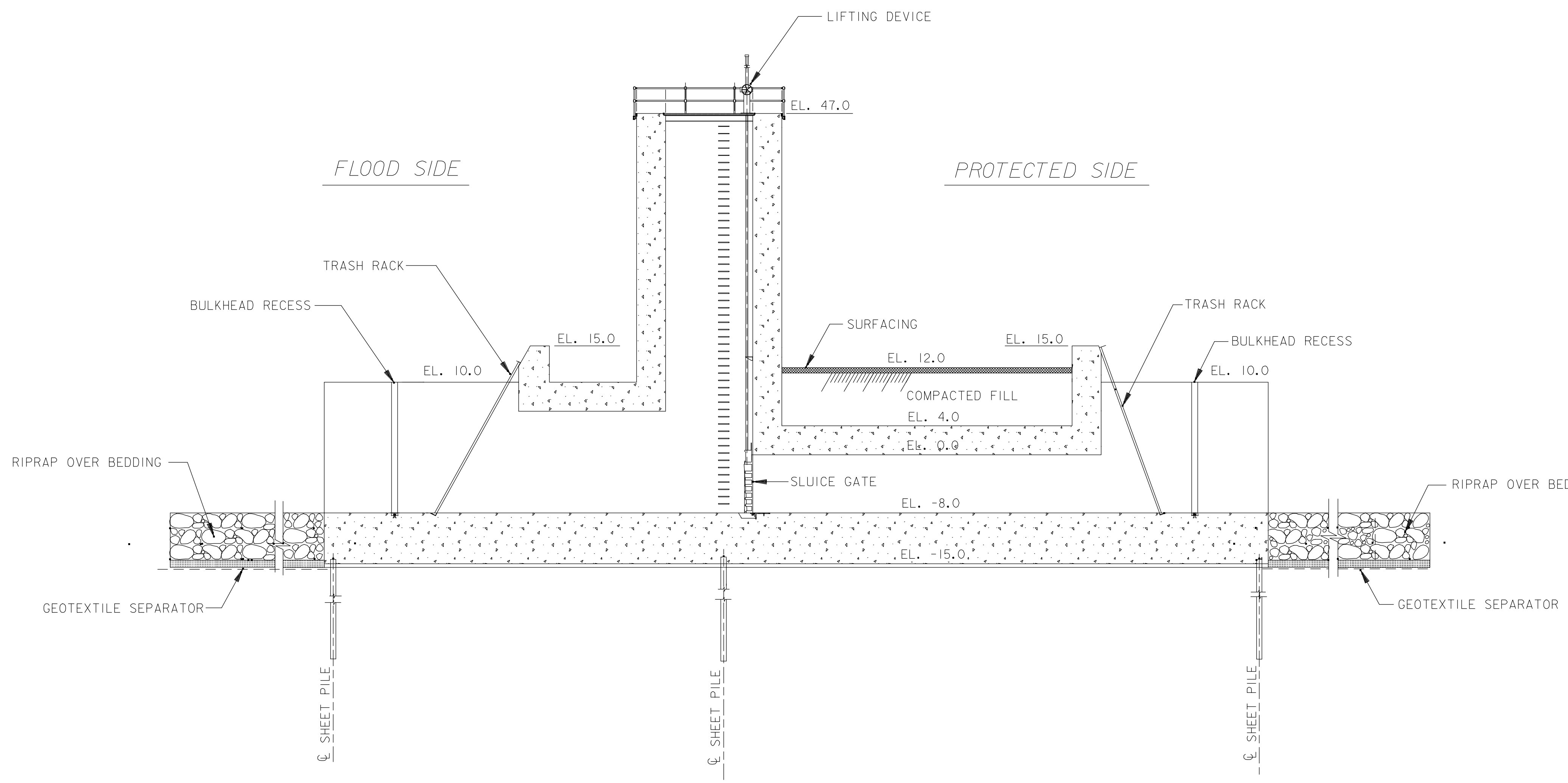
TYPICAL NEW VERTICAL PUMP STATION
WITH FRONTING PROTECTION

SHEET IDENTIFICATION NUMBER
PLATE S-4

set_id auto_username auto_design


170'–0"
TYPICAL EXHAUST FAN OPENING BARRIER
TYPICAL EXHAUST FAN OPENING BARRIER
RETRACTABLE ROLLUP WINDOW
TYPICAL MISSLE BARRIER
TYPICAL MISSLE BARRIER
TYPICAL MISSLE BARRIER
TYPICAL MISSLE BARRIER
TYPICAL PUMP STATION HARDENING DETAILS
* REPLACE WHERE REQUIRED ALL DOORS GLASS OR ALUMINUM WITH STEEL (SOLID), 22 GAGE, 1¾" W/SOUND DEADENING CORE
RETRACTABLE ROLLUP WINDOW
REPLACE ALL ALUMINUM ROLLUP DOORS WITH STEEL, 22 GAGE ROLL UP DOOR
ELEVATION
45'0'0"
⅜" PLATE
3"x3"x3" ANGLE
2 EACH/ 2'–0" WIDTH TYPICAL MISSILE BARRIER EXHAUST FAN OPENING WINDOWS
3' TYPICAL FAN EXHAUST OPENING 4' ROUND OR SQUARE EXHAUST/SKYLIGHT TURBINES
TYPICAL EXHAUST FAN OPENING BARRIER
RETRACTABLE ROLLUP
VARIES
VARIES
WINDOW OPENING COVER WITH STEEL ROLL UP LOUVERS
TYPICAL WINDOW OPENING BARRIER
5/8" ø BOLTS SPACED 1'–9" ON CENTER
L6X4X1/2
FRAME TO BE CENTERED WITH EXHAUST FAN OPENING BOTH DIRECTIONS
L3X3X3/8
L3X3X3/8
L6X4X1/2
L6X4X1/2
L3X3X3/8
L3X3X3/8
L6X4X1/2
"A" ROUGH OPENING
ELEVATION
N.T.S.
NOTES:
1) PROVIDE SEALANT BETWEEN FRAME AND WALL PANELS (ALL SIDES).
2) SEAL WELD ALL CONNECTIONS WITH 1/4" FILLET WELDS.
5/8" ø BOLTS SPACED 1'–9" ON CENTER
FACE OF BUILDING
L6X4X1/2
45°
2'–6"
PLATE 3/8"
"B" ROUGH OPEN (HEIGHT)
L3X3X3/8
L3X3X3/8
SECTION
N.T.S.
1
5 5
5/8" ø BOLTS SPACED 1'–9" ON CENTER
L6X4X1/2
PLATE 3/8"
L3X3X3/8
PLATE 3/8"
PLATE 3/8"
"B" ROUGH OPENING
6"
L3X3X3/8
2'–6"
3–0"
SECTION
N.T.S.
2
5 5
TYPICAL MISSLE BARRIER DETAILS
US ARMY CORPS OF ENGINEERS
MARK
DESCRIPTION
DATE
APPR.
DESIGNED BY: DFH
DWN BY: JAY
CKD BY: RJG
DATE: MAY, 2006
SOLICITATION NO.:
CONTRACT NO.:
SUBMITTED BY:
FILE NUMBER:
FILE NAME: 90000CAT-S/PUMP STATION-5
PLOT DATE:
SIZE:
PLOT SCALE: 1 = 10'
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
TYPICAL PUMP STATION HARDENING DETAILS
SHEET IDENTIFICATION NUMBER
PLATE S-5


32'-0"
8'-0"
8'-0"
EL. 45.0
FLOOD SIDE
PROTECTED SIDE
EL. 3.0
EL. -5.0
℄ PZ-27 SHEET PILING
30"Ø STEEL PILES TYPICAL
3'-6"
6'-6"
6'-6"
7'-0"
7'-0"
7'-0"
7'-0"
3'-6"
48'-0"
PROTECTION TO EL. 45.0
23'-0"
6'-0"
5'-0"
EL. 35.0
FLOOD SIDE
PROTECTED SIDE
EL. 3.0
EL. -3.0
℄ PZ-27 SHEET PILING
24"Ø STEEL PILES TYPICAL
3'-0"
5'-0"
5'-0"
6'-0"
6'-0"
6'-0"
3'-0"
34'-0"
PROTECTION TO EL. 35.0
16'-0"
6'-0"
5'-0"
EL. 30.0
FLOOD SIDE
PROTECTED SIDE
EL. 3.0
EL. -2.0
℄ PZ-27 SHEET PILING
24"Ø STEEL PILES TYPICAL
3'-0"
6'-0"
5'-0"
5'-0"
5'-0"
3'-0"
27'-0"
PROTECTION TO EL. 30.0
SCALE: 1" = 5'
5' 0 5' 10' 15' 20'
C•A•D
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
DESIGNED BY:
DWN BY:
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NAME:
FILE NUMBER:
PLOT DATE:
PLOT SCALE:
SIZE:
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
T-WALL SECTIONS
SHEET IDENTIFICATION NUMBER
PLATE S-6



TYPICAL SLUICE GATE SECTION

SCALE: 1" = 10'

10' 0 10' 20' 30' 40'

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

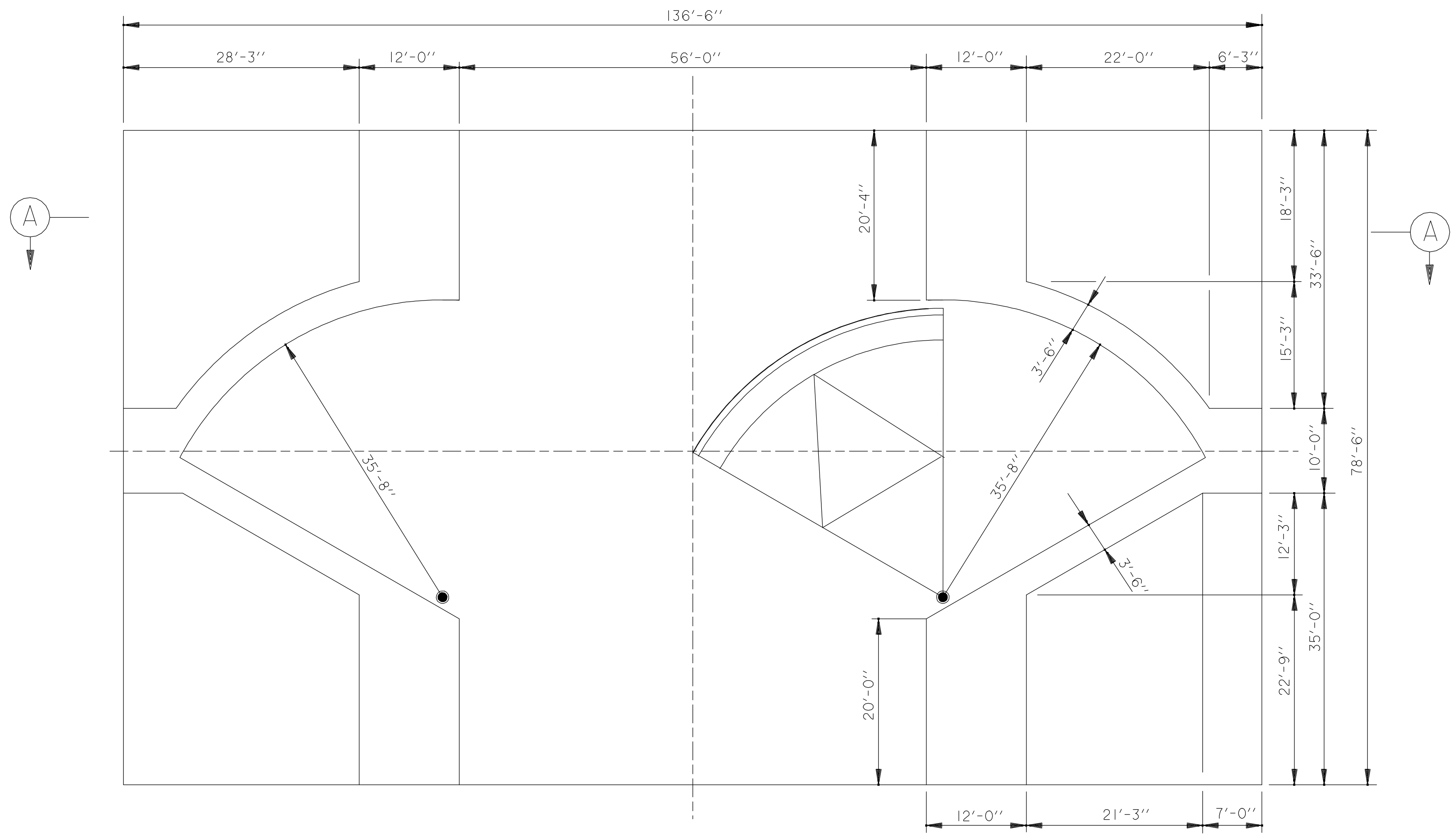
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: DATE:
DWN BY: CKD BY: SOLICITATION NO.:
SUBMITTED BY: CONTRACT NO.:
FILE NAME: FILE NUMBER:
SIZE: PLOT SCALE: PLOT DATE:

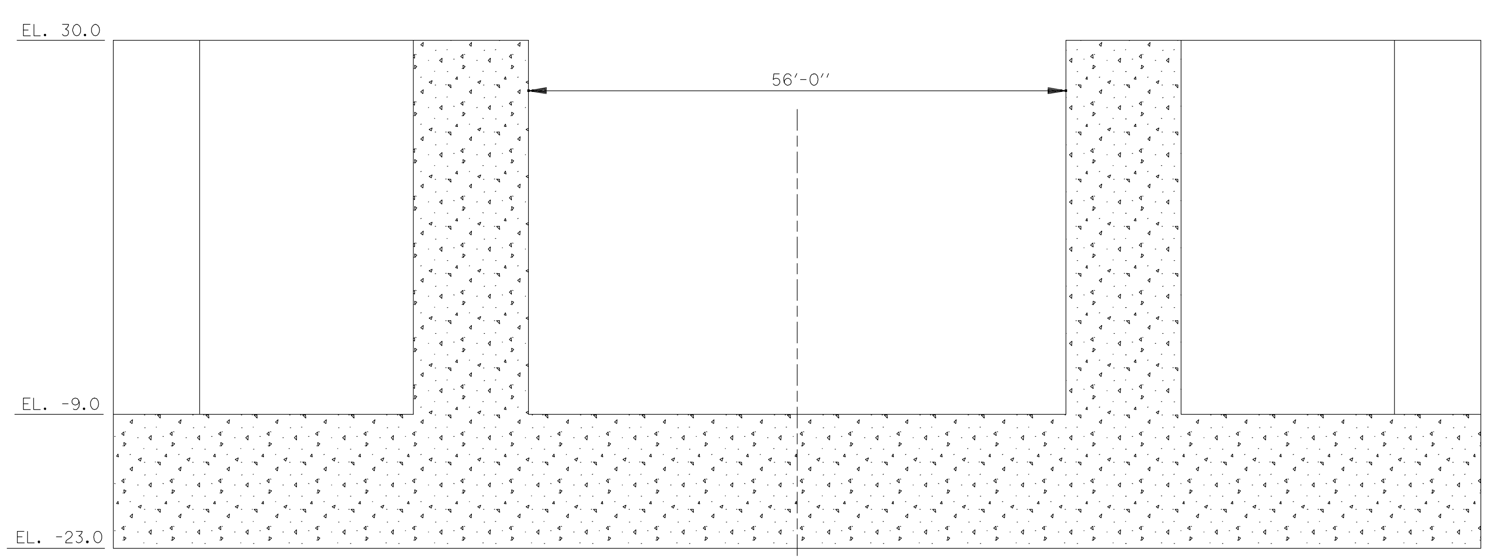
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

SLUICE GATE STRUCTURE
PROTECTION TO EL. 45.0

SHEET IDENTIFICATION NUMBER
PLATE S-7



PLAN
SCALE: 1" = 10'



SECTION (A)
SCALE: 1" = 10'

SCALE: 1" = 10'
10' 0 10' 20' 30' 40'

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

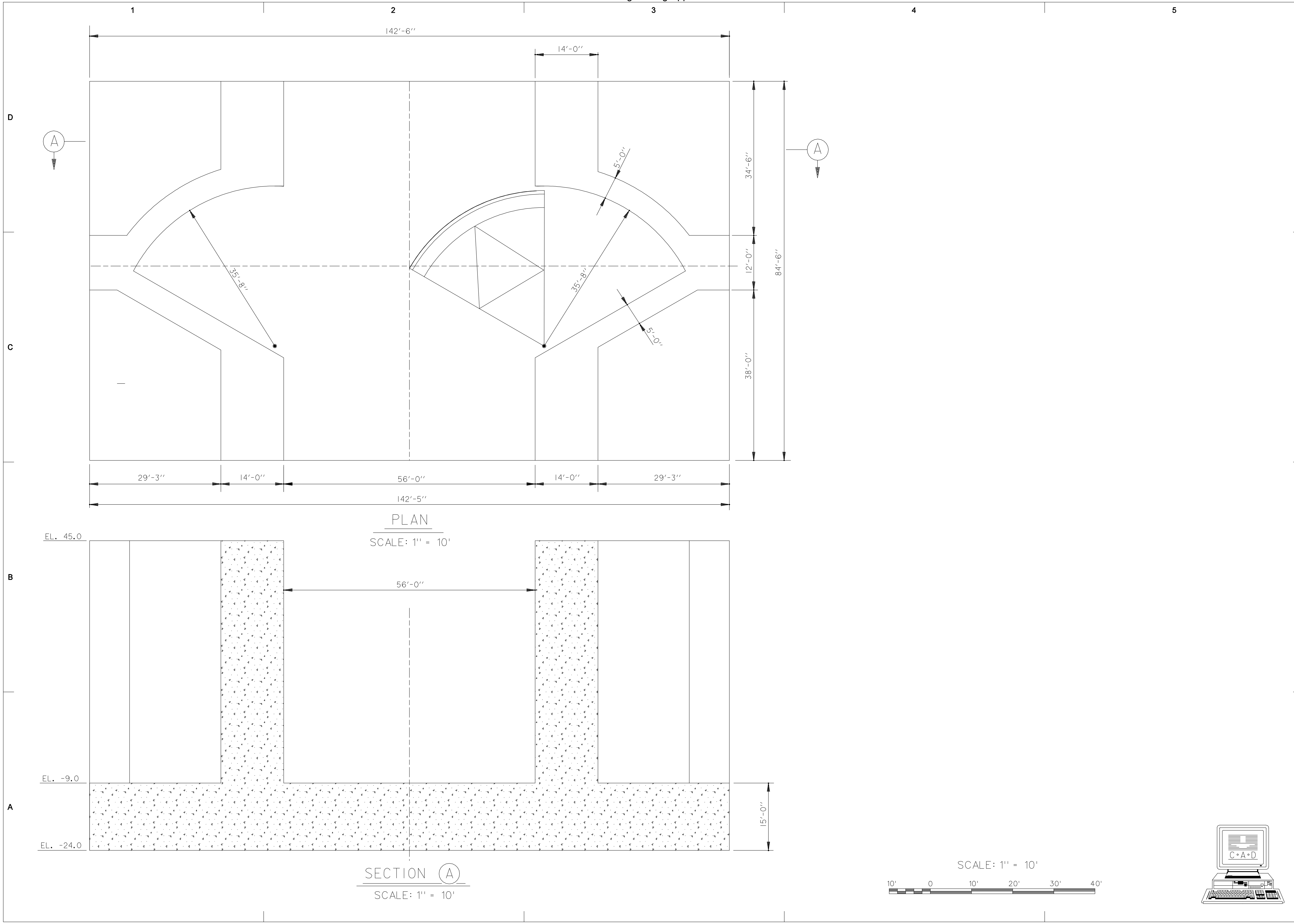
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: | DATE:
DWN BY: | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
FILE NAME: | FILE NUMBER:
SIZE: | PLOT SCALE: | PLOT DATE:

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

SECTOR GATE
56' WIDE - SILL EL. -9
PROTECTION TO EL. 30.0

SHEET IDENTIFICATION NUMBER
PLATE S-8



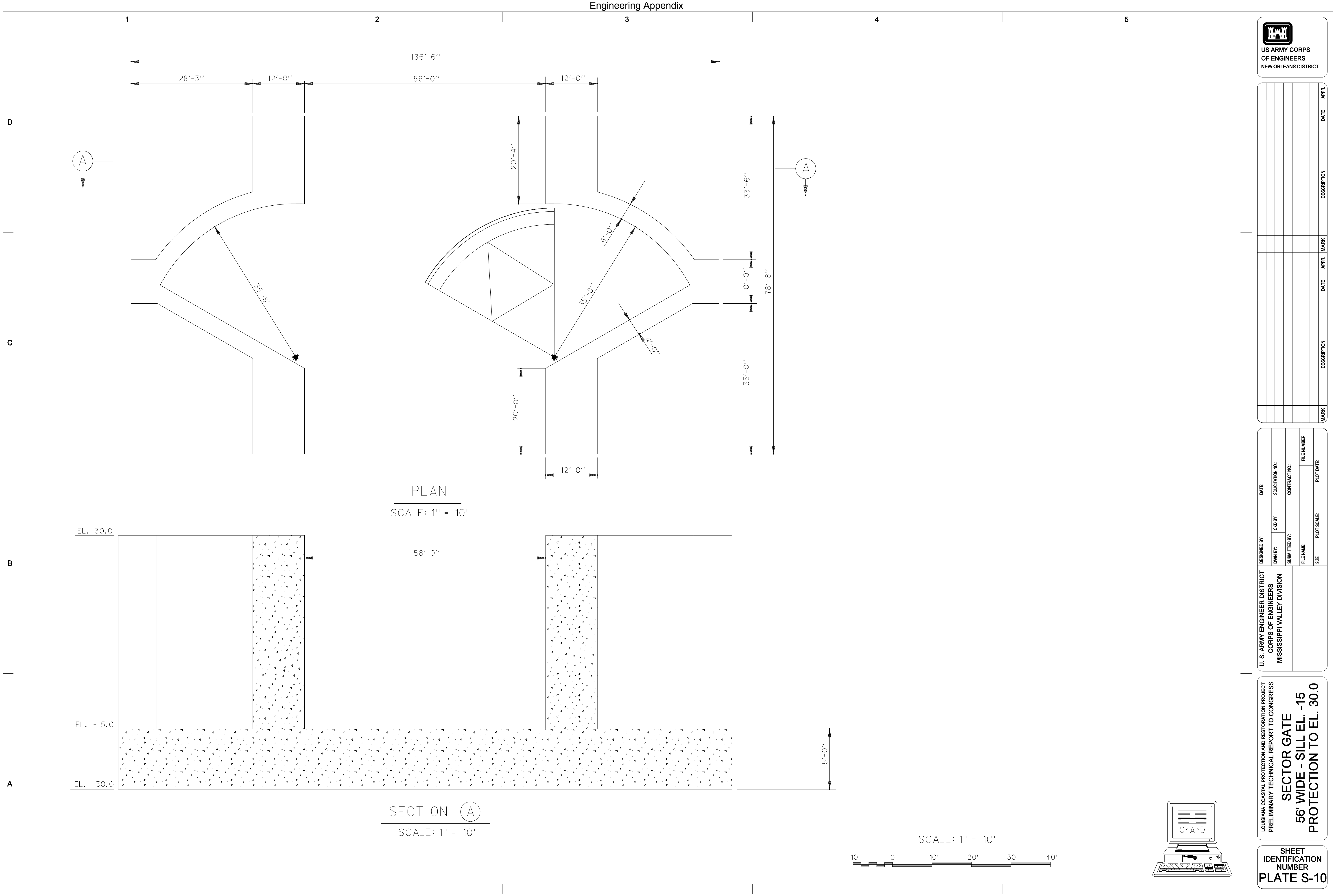
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

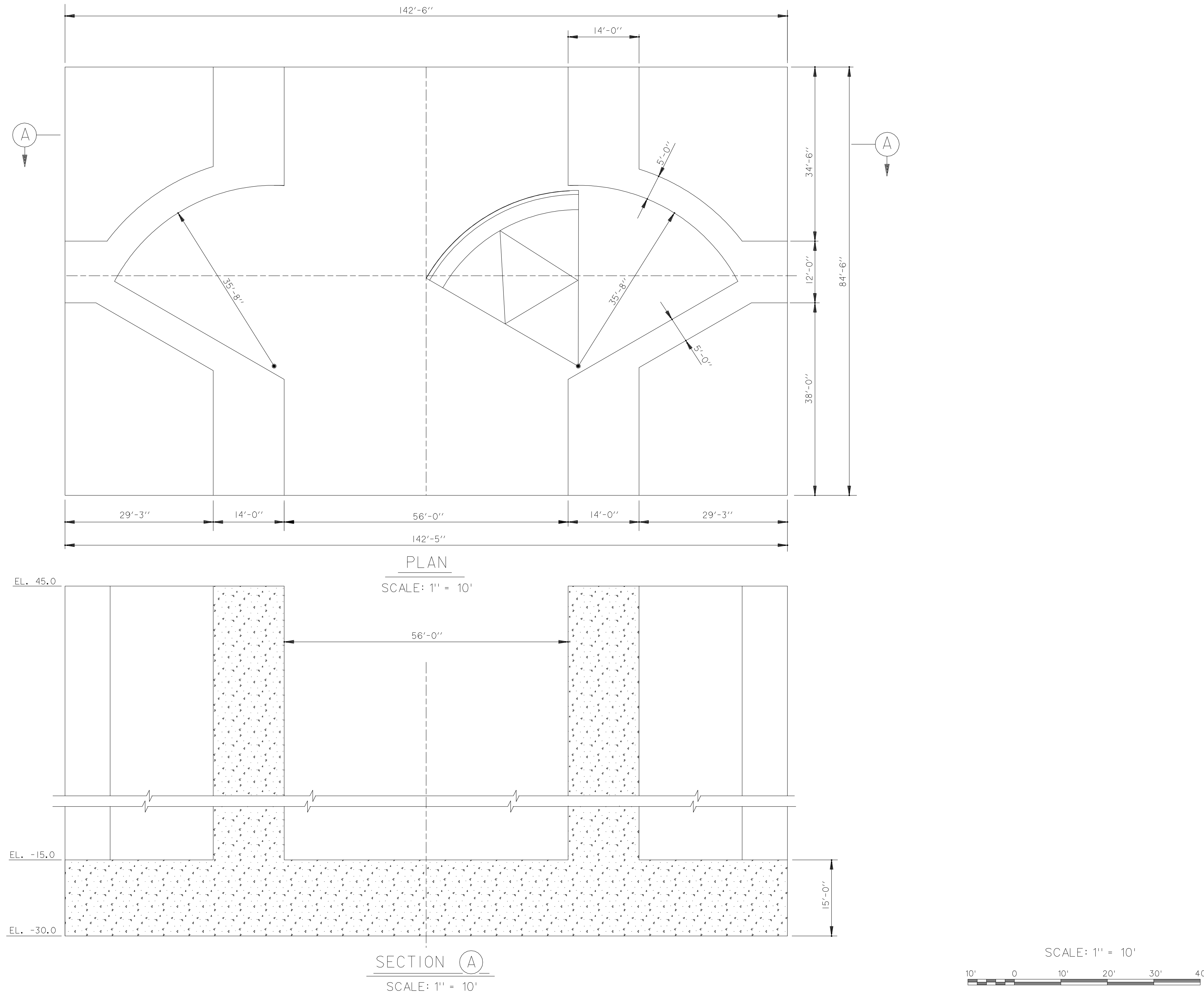
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

SECTOR GATE
56' WIDE - SILL EL. -9
PROTECTION TO EL. 45.0

SHEET IDENTIFICATION NUMBER
PLATE S-9


136'-6"
28'-3"
12'-0"
56'-0"
12'-0"
20'-4"
33'-6"
4'-0"
35'-8"
35'-8"
10'-0"
78'-6"
4'-0"
35'-0"
20'-0"
12'-0"
PLAN
SCALE: 1" = 10'
EL. 30.0
56'-0"
EL. -15.0
EL. -30.0
15'-0"
SECTION A
SCALE: 1" = 10'
SCALE: 1" = 10'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
SECTOR GATE
56' WIDE - SILL EL. -15
PROTECTION TO EL. 30.0
SHEET IDENTIFICATION NUMBER
PLATE S-10



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NEW ORLEANS DISTRICT

U. S. ARMY ENGINEER DISTRICT
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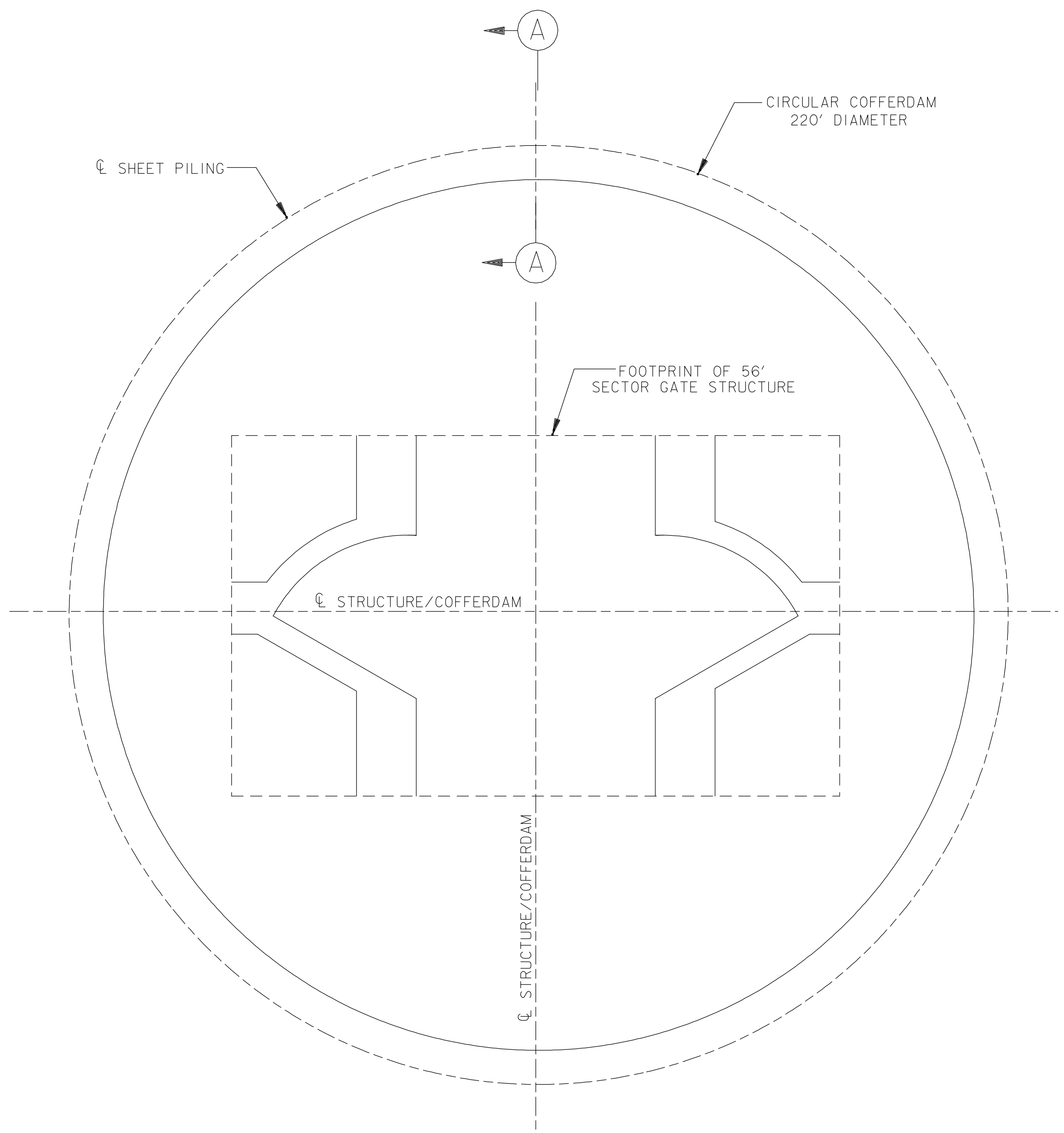
MISSISSIPPI VALLEY DIVISION

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

SECTOR GATE
56' WIDE - SILL EL. -15
PROTECTION TO EL. 45

SHEET IDENTIFICATION NUMBER
PLATE S-11

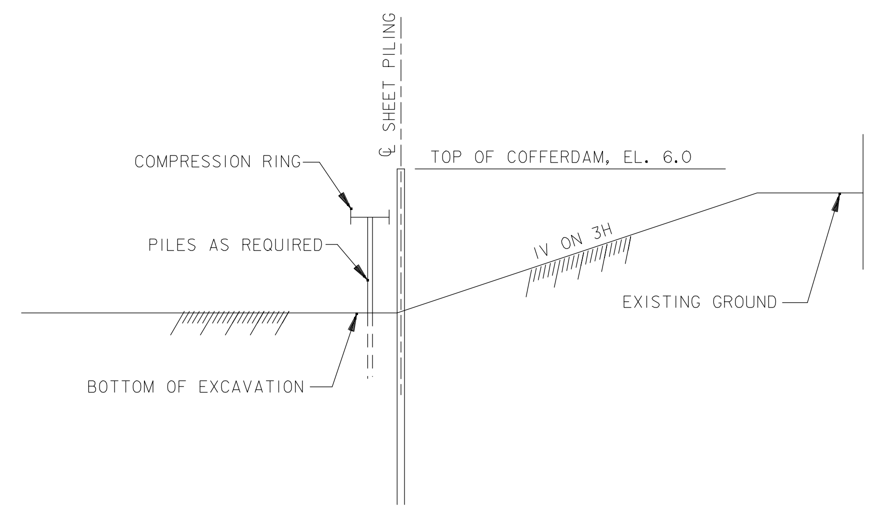


CIRCULAR COFFERDAM FOR 56' SECTOR GATES

PLAN

SCALE: 1" = 20'

20' 0 20' 40' 60' 80'



SECTION A

SCALE: 1" = 20'

20' 0 20' 40' 60' 80'

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OF ENGINEERS
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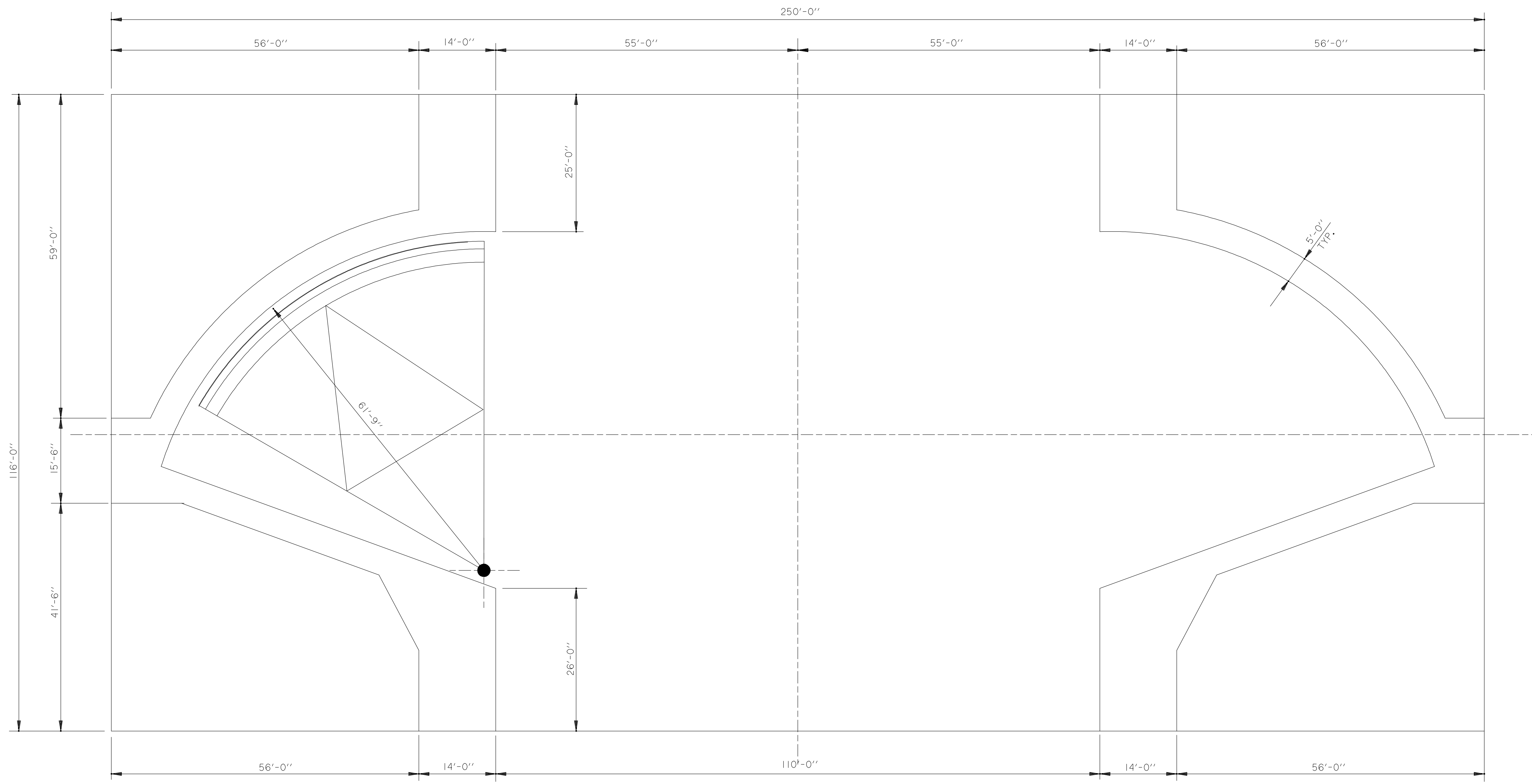
CIRCULAR COFFERDAM
56' SECTOR GATE

SHEET
IDENTIFICATION
NUMBER
PLATE S-12



110' WIDE SECTOR GATE
SILL EL. -15.0

PLAN

SCALE: 1" = 10'

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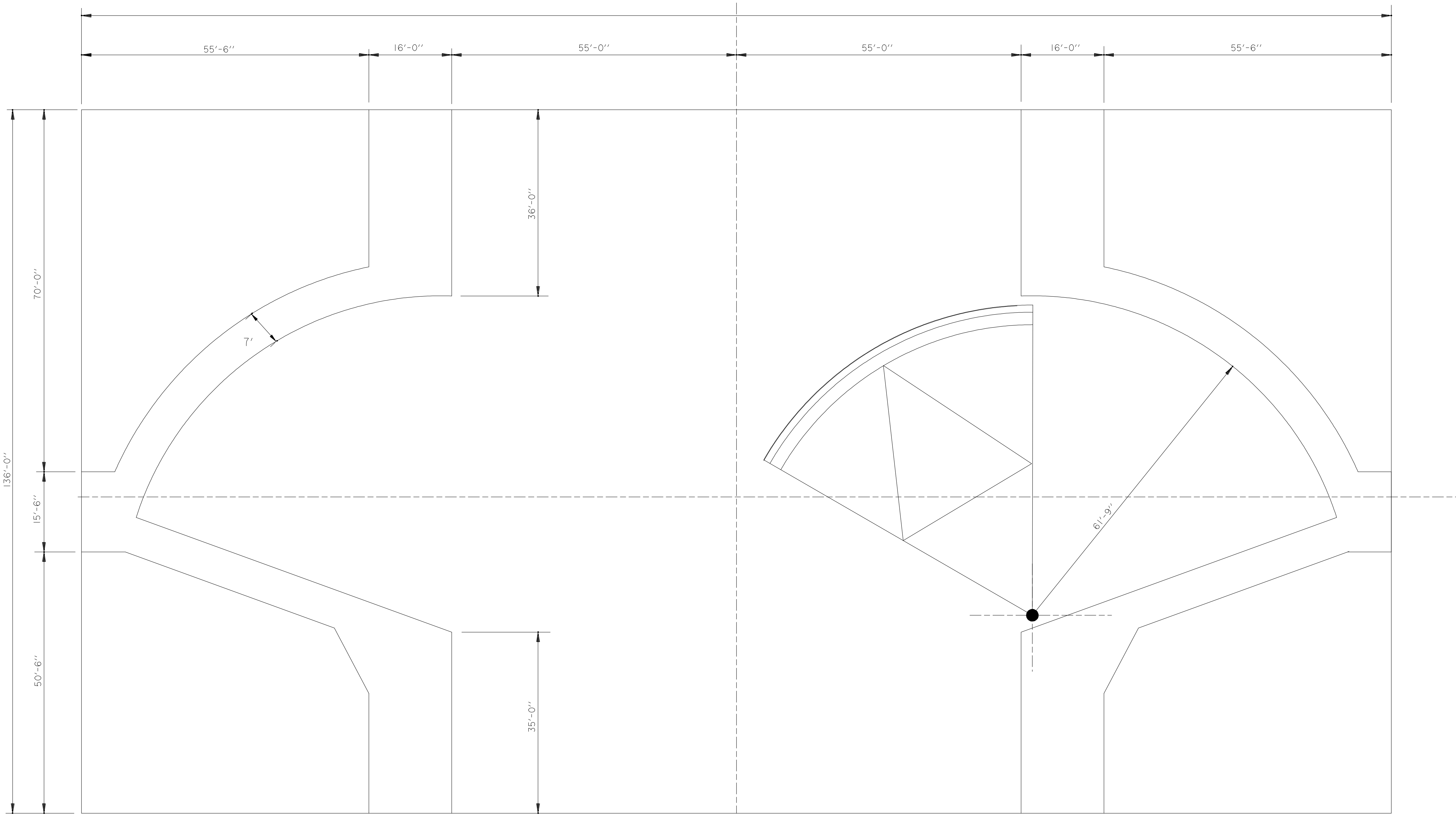
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

SECTOR GATE
110' WIDE - SILL EL. -15.0
PROTECTION TO EL. 30.0

SHEET IDENTIFICATION NUMBER
PLATE S-13



SECTOR GATE
110' WIDE - SILL EL. -15.0

PLAN

SCALE: 1" = 10'

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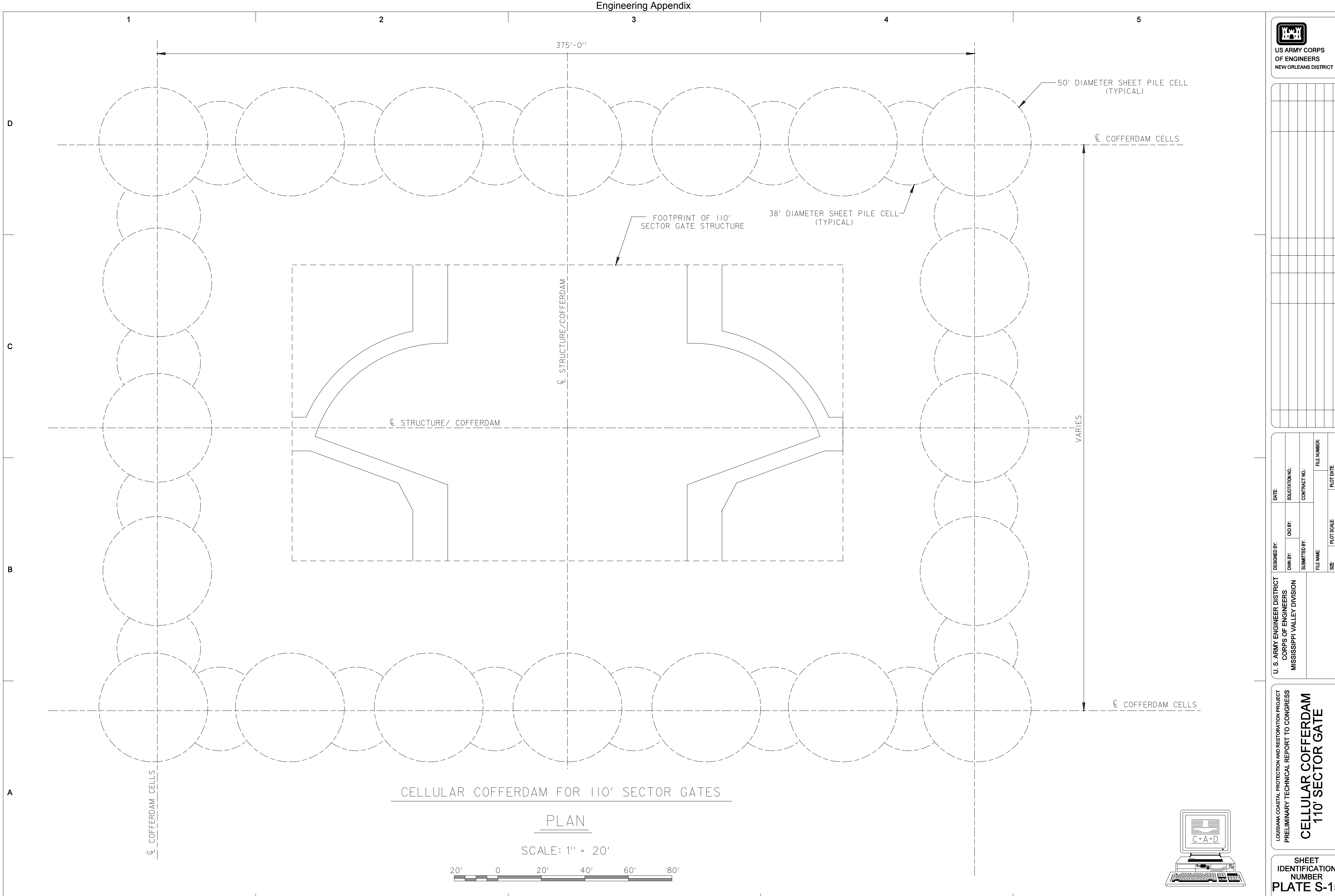
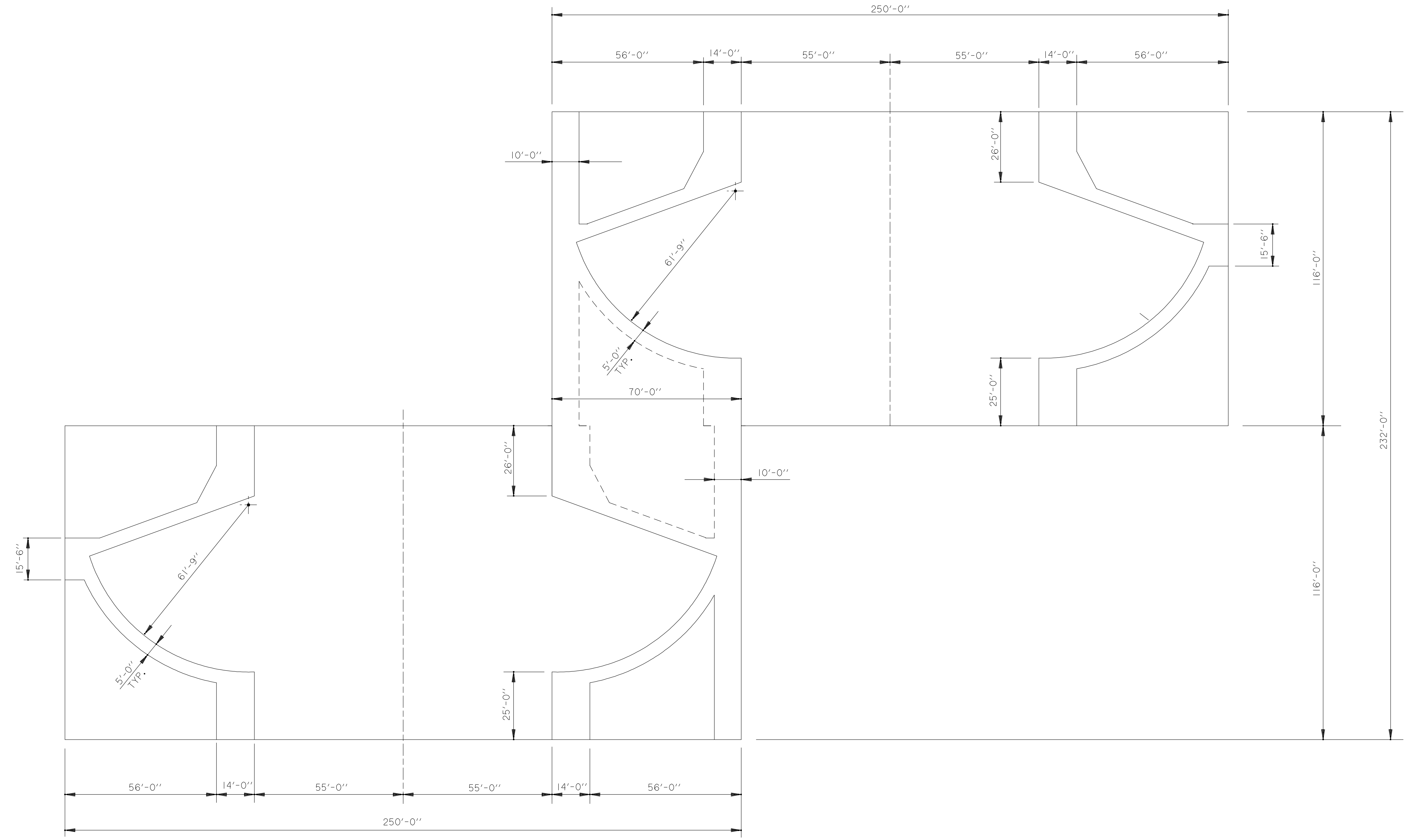
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

SECTOR GATE
110' WIDE - SILL EL. -15
PROTECTION TO EL. 45.0

SHEET IDENTIFICATION NUMBER
PLATE S-14


375'-0"
50' DIAMETER SHEET PILE CELL (TYPICAL)
℄ COFFERDAM CELLS
38' DIAMETER SHEET PILE CELL (TYPICAL)
FOOTPRINT OF 110' SECTOR GATE STRUCTURE
℄ STRUCTURE/COFFERDAM
℄ STRUCTURE/ COFFERDAM
VARIES
℄ COFFERDAM CELLS
℄ COFFERDAM CELLS
CELLULAR COFFERDAM FOR 110' SECTOR GATES
PLAN
SCALE: 1" = 20'
20' 0 20' 40' 60' 80'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
CELLULAR COFFERDAM
110' SECTOR GATE
SHEET IDENTIFICATION NUMBER
PLATE S-15



DOUBLE SECTOR GATE- 110' X 30' HIGH -15' SILL

PLAN

SCALE: 1" = 20'

20' 0 20' 40' 60' 80'

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

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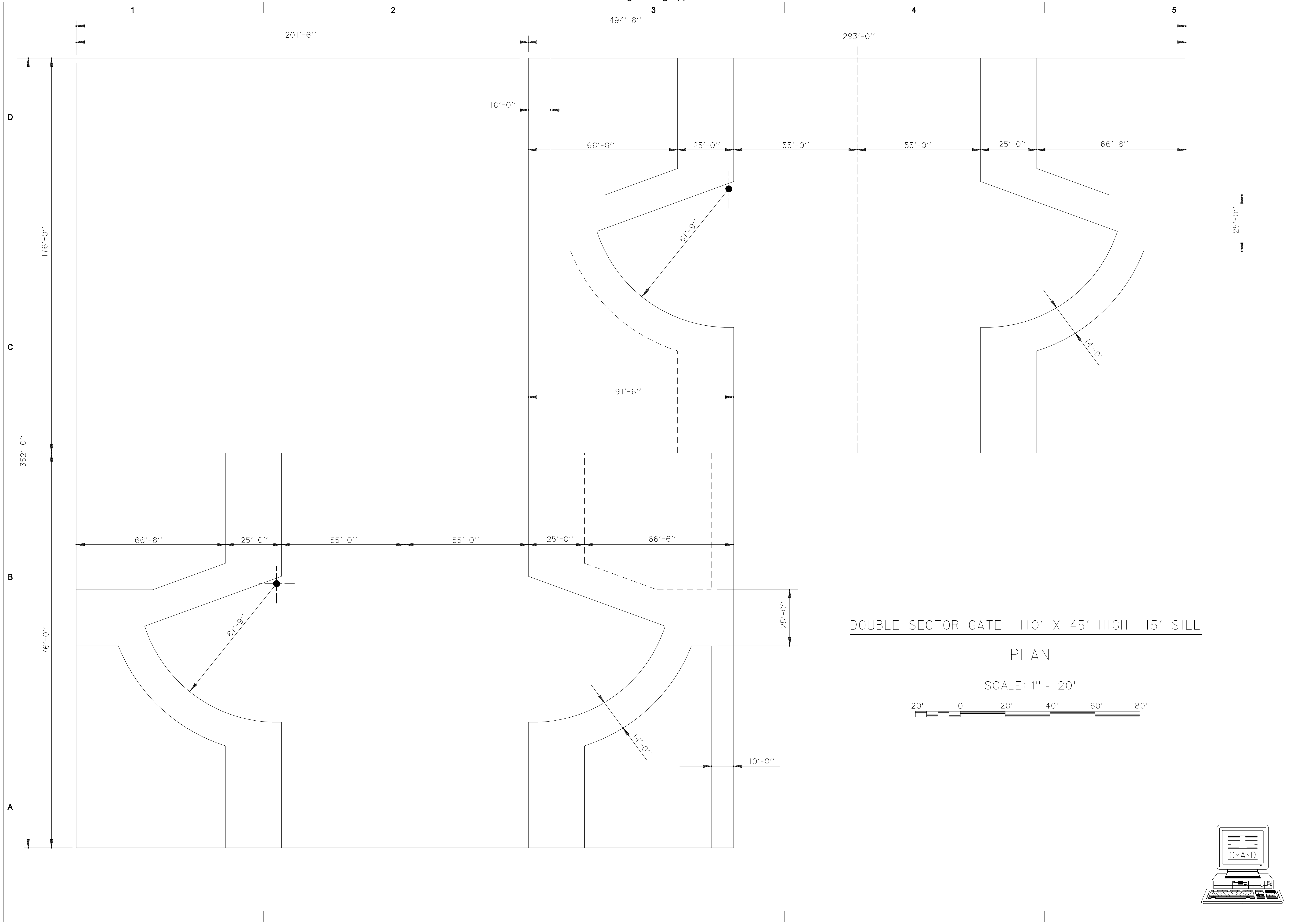
FILE NAME: | PLOT SCALE: | PLOT DATE: | FILE NUMBER:
SIZE:

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

DOUBLE SECTOR GATE
110' WIDE - SILL EL. -15.0
PROTECTION TO EL. 30.0

SHEET IDENTIFICATION NUMBER
PLATE S-16



DOUBLE SECTOR GATE- 110' X 45' HIGH -15' SILL

PLAN

SCALE: 1" = 20'

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MISSISSIPPI VALLEY DIVISION

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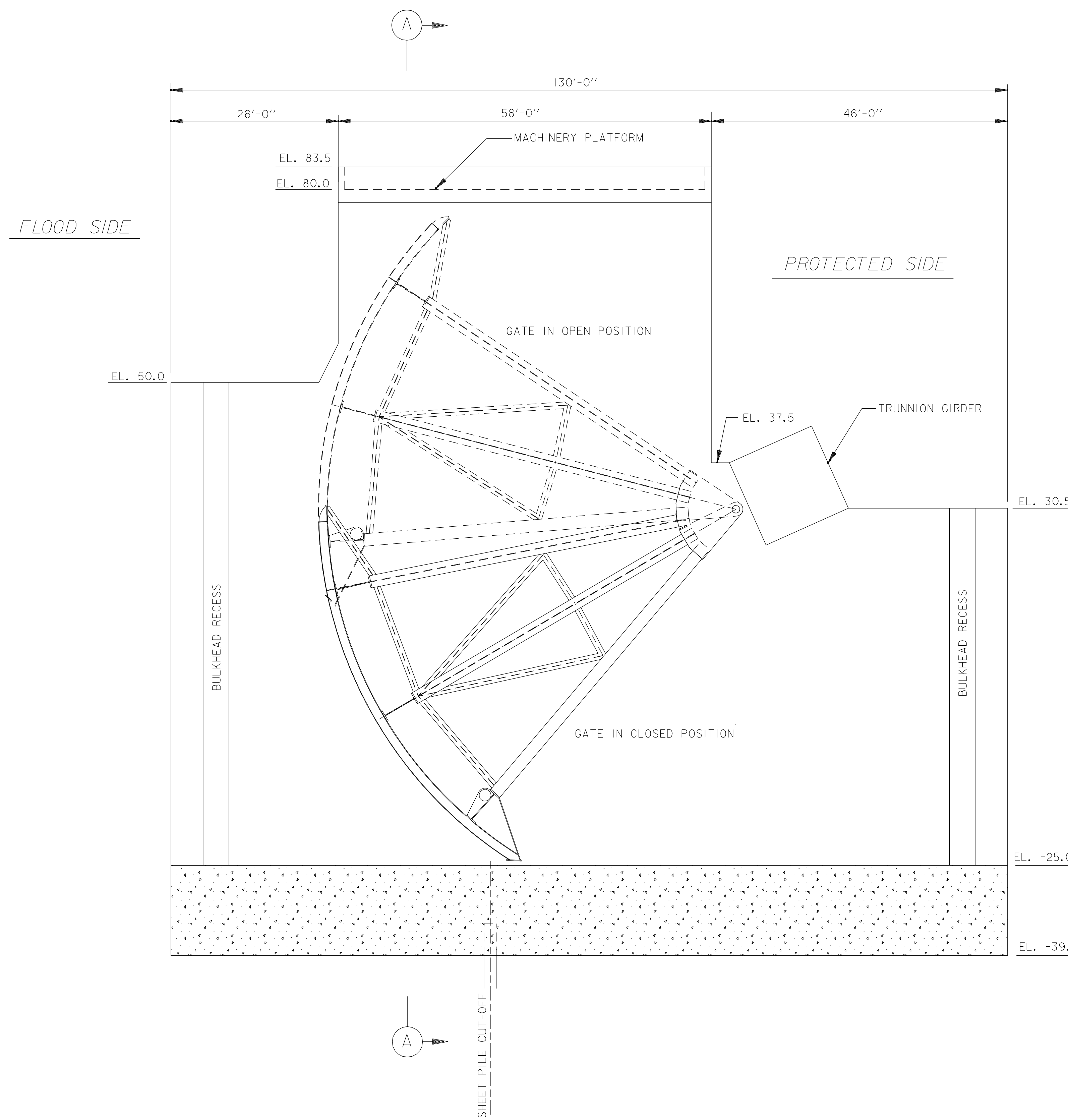
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

DOUBLE SECTOR GATE
110' WIDE - SILL EL. -15.0
PROTECTION TO EL. 45.0

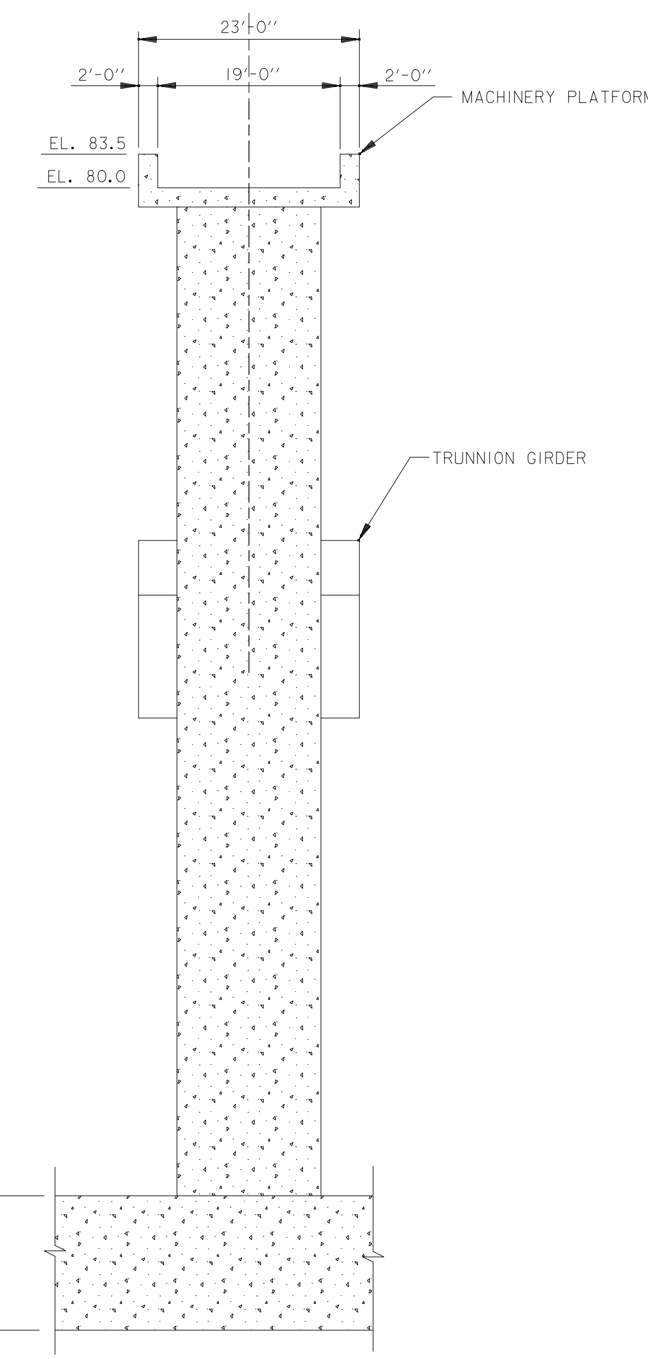
SHEET IDENTIFICATION NUMBER
PLATE S-17



TYPICAL TAINTER GATE STRUCTURE

SCALE: 1" = 10'

10' 0 10' 20' 30' 40'



SECTION A

SCALE: 1" = 10'

10' 0 10' 20' 30' 40'

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

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CORPS OF ENGINEERS
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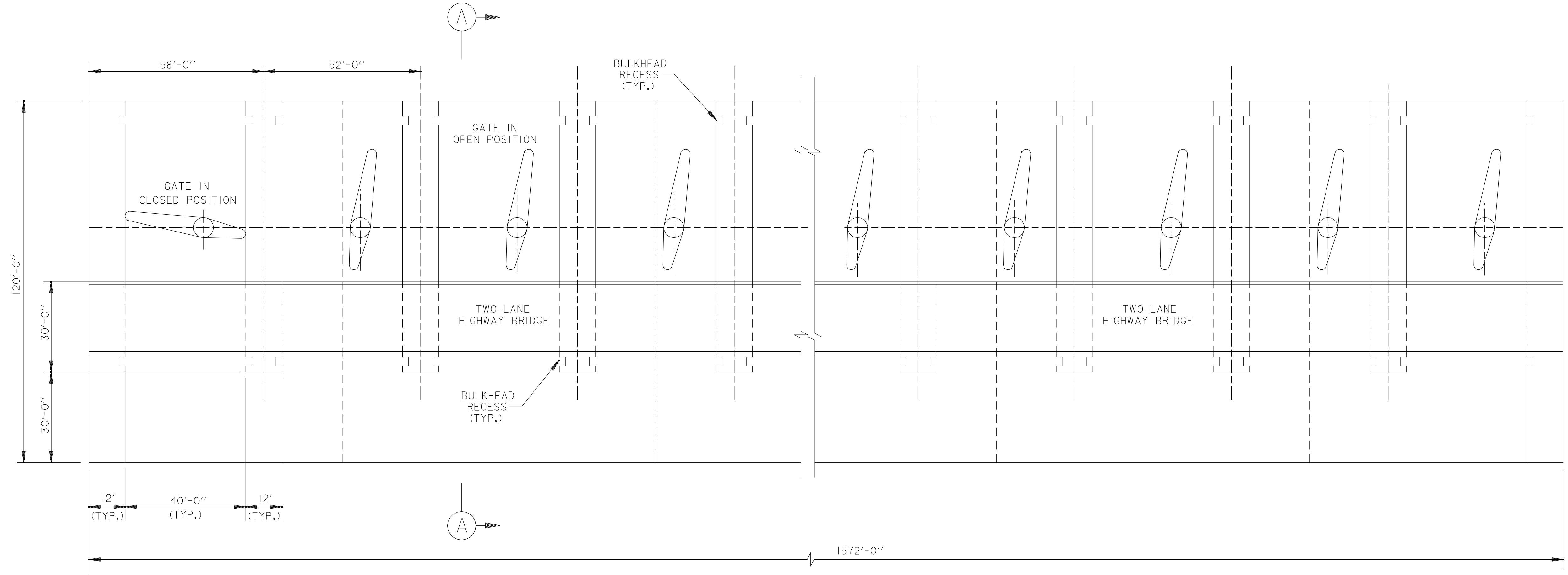
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

TAINER GATE STRUCTURE
PROTECTION TO EL. 30.0

SHEET IDENTIFICATION NUMBER
PLATE S-18

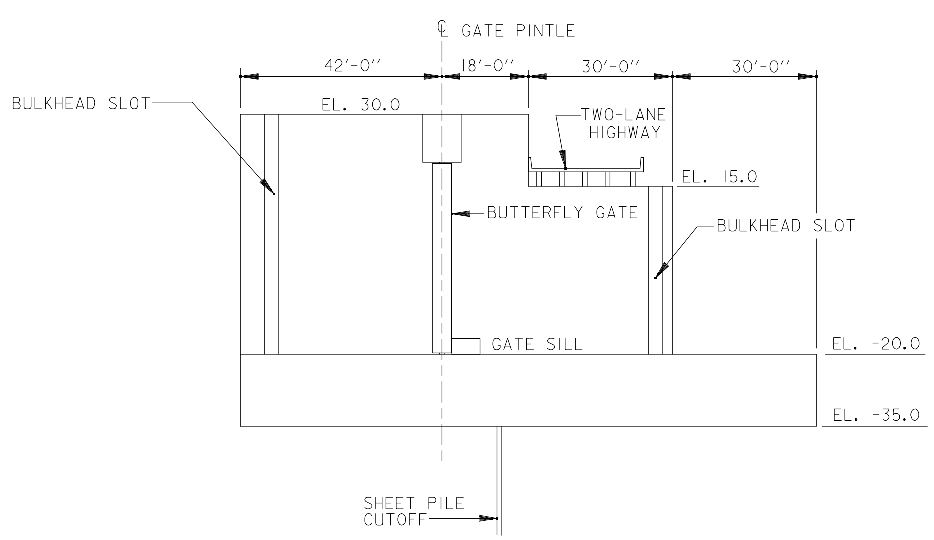


PLAN BELOW EL. 20.0

BUTTERFLY GATED STRUCTURE

SCALE: 1" = 20'

20' 0 20' 40' 60' 80'



SECTION (A)

SCALE: 1" = 20'

20' 0 20' 40' 60' 80'

US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

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MARK	DESCRIPTION	DATE	APPR.

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CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

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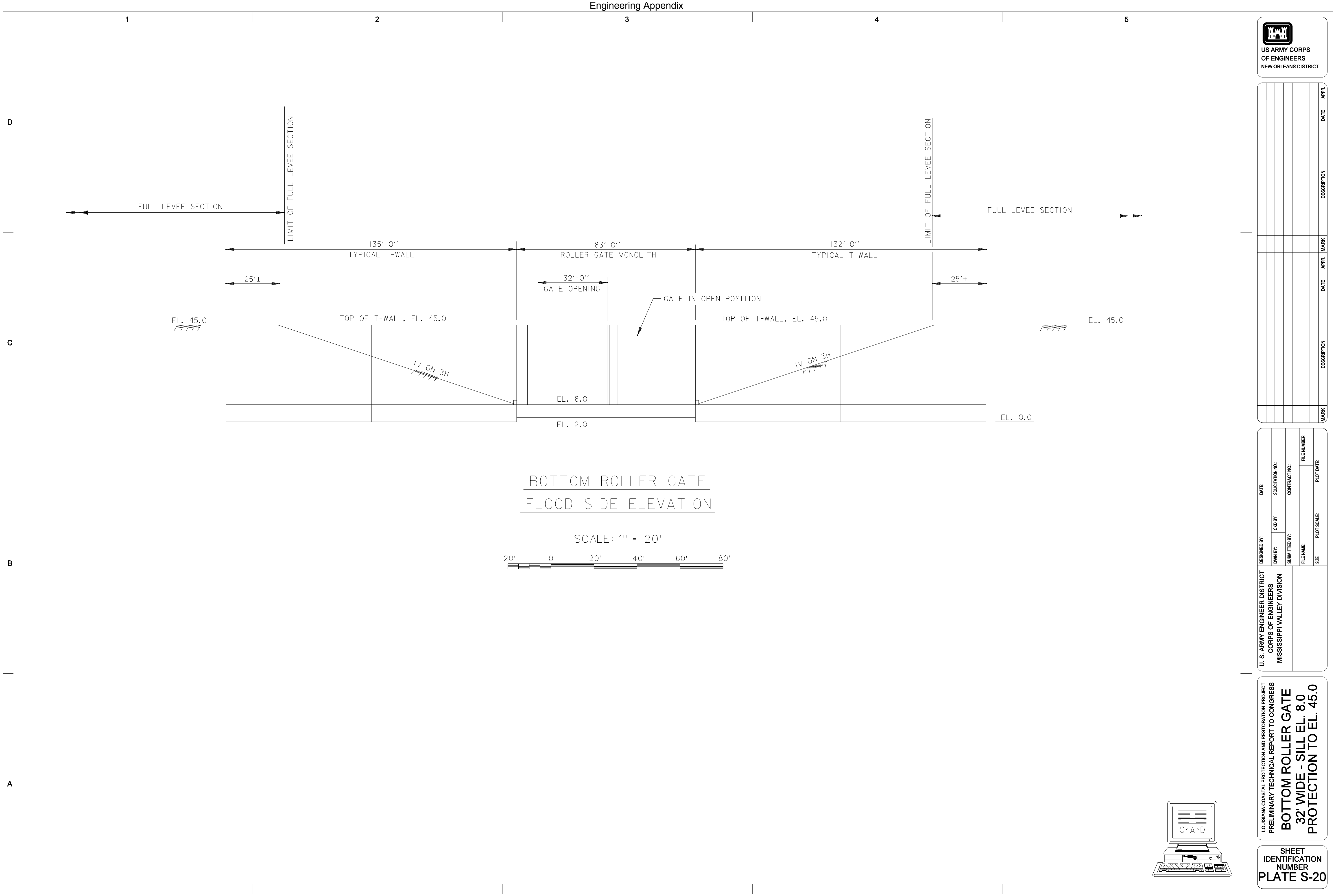
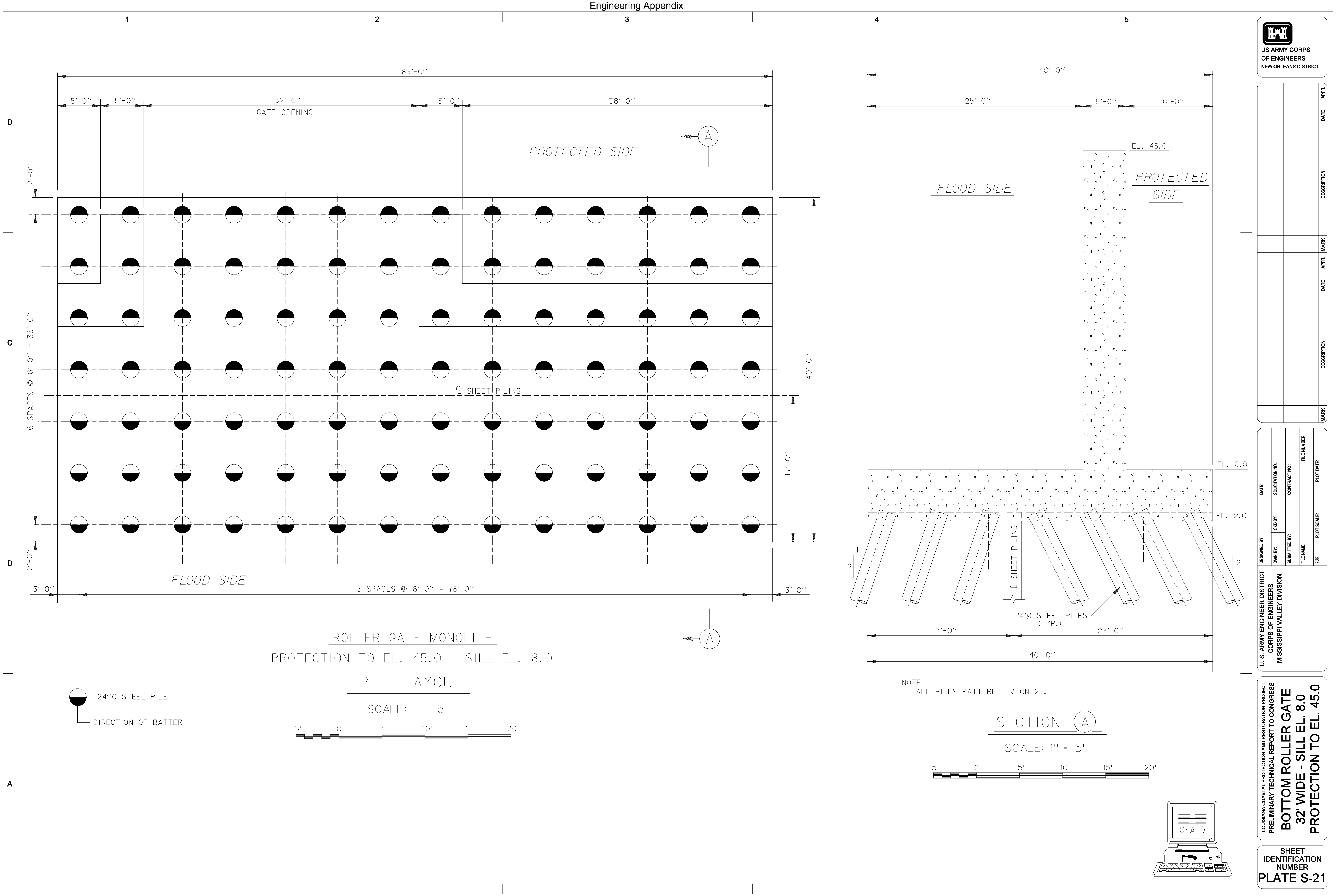
DWN BY: | SOLICITATION NO.:
SUBMITTED BY: | CONTRACT NO.:
FILE NAME: | PLOT SCALE: | PLOT DATE: | FILE NUMBER:
SIZE:

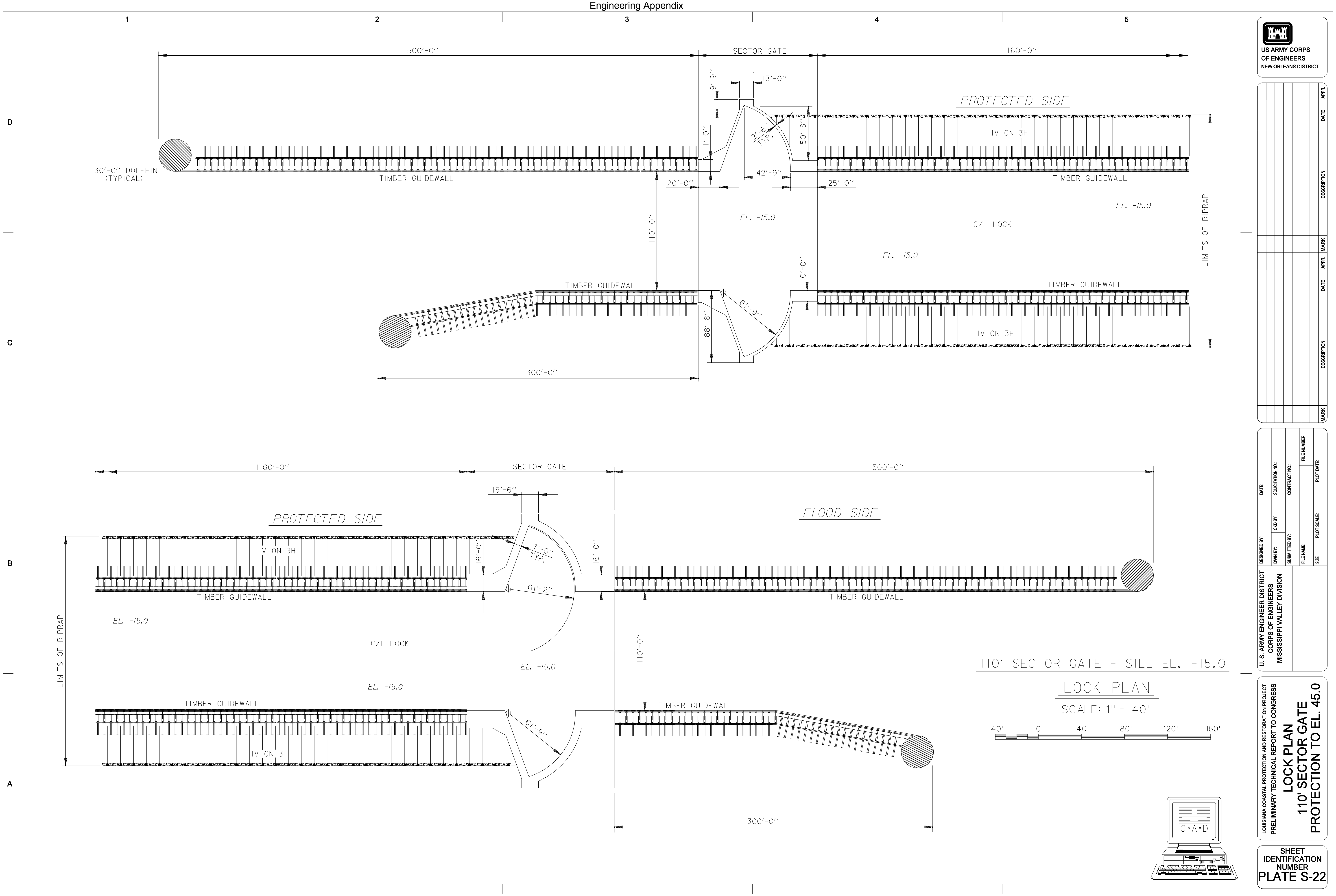
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

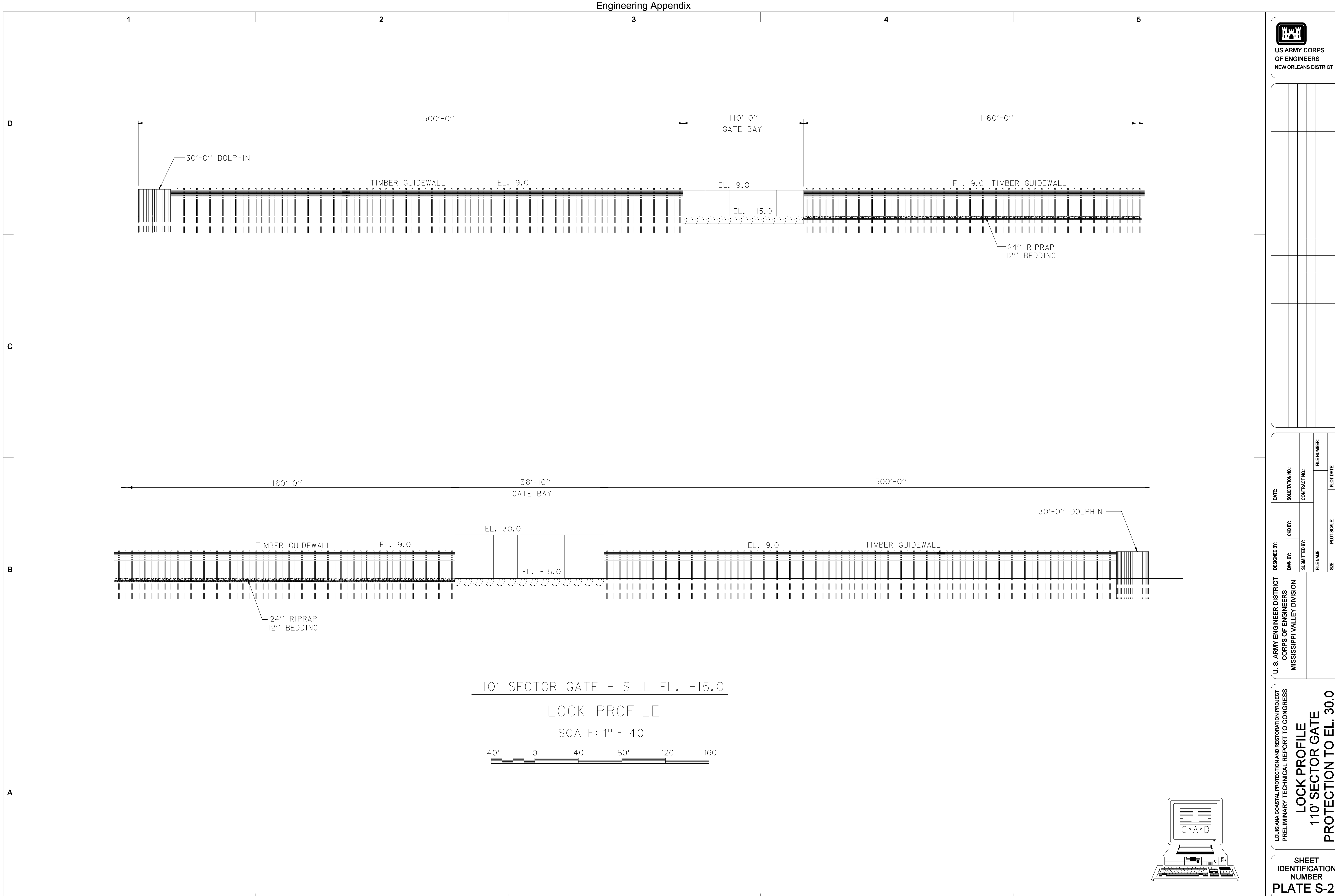
BUTTERFLY GATED STRUCTURE PLAN AND SECTION

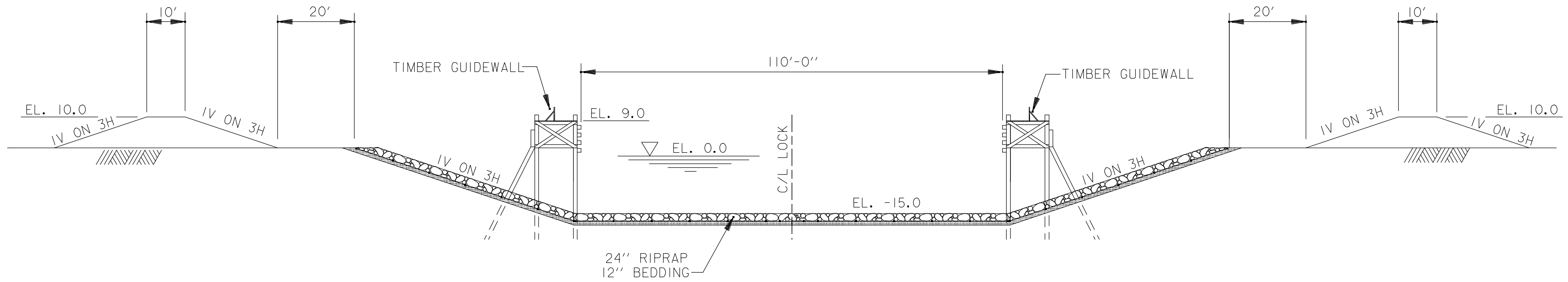
SHEET IDENTIFICATION NUMBER
PLATE S-19


FULL LEVEE SECTION
LIMIT OF FULL LEVEE SECTION
135'-0"
TYPICAL T-WALL
83'-0"
ROLLER GATE MONOLITH
132'-0"
TYPICAL T-WALL
25'±
32'-0"
GATE OPENING
GATE IN OPEN POSITION
EL. 45.0
TOP OF T-WALL, EL. 45.0
1V ON 3H
EL. 8.0
EL. 2.0
EL. 0.0
BOTTOM ROLLER GATE
FLOOD SIDE ELEVATION
SCALE: 1" = 20'
20' 0 20' 40' 60' 80'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
BOTTOM ROLLER GATE
32' WIDE - SILL EL. 8.0
PROTECTION TO EL. 45.0
SHEET IDENTIFICATION NUMBER
PLATE S-20


83'-0"
5'-0"
5'-0"
32'-0"
GATE OPENING
5'-0"
36'-0"
PROTECTED SIDE
A
2'-0"
6 SPACES @ 6'-0" = 36'-0"
40'-0"
℄ SHEET PILING
17'-0"
2'-0"
FLOOD SIDE
3'-0"
13 SPACES @ 6'-0" = 78'-0"
3'-0"
ROLLER GATE MONOLITH
PROTECTION TO EL. 45.0 - SILL EL. 8.0
PILE LAYOUT
SCALE: 1" = 5'
24"Ø STEEL PILE
DIRECTION OF BATTER
5' 0 5' 10' 15' 20'
40'-0"
25'-0"
5'-0"
10'-0"
EL. 45.0
FLOOD SIDE
PROTECTED SIDE
EL. 8.0
EL. 2.0
℄ SHEET PILING
2
2
24'Ø STEEL PILES (TYP.)
17'-0"
23'-0"
40'-0"
NOTE:
ALL PILES BATTERED 1V ON 2H.
SECTION A
SCALE: 1" = 5'
5' 0 5' 10' 15' 20'
C•A•D
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
MARK
DESCRIPTION
DATE
APPR.
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
DESIGNED BY:
DWN BY:
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NAME:
FILE NUMBER:
PLOT DATE:
PLOT SCALE:
SIZE:
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
BOTTOM ROLLER GATE
32' WIDE - SILL EL. 8.0
PROTECTION TO EL. 45.0
SHEET IDENTIFICATION NUMBER
PLATE S-21


500'-0"
SECTOR GATE
1160'-0"
PROTECTED SIDE
IV ON 3H
30'-0" DOLPHIN (TYPICAL)
TIMBER GUIDEWALL
EL. -15.0
C/L LOCK
LIMITS OF RIPRAP
300'-0"
FLOOD SIDE
110' SECTOR GATE - SILL EL. -15.0
LOCK PLAN
SCALE: 1" = 40'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
LOCK PLAN
110' SECTOR GATE
PROTECTION TO EL. 45.0
SHEET IDENTIFICATION NUMBER
PLATE S-22

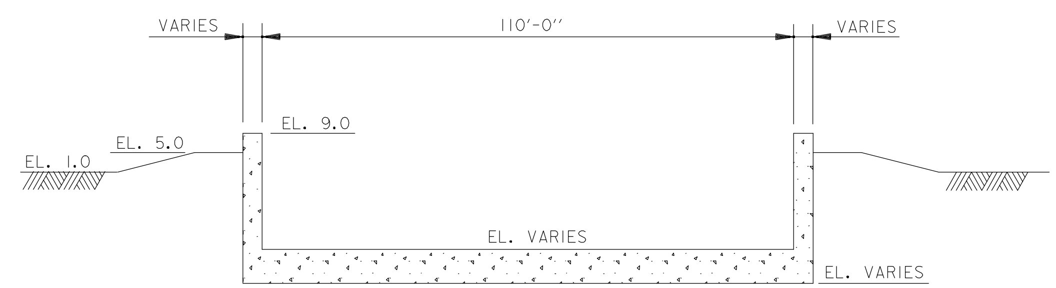

500'-0"
110'-0"
GATE BAY
1160'-0"
30'-0" DOLPHIN
TIMBER GUIDEWALL
EL. 9.0
EL. -15.0
24" RIPRAP
12" BEDDING
136'-10"
EL. 30.0
110' SECTOR GATE - SILL EL. -15.0
LOCK PROFILE
SCALE: 1" = 40'
40' 0 40' 80' 120' 160'
US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS
LOCK PROFILE
110' SECTOR GATE
PROTECTION TO EL. 30.0
SHEET IDENTIFICATION NUMBER
PLATE S-23



EARTH CHAMBER SECTION

SCALE: 1" = 20'

20' 0 20' 40' 60' 80'



CONCRETE CHAMBER SECTION

SCALE: 1" = 20'

20' 0 20' 40' 60' 80'

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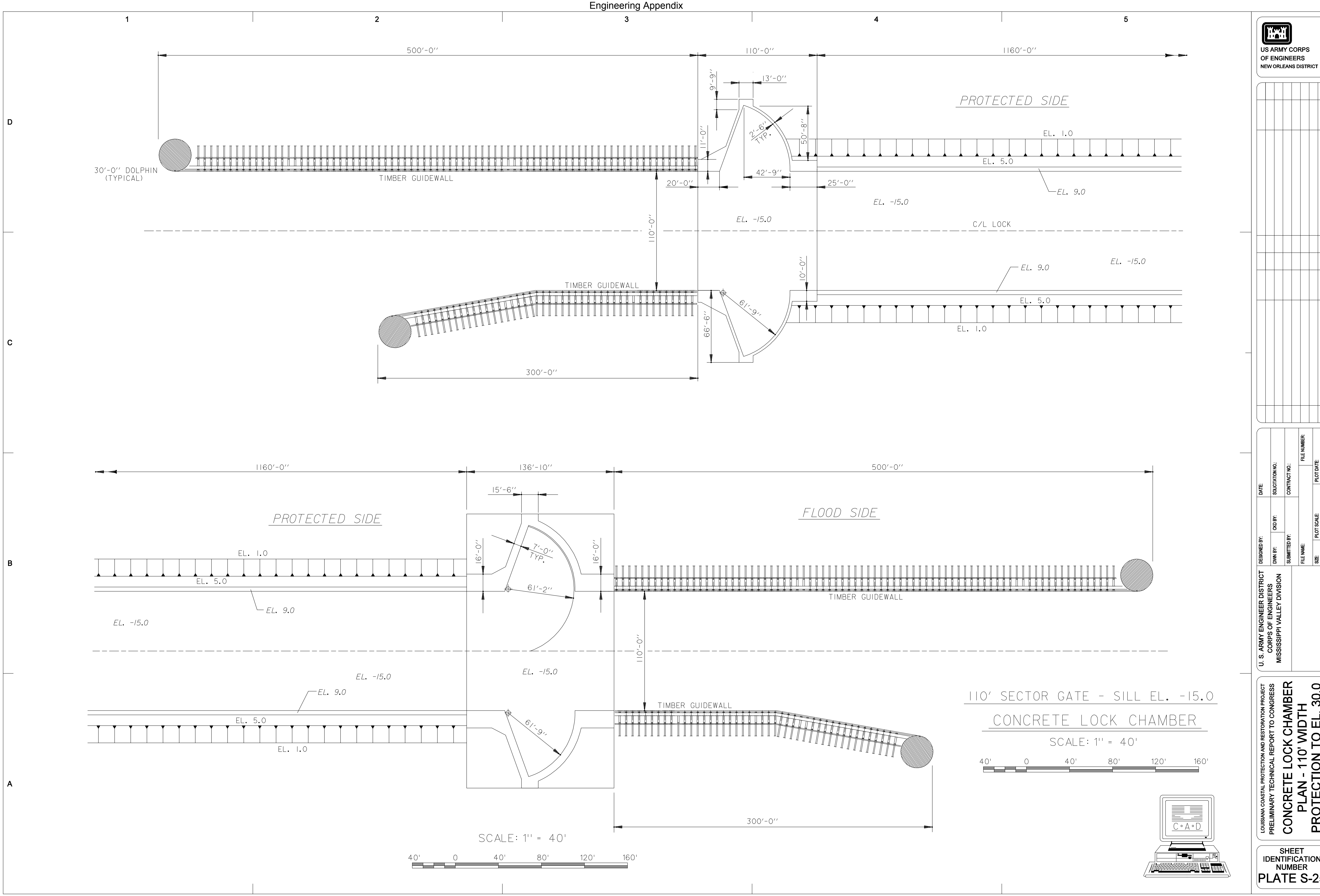
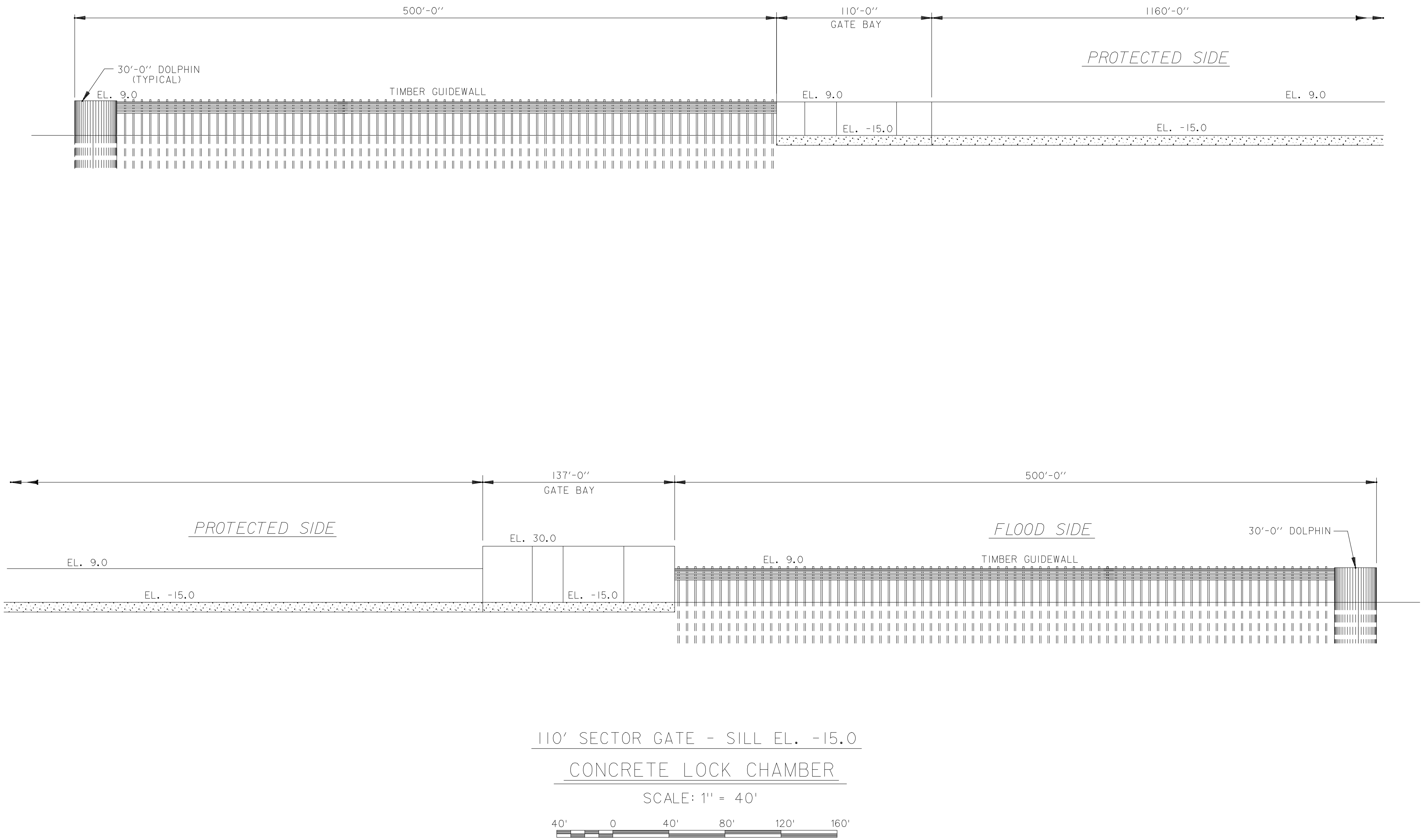
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

LOCK CHAMBER SECTIONS
110' WIDTH

SHEET IDENTIFICATION NUMBER
PLATE S-24


US ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT
PROTECTED SIDE
FLOOD SIDE
30'-0'' DOLPHIN (TYPICAL)
TIMBER GUIDEWALL
C/L LOCK
EL. 1.0
EL. 5.0
EL. 9.0
EL. -15.0
500'-0''
110'-0''
1160'-0''
136'-10''
300'-0''
110' SECTOR GATE - SILL EL. -15.0
CONCRETE LOCK CHAMBER
SCALE: 1'' = 40'
U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION
LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT PRELIMINARY TECHNICAL REPORT TO CONGRESS
CONCRETE LOCK CHAMBER PLAN - 110' WIDTH PROTECTION TO EL. 30.0
SHEET IDENTIFICATION NUMBER
PLATE S-25



US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

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MARK	DESCRIPTION	DATE	APPR.

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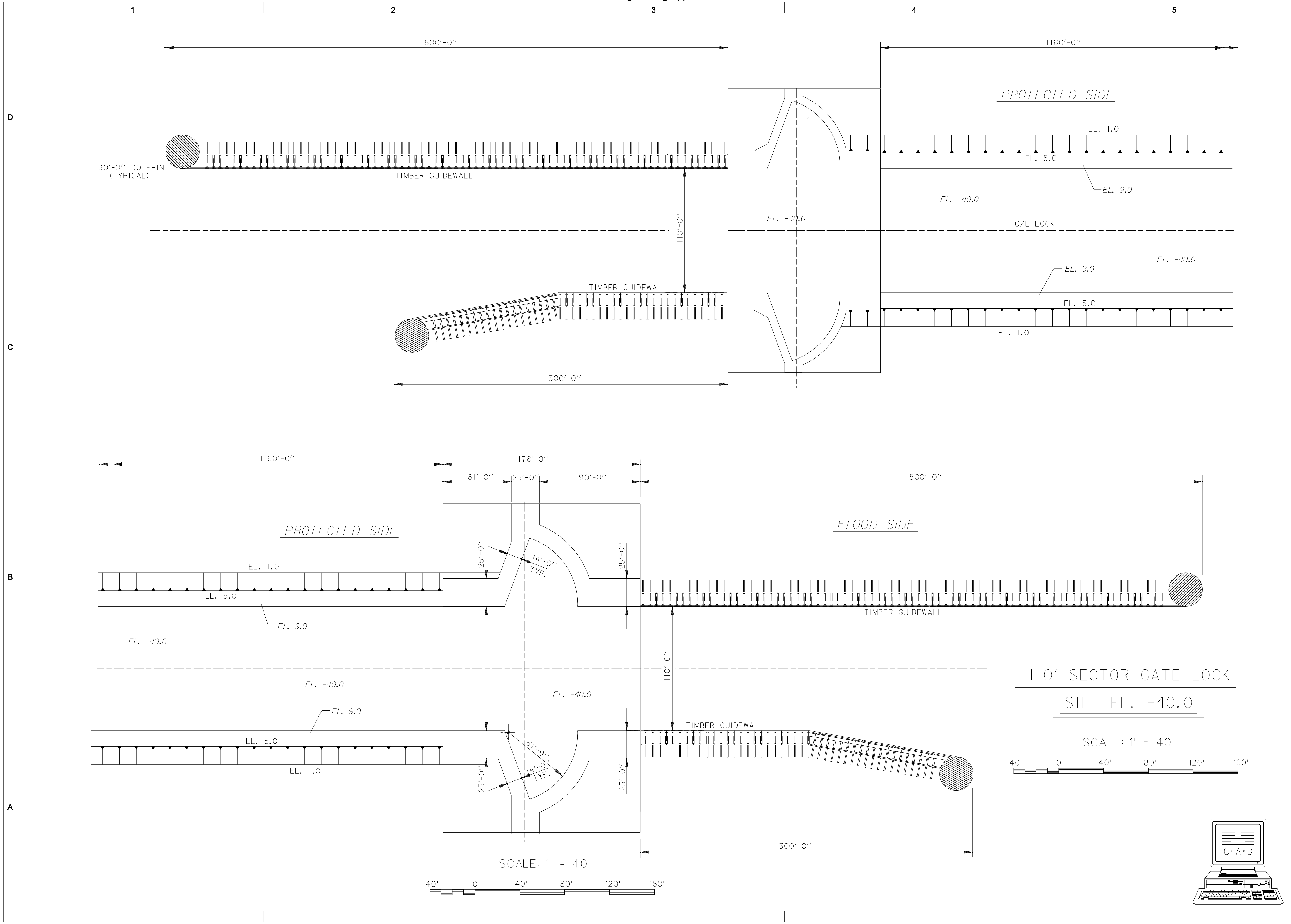
FILE NAME: FILE NUMBER:
SIZE: PLOT SCALE: PLOT DATE:

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

CONCRETE LOCK CHAMBER ELEVATION - 110' WIDTH PROTECTION TO EL. 30.0

SHEET IDENTIFICATION NUMBER
PLATE S-26



US ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

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MARK	DESCRIPTION	DATE	APPR.

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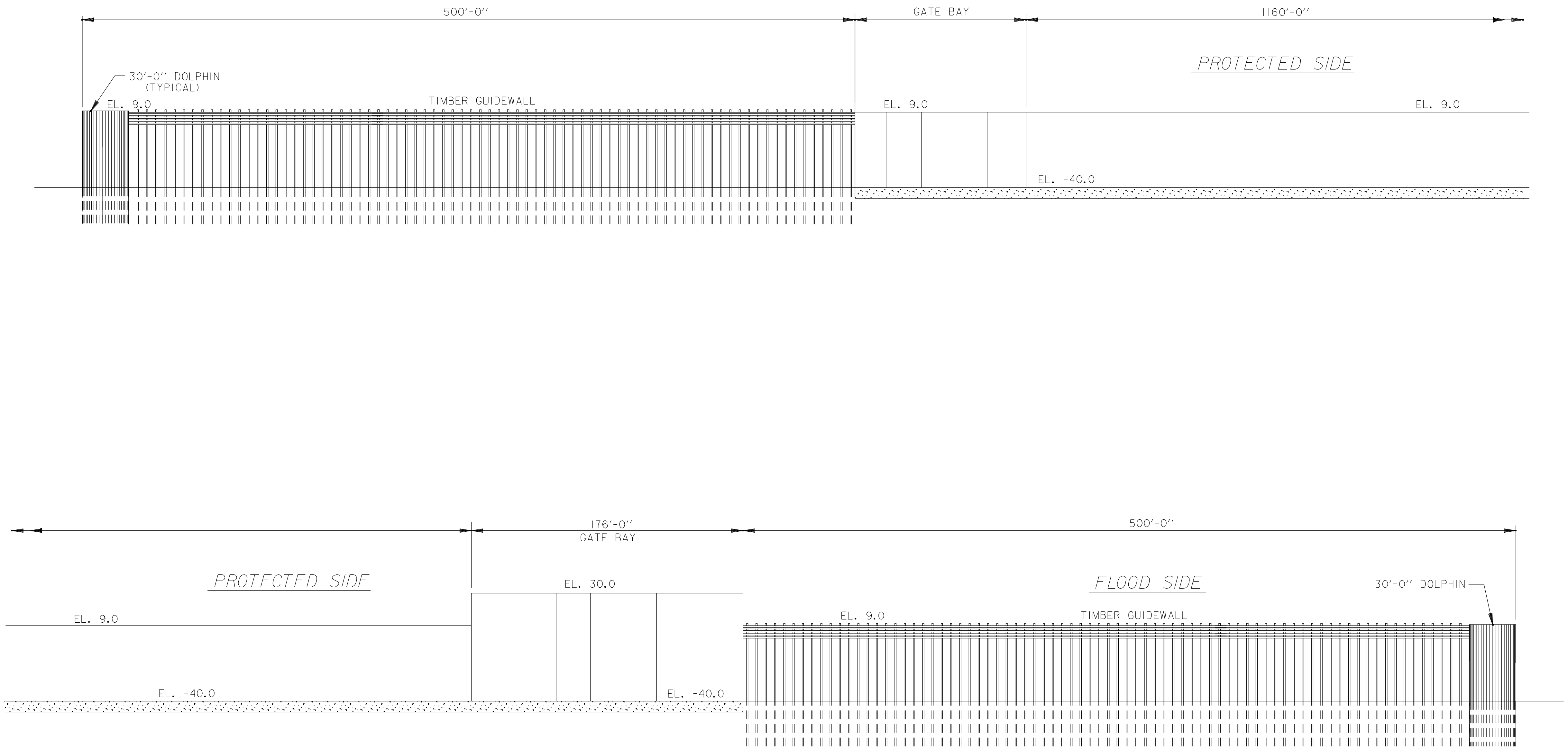
FILE NAME: | FILE NUMBER:
SIZE: | PLOT SCALE: | PLOT DATE:

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

CONCRETE LOCK CHAMBER PLAN - 110' WIDTH PROTECTION AT EL. 45.0

SHEET IDENTIFICATION NUMBER
PLATE S-27



110' SECTOR GATE LOCK

SILL EL. -40.0

SCALE: 1" = 40'

40' 0 40' 80' 120' 160'

US ARMY CORPS OF ENGINEERS
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MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY ENGINEER DISTRICT
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MISSISSIPPI VALLEY DIVISION

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FILE NAME: | FILE NUMBER:
SIZE: | PLOT SCALE: | PLOT DATE:

LOUISIANA COASTAL PROTECTION AND RESTORATION PROJECT
PRELIMINARY TECHNICAL REPORT TO CONGRESS

CONCRETE LOCK CHAMBER ELEVATION - 110' WIDTH PROTECTION TO EL. 30.0

C•A•D

SHEET IDENTIFICATION NUMBER
PLATE S-28

ANNEX 1

COASTAL RESTORATION FEATURES

ANNEX 1
COASTAL RESTORATION FEATURES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

ANNEX 1
COASTAL RESTORATION FEATURES

GENERAL

A group of coastal restoration measures were developed by the Habitiat Evaluation Team (HET). These measures were put together to develop alternative coastal restoration plans. The goal of these coastal restoration plans is to sustain the current coastline to maintain the current level of hurricane and storm damage risk reduction. Details of how these measures and alternatives were developed can be found in the Coastal Restoration Plan Component Appendix.

One of the alternative plans was selected as a representative plan for use in the Multi Criteria Decision Making Analysis (MCDA). Designs and costs were developed for those measures contained in the representative plan. A list of those measures is shown in table 1 below and shown on figures 1-5. These measures are described in detail in the paragraphs below. Measures are divided by Planning Units as shown in figures 1-5. These Planning Units are described in detail in the Background section of the Engineering Appendix.

Table 1 - Coastal Restoration Plan Component – Representative Plan Features

Figure #	Map ID #	Measure
Planning Unit 1 – Alternative R2 (Pulsed Diversion)		
1	2-1	Blind River Diversion
1	2-2	Hope Canal Diversion
1	2-3	Labranche Diversion
1	2-4	Bayou Bienvenue Diversion
1	2-5	East New Orleans Land Bridge Marsh Creation
1	2-6	Bayou LaLoutre Diversion
1	2-7	Biloxi Marshes Shore Protection
1	2-8	Biloxi Marshes Marsh Creation
1	2-9	Bayou Terre aux Bouefs Diversion
1	2-10	Bayou Terre aux Bouefs Marsh Creation
1	2-11	Breton Sound Strategic Land Bridge
1	2-12	Caernarvon Diversion
1	2-13	Caernarvon Area Marsh Creation
1	2-14	Bayou Lamoque Diversion
1	2-15	Grand Bay Diversion
Planning Unit 2 – Alternative R2 (Pulsed Diversion)		
2	2-1	Lagan Diversion

Table 1 - Coastal Restoration Plan Component – Representative Plan Features		
Figure #	Map ID #	Measure
2	2-2	Edgard Diversion
2	2-3	Davis Pond Freshwater Diversion Reauthorization
2	2-4	Naomi Diversion
2	2-5	Myrtle Grove Diversion
2	2-6	Strategic Marsh Creation in Lower Basin
2	2-7	North Bay Rim Marsh Creation /Protection
2	2-8	West Point a la Hache Diversion
2	2-9	Port Sulphur Diversion
2	2-10	Buras Diversion
2	2-11	Fort Jackson Diversion
2	2-12	Barrier Island Restoration
Planning Unit 3a – Alternative R1 (Mississippi River Diversions Alternative)		
3	1-1	HNC Lock Multi-purpose Operation
3	1-2	Convey Atchafalaya River Water via the GIWW
3	1-3	Lapeyrouse Canal Diversion
3	1-4	Blue Hammock Diversion
3	1-5	Upper Lake Boudreaux Basin Mississippi River Diversion
3	1-6	East Terrebonne Mississippi River Diversion
3	1-7	Grand Bayou & Jean LaCroix Basin Mississippi River Diversion
3	1-8	Pipeline Conveyance Marsh Creation
3	1-9	North Terrebonne Bay Rim Marsh Creation
3	1-10	DuLarge to Grand Caillou Landbridge Marsh Creation
3	1-11	South Caillou Landbridge Marsh Creation
3	1-12	Isles Dernieres Restoration
3	1-13	Timbalier Islands Restoration
Planning Unit 3b – Alternative R1 (Marsh Creation with Shoreline Protection)		
4	1-1	Penchant Basin Plan
4	1-2	Convey Atchafalaya River water via the GIWW
4	1-3	Relocate the Navigation Channel through Lower Atchafalaya River Delta
4	1-4	Increase Sediment Transport Down Wax Lake Outlet
4	1-5	Barrier Reef from Eugene Island to Pointe au Fer Island
4	1-6	Blue Hammock Bayou Freshwater Introduction
4	1-7	Gulfshore Protection at Point au Fer Island
4	1-8	Freshwater Bayou Bank Protection, Belle Isle to Lock
4	1-9	Southwest Pass Bank Protection
4	1-10	Marsh Island Shoreline Protection

Table 1 - Coastal Restoration Plan Component – Representative Plan Features		
Figure #	Map ID #	Measure
4	1-11	Gulfshore Protection from Freshwater Bayou to Southwest Pass
4	1-12	Shoreline Protection at Vermillion Bay & West Cote Blanche Bay
4	1-13	East Cote Blanche Bay Shore Protection
4	1-14	Bayou Decade Area Marsh Creation
4	1-15	Brady Canal Area Marsh Creation
4	1-16	Pointe au Fer Island Marsh Creation
4	1-17	Marsh Island Marsh Creation
4	1-18	Wax Lake Outlet Delta Marsh Creation
4	1-19	Bayou Penchant Area Marsh Creation
4	1-20	Terrebonne GIWW Area Marsh Creation
PU4 – Alternative R1 – (Marsh Creation with Shoreline Protection)		
5	1-1	Marsh Creation at Mud Lake
5	1-2	Marsh Creation at South Grand Chenier
5	1-3	Marsh Creation at South Pecan Island
5	1-4	Marsh Creation at East Pecan Island
5	1-5	Marsh Creation at No-Name Bayou
5	1-6	Marsh Creation at NW Calcasieu Lake
5	1-7	Marsh Creation at East Calcasieu Lake
5	1-8	Marsh Creation at Black Bayou
5	1-9	Marsh Creation at Gum Cove
5	1-10	Marsh Creation at Cameron Meadows
5	1-11	Marsh Creation at Central Canal
5	1-12	GIWW bank Stabilization
5	1-13	Grand Lake Bank Stabilization
5	1-14	White Lake Bank Stabilization
5	1-15	Gulf Shoreline Stabilization (Sabine River to Calcasieu River)
5	1-16	Gulf Shoreline Stabilization (Calcasieu River to Freshwater Bayou)

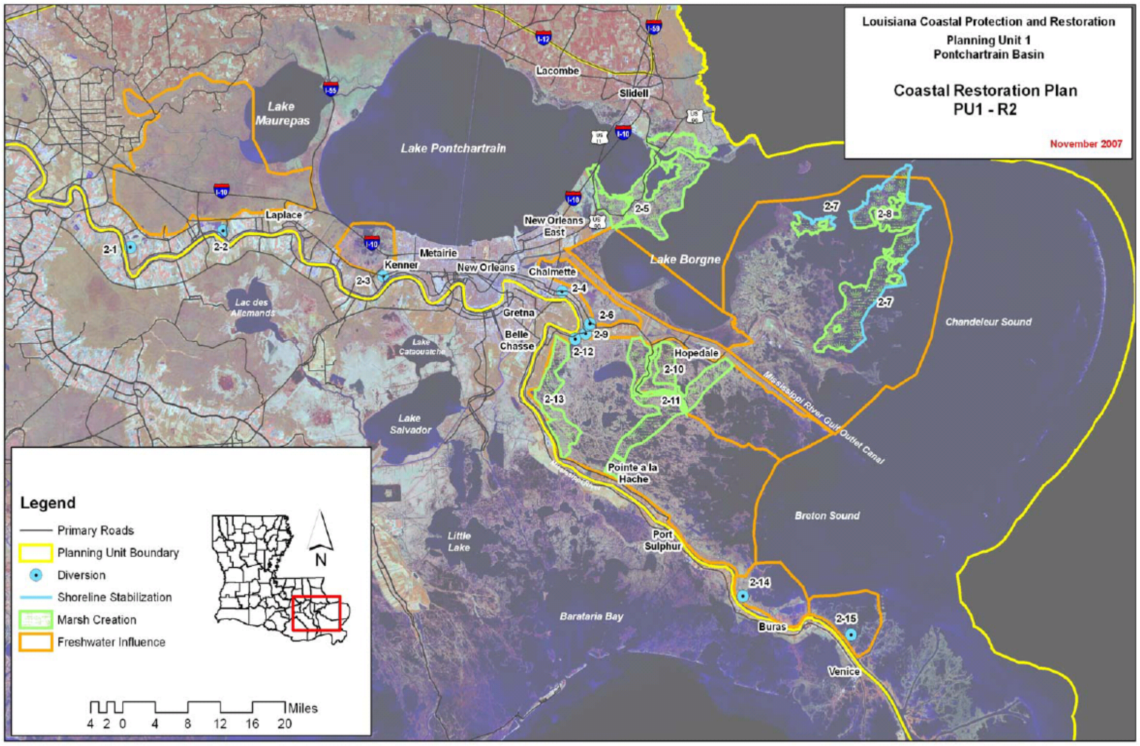


Figure 1: PU1 Representative Plan Features

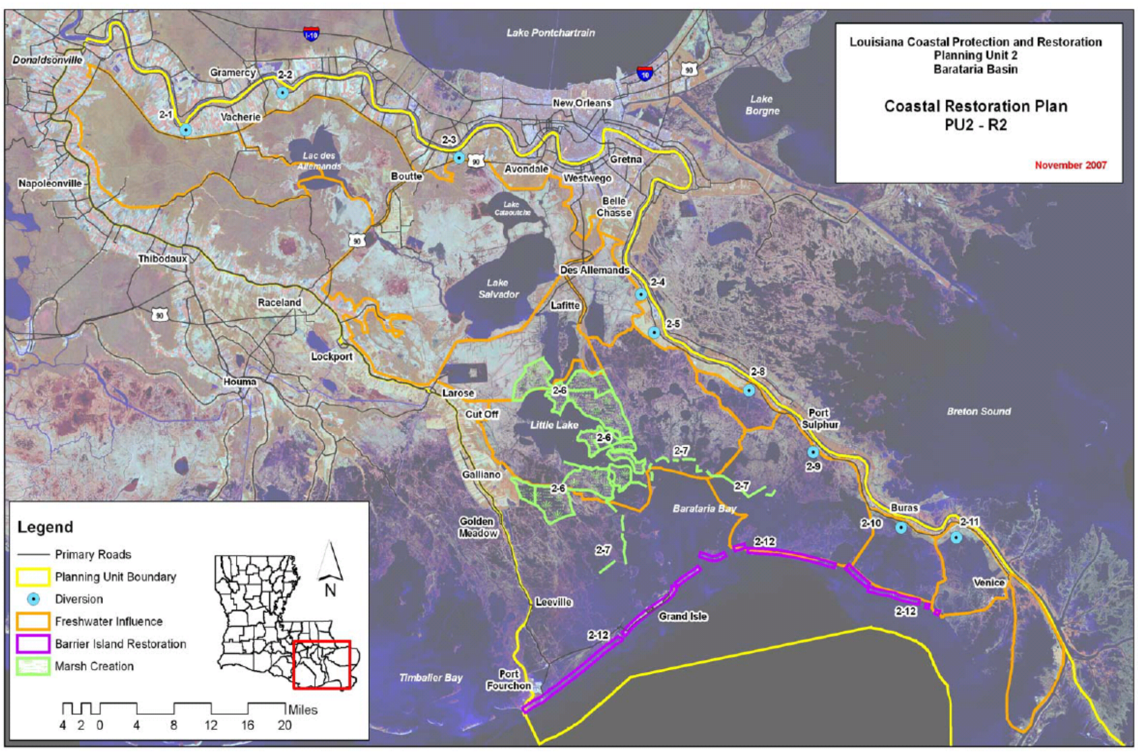


Figure 2: PU2 Representative Plan Features

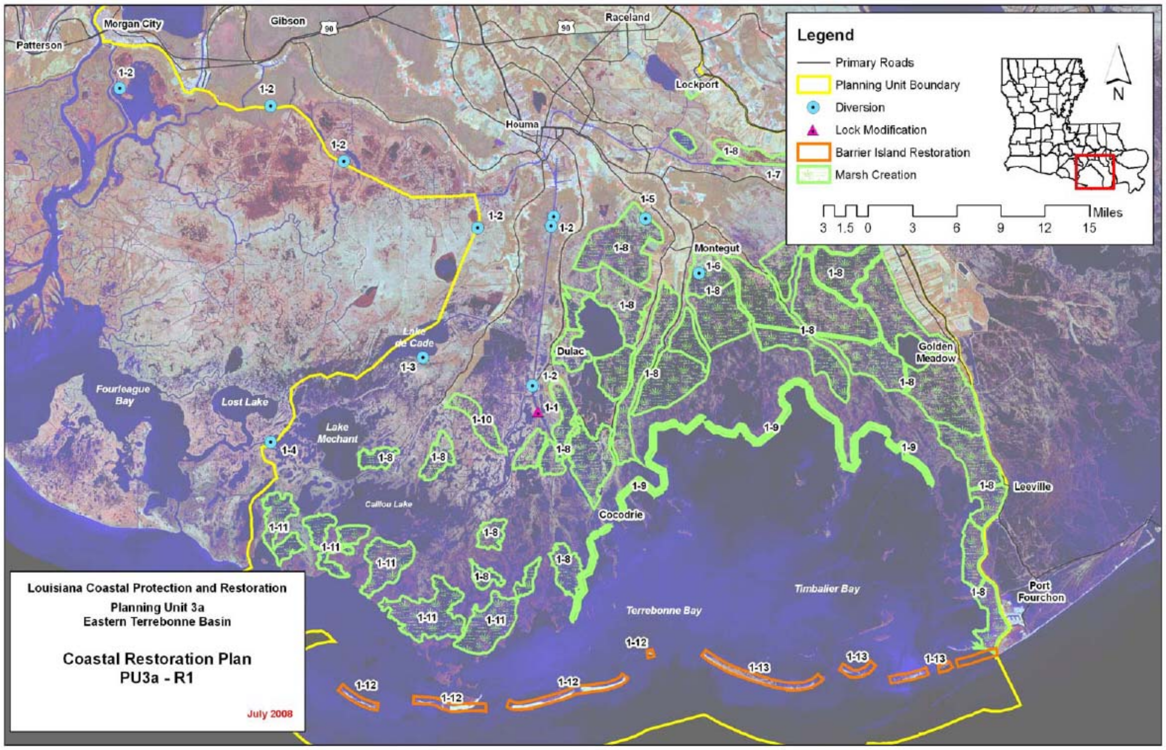


Figure 3: PU3a Representative Plan Features

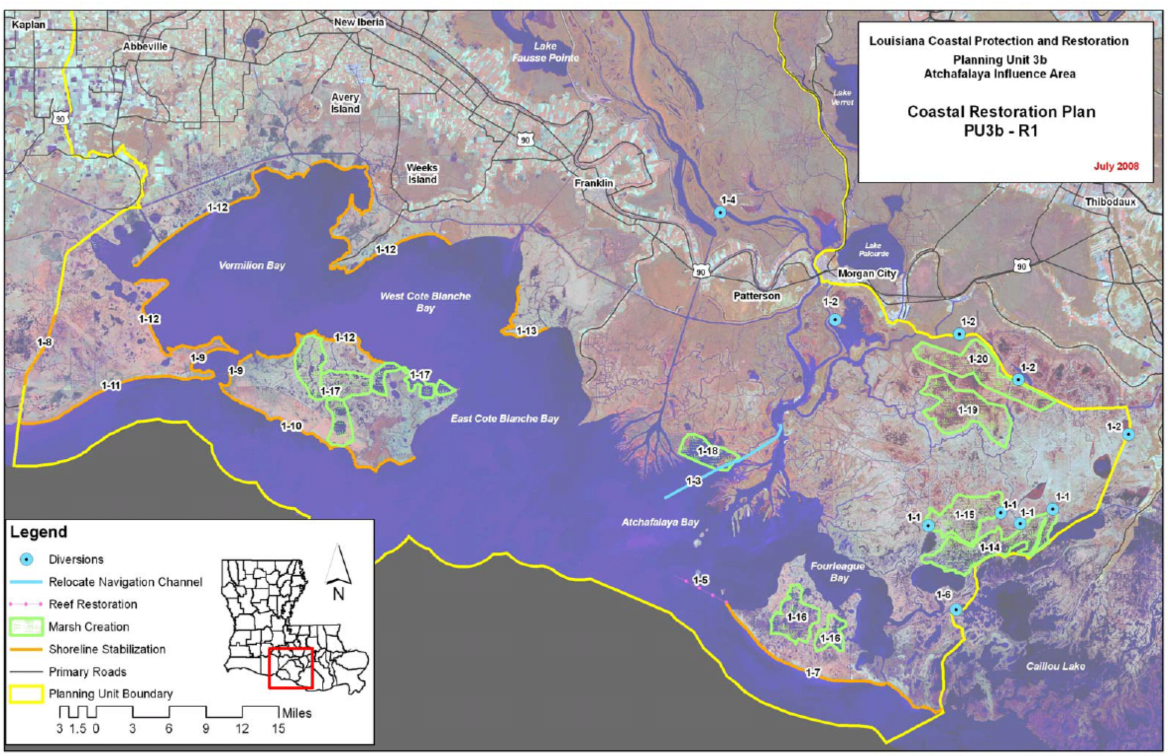


Figure 4: PU3b Representative Plan Features

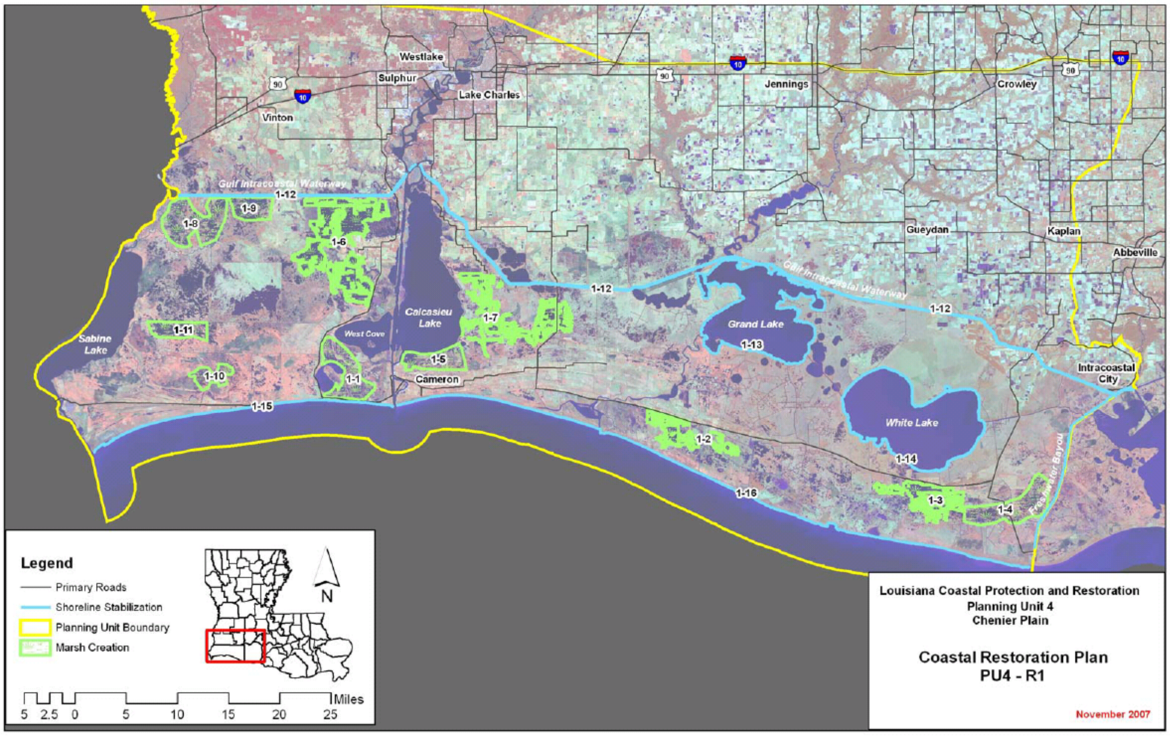


Figure 5: PU4 Representative Plan Features

DIVERSIONS

GENERAL

Freshwater diversions are diversions designed to take river water and its accompanying sediment and divert it into the surrounding marshlands to create or enhance marsh. For this effort diversions were sized in order to create or sustain a certain amount of marsh acreage. The NRCS-Boustany model, with ERDC modifications, was used to provide rough estimates of receiving area benefits for each year of the 100-year project life. Model benefits are based in part on Mississippi River discharge and the corresponding suspended sediment concentration. The results of the model were used to determine the required capacity for each diversion. These capacities are shown in Table 2. Details of the NRCS-Boustanay model and its application can be found in the Coastal Restoration Plan Component Appendix.

Table 2 – Required Diversion Capacities				
Diversion Site	Low Flow Year		High Flow Year	
	Avg. Flow (cfs)	High Flow (cfs)	Avg. Flow (cfs)	High Flow (cfs)
PU1				
Blind River	2,121	3,881	19,612	36,256
Hope Canal	2,121	3,881	19,612	36,256
LaBranche	138	253	1,209	2,212

Bayou Bienvenue	5,000	9,150	96,000	175,680
Bayou LaLoutre	5,224	9,560	63,000	115,290
Bayou Terre aux Boeufs	2,714	4,967	30,690	56,163
Caernarvon	4,397	8,047	48,525	88,801
Bayou Lamoque	7,912	14,479	22,044	40,341
Grand Bay	971	1,777	10,074	18,435
PU2				
Lagan	2,198	4,022	9,048	16,558
Edgard	967	1,773	10,599	19,396
Naomi	328	600	3,273	5,990
Myrtle Grove	5,240	9,589	64,830	118,639
Port Sulphur	2,757	5,045	34,062	62,333
Buras	1,315	2,406	11,409	20,878
Ft. Jackson	1,122	2,053	15,630	29,152
West Point a la Hache	475	869	5,382	9,849

HYDRAULIC DESIGN OF DIVERSIONS

General

A goal in diverting flow from the Mississippi River is to successfully transport sediment to regions suitable for marsh creation. Location and angle of the diversion is critical for maximizing the sediment load transported from the river to the potential site. A total of seventeen river diversions were designed and placed at various locations along the river. All diversion locations lie between Mississippi R.M 161.9 and R.M. 16. Much of the emphasis was placed upon locating diversions along the river where it would be easiest to reach the intended site. In some cases, it was possible to reach a sediment starved region by diverting water from the river into existing canals or bayous. Four basic diversion designs were implemented including culvert, siphon, Old River Control (ORC), and uncontrolled type diversions. Of the seventeen diversions there were 6 culvert designs, 1 siphon design, 5 ORC designs, and 5 uncontrolled designs.

Methodology

Diversion designs include all pertinent information needed to design the diversion as well length of inflow and outflow channel needed to get the freshwater from the river to the site.

Each diversion was designed to accommodate maximum flow at high river stage. Culvert and ORC type designs implemented the use of the full pipe outlet control flow equation.

$$H = \left(1 + K_e + \left(29n^2 L \big/ R^{1.333}\right)\right) \times \left(V^2 \big/ 2g\right) \qquad \textit{(Refer to TM 5-820-4 pg B-12)}$$

, where H is the head (ft), K_e is the entrance loss coefficient, n is manning's roughness coefficient, L is the length of the structure (ft), R is the hydraulic radius, V is the velocity (ft/s), and g is gravity (ft/s^2).

Culvert design and quantity were determined based upon the above mentioned equation with a manning's n of 0.015 for float finished concrete (TM 5-820-4 pg B-12) and an entrance loss coefficient of 0.5 for a concrete pipe with squared edge.

Siphons were designed based upon the same equation as above with additional head loss coefficients added based upon the number of siphon bends in the design. The modified equation is given below.

$$H = \left(1 + K_e + K_{b1} + K_{b2} + K_{b3} + K_{b4} + \left(29n^2 L \big/ R^{1.333}\right)\right) \times \left(V^2 \big/ 2g\right)$$

where K_{b1}, K_{b2}, K_{b3}, and K_{b4} are the siphon bend loss coefficients. Bends were approximated based upon the existing levee cross section at the given location. Flow through the siphon was assumed to be full. With all critical information, the equation was solved and siphon diameter and quantity were determined.

The last type of design was based upon an uncontrolled diversion (UC). These diversions were designed as earthen channels trapezoidal in shape. The head loss from inflow to outflow was assumed as 0.5 feet and channel slope was calculated based upon this assumption. A 1:3 side slope was assumed in each of the UC type designs. Finally, Manning's equation was used in designing the bottom width of the channel given critical equation variables along with the maximum flow at high river stage.

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

, where Q is the flow (ft^3/s), n is manning's roughness coefficient, A is area of flow (ft^2), R is hydraulic radius, and S is slope of channel.

Inflow/ Outflow Channels

Inflow distance was maintained as the distance from the diversion side of the Mississippi River bank to the diversion outlet measured at the top of levee. Outflow channels are coarser in their approximation since the region cannot be specified over a few feet but over a much greater distance. Containment levees were designed to run along the outflow channels of the uncontrolled diversions. Containment length was determined based upon the slope of the water surface at the start of the outflow channel. Based upon water surface slope, the water was contained until reasonable water elevation was attained. In some cases the length of containment was kept as the entire length of the outflow channel.

Results

Below is a list of all seventeen diversions including respective sizes and quantities.

Type	Location	Size (H x W)	Number
Culvert	Blind River	15ft x 18ft	5
Culvert	Hope Canal	15ft x 16ft	6
Culvert	Lagan	14ft x 15ft	3
Culvert	Edgard	15ft x 18ft	3
Culvert	Naomi	15ft x 20ft	1
Culvert	West Pt. a la Hache	12ft x 16ft	3

Type	Location	Size (Diam.) – Mat.	Number
Siphon	LaBranche	6ft – RCP	4

Type	Location	Size (H x W)	Number
ORC	Bayou Bienvenue	30ft x 52ft	5
ORC	Bayou LaLoutre	30ft x 45ft	4
ORC	Bayou Terre aux Boeufs	30ft x 44ft	2
ORC	Caernarvon	30ft x 46ft	3
ORC	Myrtle Grove	25ft x 46ft	5

Type	Location	Size (BW – S)	Number
UC	Bayou Lamoque	90ft – 0.00034ft/ft	1
UC	Grand Bay	25ft – 0.00024ft/ft	1
UC	Port Sulphur	320ft – 0.00012ft/ft	1
UC	Buras	25ft – 0.00027ft/ft	1
UC	Fort Jackson	100ft – 0.00018ft/ft	1

Notation:
RCP = Reinforced Concrete Pipe
BW = Bottom Width

STRUCTURES

General

Hydraulic design information such as project location, structure type, structure size (number of openings, size of openings, length of culvert) was provided for all controlled diversions. These diversions fell into three categories of projects: large diversion (Old River Auxiliary Structure type); box culverts (Davis Pond type); and siphons (Hero Canal type). Figures 6 to 8 show typical diversion structures of the three types. The main cost estimate items were taken from the feasibility reports for each of the three projects, shown above in parentheses. The quantities for each of these items were determined based on the following assumptions:

- natural ground elevation taken from available LIDAR
- Mississippi River flood protection elevation based on nearest river mileage
- all excavations have 1V on 6H side slopes

Rudimentary designs were performed to establish the nominal dimensions of major structural components and high cost items. These rudimentary designs were based on proven concepts and historical data. Items deemed as not critical to the overall estimate were sized by engineering judgment, relying heavily on the experience of the designer.

Box Culverts

The structure used for these project features was modeled after the Davis Pond Diversion Structure. The diversion structure is compromised of inflow monoliths, a gate monolith, box culvert monoliths, a downstream bulkhead monolith, and outflow monoliths. A cofferdam will be required to maintain the Mississippi River flood protection during construction of the structure.

Large Diversions

The structure used for these project features was modeled after the Old River Auxiliary Structure. The structure will be a non-navigable pile supported, tainter gated structure. The tainter gates are similar to the gates used in the Old River Auxiliary Structure.
A cofferdam will be required to maintain the Mississippi River flood protection during construction of the structure.

Siphon

The structure used for this project feature was modeled after the Hero Canal Diversion Structure. The project feature consists of a siphon which crosses over the Mississippi River levee, crosses under a highway, and discharges into the marsh.

Figure 6: Typical Box Culvert Structure

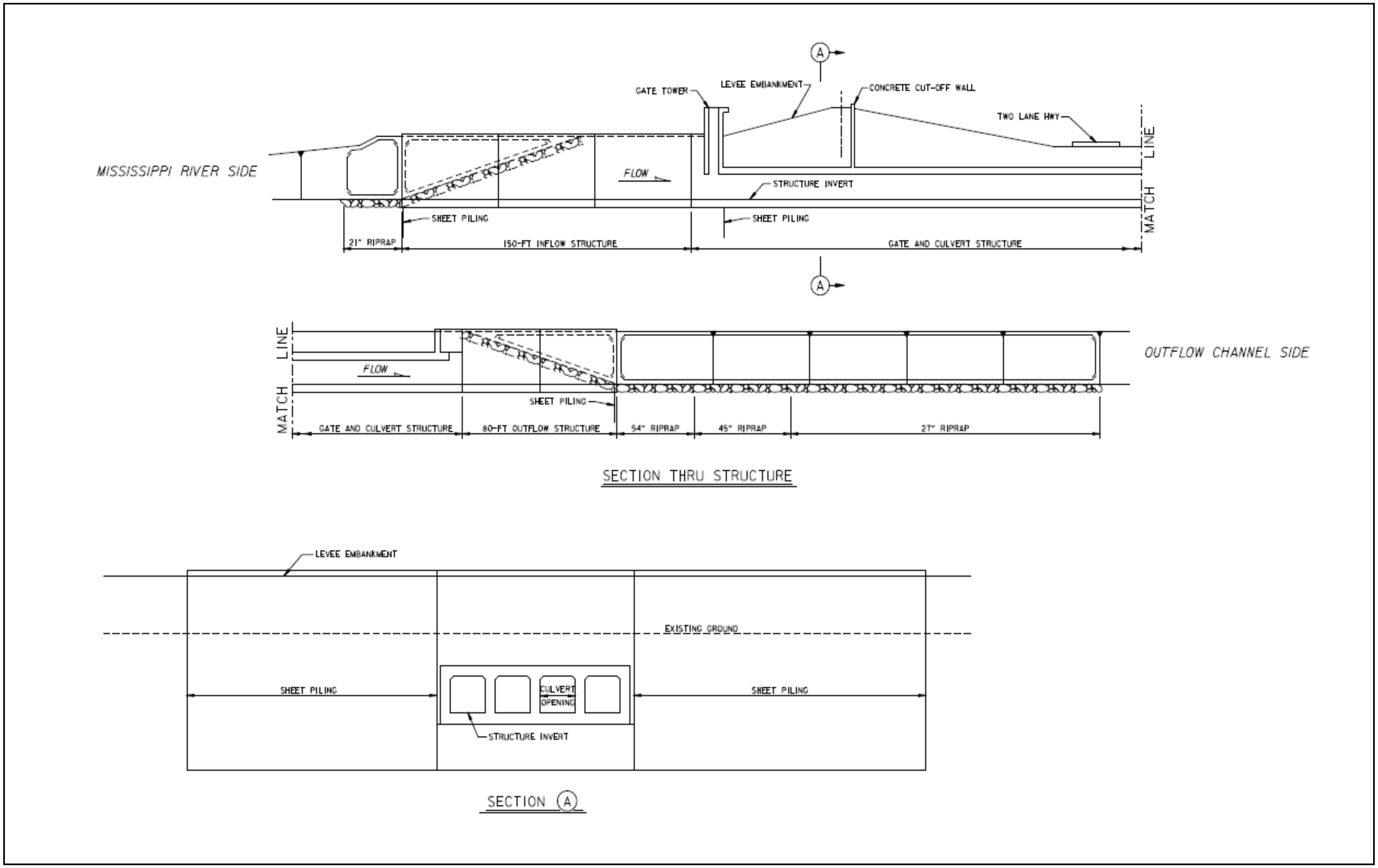


Figure 7: Typical Large Diversion Structure

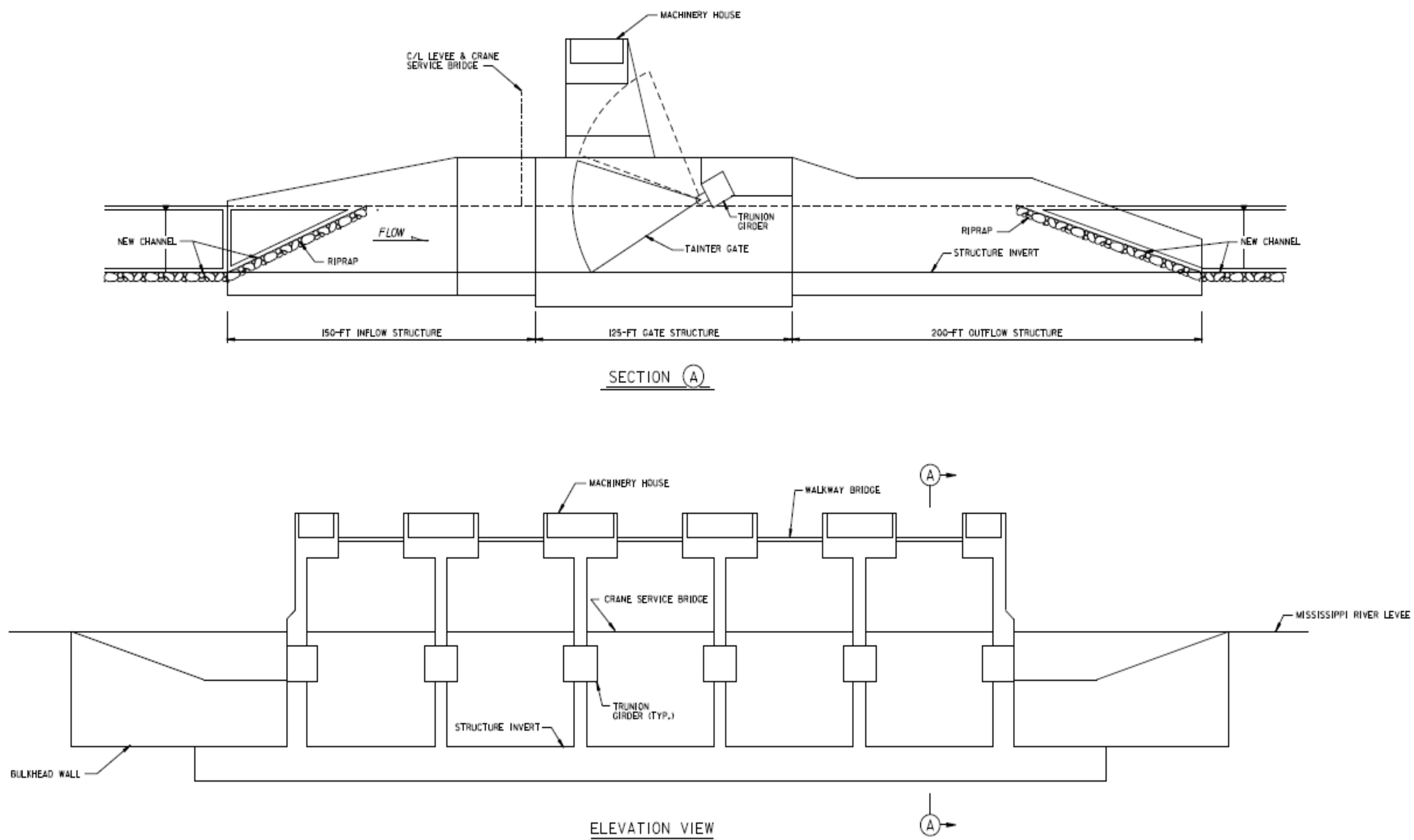
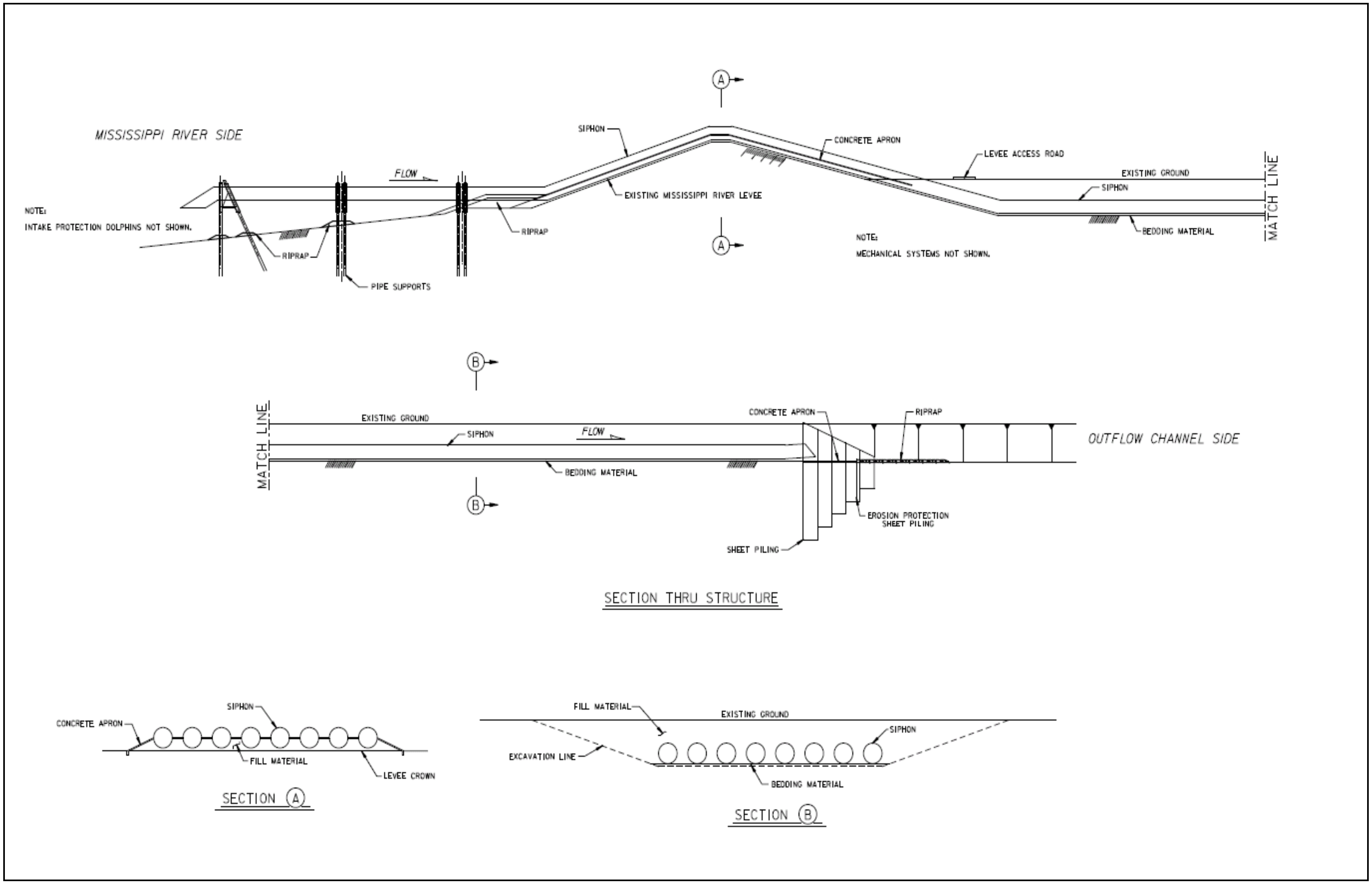


Figure 8: Typical Siphon Structure



CHANNELS

Design Methods for Outflow Channels

Hydraulic design information including channel inverts, bottom width and length was provided for each of the proposed diversions. Plates 1 to 17 show the structure and channel location and channel cross section for each diversion. The diversion channels will be mechanically or hydraulically dredged, depending on the location of the diversion channel. The channels will be cut to the depth of the outflow inverts of the culverts. The alignment of the outflow channel will run from the diversion structure to the marsh. Cut material from the channel shall then used to create adjacent levees on each side of the channel. The levees will be offset 50' from the edge of the channel to the toe of the leaves. The levees will have 4:1 slopes with the dimensions of the levees calculated to use all of the cut material from the channel. The levees will then be capped with 2.5' of clay brought in from borrow pits. The levees and the slopes of the channel are to be hydro seeded once construction is completed. Specific channels were designated by the hydraulic design to have rip rap armored slopes. The following assumptions were made prior to the design of the diversion channels:

1. Borrow for the 2.5' clay caps will be brought in from borrow pits located within 30 miles of the diversion channel location. The exact location of the pits will be determined during detailed design.
2. Unless specified by the hydraulic design information 1,000ft armor lengths for the diversion channels were used.

MARSH CREATION

GENERAL

The proposed features include an extensive list of marsh creation and restoration. Marsh creation elements were included in all planning units. Each element is a combination of open water and deteriorated (broken) marsh. As surveys of each element were not performed for this analysis, an assumed lift was used for open water areas, deemed marsh creation, and for deteriorated marsh, deemed marsh nourishment. Quantity needed to fill elements within each planning unit is included in table 3 below. Required acreage was determined from maps developed by the HET.

Table 3 – Marsh Creation Borrow Requirements

Planning Unit 1	**Acreage**	**% Open Water**	**Borrow Needed**
East New Orleans Landbridge	42,590	100%	178,633,000cy
Biloxi Marshes	124,440	100%	655,983,000cy
Bayou Terre aux Boeufs	12,190	100%	127,822,000cy

Breton Sound Landbridge	31,900	100%	334,661,000cy
Caernarvon Area	17,780	100%	186,453,000cy
subtotal PU1	**228,900 acres**		1,483,552,000cy
Planning Unit 2			
Strategic Lower Basin	52,385	50%	146,000,000cy
Planning Unit 3a			
Pipeline Conveyance	156,250	100%	1,638,532,000cy
duLarge to Grand Caillou Landbridge	2,920	100%	30,611,000cy
South Caillou Lake Landbridge	27,850	100%	291,956,500cy
Subtotal PU3a	**187,020**		**1,961,095,500cy**
Planning Unit3b			
Bayou Decade	12,419	100%	100,179,933
Brady Canal	9,351	100%	75,431,400
Pointe au Fer	9,619	100%	77,593,000
Marsh Island	18,525	100%	149,432,820
Wax Lake Outlet Delta	4,920	100%	39,688,000
Bayou Penchant Area	13,182	100%	106,334,800
Terrebonne GIWW	12,733	100%	102,712,867
subtotal PU3b	**33,203 acres**		268,000,000cy
Planning Unit 4			
Mud Lake	9,625	60%	68,516,331
South Grand Chenier	5,570	80%	46,728,587
South Pecan Island	7,993	100%	77,372,240
East Pecan Island	12,123	50%	78,233,760
No Name Bayou	6,697	40%	38,896,176
NW Calcasieu Lake	24,280	100%	235,030,400
East Calcasieu Lake	12,086	100%	116,992,480
Black Bayou	13,315	70%	103,111,360
Gum Cove	5,356	70%	41,476,864
Cameron Meadows	3,736	50%	24,109,653
Central Canal	5,355	80%	44,924,880
subtotal PU4	**106,163 acres**		1,404,958,948cy
Total all planning units			

The major factor in the cost for marsh creation and nourishment is location of borrow. Borrow is limited for the enormous quantity needed to complete all planning units.

Sources included in this design include maintenance (O&M) quantities from federal channels, lakes, bays, and the Gulf of Mexico.

a. O&M quantities were calculated from current dredge cycles. Each channel has an average quantity and time between dredge cycles. Most channels have an ongoing beneficial use program. This project would pull all material from those programs. No material was left in the cycle to complete ongoing beneficial use of materials dredged from the O&M program. In addition, reductions in maintenance quantities may occur by stabilizing banks and redirecting channels as required by other elements within this project. For example, widening and deepening the Wax Lake Outlet or armoring the GIWW or Freshwater Bayou may result in less maintenance dredging. The magnitude of these reductions was not estimated at this level of analysis. Lastly, the available quantity in the dredge cycle did not consider addition material available for deepening or widening the existing authorized dimensions.

b. Many lakes were considered for borrow. Borrow from interior lakes was limited to 20% of the existing lake bottom.

c. Many bays were considered for borrow. Borrow from bay areas was limited to 10% of the existing bay bottom.

d. Due to the fact that borrow required exceeds borrow available from O&M, lakes, and bays, the Gulf of Mexico was added as a borrow source. Borrow from the Gulf of Mexico will impact certain marsh creation sites due to high salinities in both the borrow and slurry water.

Many marsh creation sites require multiple boosters and miles of discharge pipe. As such, an access corridor is included for some sites. Access corridor for booster, pipeline, and work boats includes an 80ft bottom width at elevation (-)8.0ft. Access corridors excavated from the Gulf shall be backfilled and armored when it intercepts existing gulf side shoreline. Access corridors from the Gulf to be backfilled and armored include Pecan Island and Grand Chenier.

Dredge quantities are well beyond normal magnitudes for existing large dredge contracts. Due to the time and cost to prepare access for these sites, a larger contract must be approved. For the purpose of this report, a maximum contract of 3 years and 40,000,000cys was used.

Costs do not include planting the newly constructed/nourished marsh elements. Future submittal will include environmental input into planting scheme. It is also assumed that bio-accumulation of newly constructed marsh will maintain marsh elevation. No additional lifts are included on any marsh creation element.

SHORELINE PROTECTION

GENERAL

Three separate and distinct shoreline protection features were evaluated under this effort:

(1) Shoreline protection along the gulf coastline within planning units 4 and 3b

(2) foreshore protection along both banklines of the GIWW within planning unit 4

(3) nearshore protection along the entire perimeter of Grand and White Lakes not currently stabilized by previous stone construction efforts.

The section of coastline between Peveto Beach and Holly Beach was excluded since shoreline protection already exists in that section. Stabilization measures were included in order to decrease gulf shore erosion rates and to prevent the inward degradation of wetlands in order to reduce loss rates and enhance the sustainability success of other restoration measures.

PLANNING UNITs 3a AND 3b

Atchafalaya and Chenier Plain Gulf Shoreline Stabilization

The design for the breakwaters were based on conventional and proven existing designs. This shoreline protection was estimated based on conventional stone structures. The Grand Isle offshore segmented breakwater template was used as the basis for offshore breakwaters. The cross section has a five foot crown at elevation +4.0, 1 vertical on 2 horizontal side slopes, and was aligned along the elevation -6.0 contour (figure 9). For initiation of this planning cost estimate, segments are anticipated to be 200 feet long with 300 foot gaps between segments. Approximately 98 miles of proposed breakwater overlaid on geotextile fabric is proposed under this study evaluation.

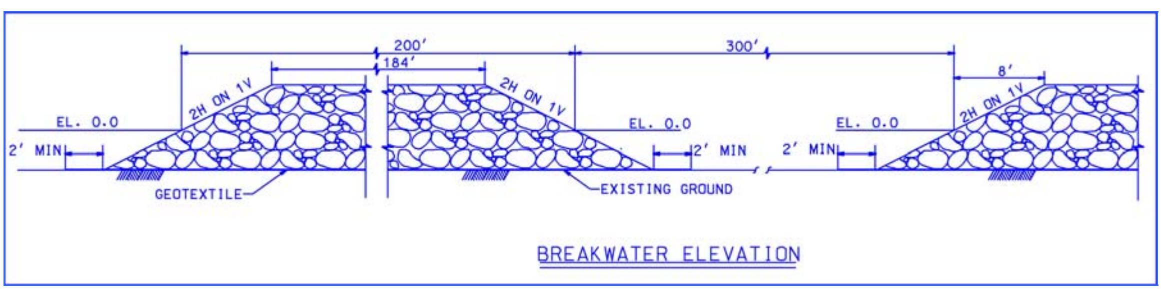


Figure 9: Gulf Shoreline Stabilization Section

The area was divided into reaches and geotechnical estimates of construction losses for each reach were provided. Structure side slopes and construction losses due to foundation conditions were estimated based on available foundation data, general geology information, and experience in the coastal area. Site specific surveys, hydraulic analysis, and geotechnical analysis will be required to refine this proposed design. Table 4 shows the reach, estimated length, and construction losses used for estimating purposes.

Table 4 - Assumed Length and Construction Loss for Measure

Reach	Length (LF)	Construction Loss
Stone Breakwaters – Freshwater Bayou to Southwest Pass	58,646	50%
Stone Breakwaters – Freshwater to Rollover	72,153	50%
Stone Breakwaters – Rollover to Mermentau	160,560	45%
Stone Breakwaters – Mermentau to Calcasieu	107,169	40%
Stone Breakwaters – Calcasieu to Holly Beach	45,673	35%
Stone Breakwaters – Perveto Beach to Sabine	74,770	30%

PLANNING UNIT 4

Near Shoreline Stabilization, Grand and White Lakes

Stone shoreline protection along the entire rim of Grand and White Lakes is proposed to halt degradation of the shoreline and breaching into existing marsh and upland areas as a result of wind induced wave energy. A successful CWPPRA Project ME-22 located along the southern shoreline of White Lake from Will’s Point to the western shore of Bear Lake in Vermilion Parish, Louisiana, included constructing segmented breakwaters to protect approximately 61,500 linear feet of shoreline to protect 687 acres of shoreline and interior marsh (figure 10). The breakwaters were constructed with gaps to allow aquatic organisms and water to move freely. Material dredged to create a flotation channel was placed beneficially behind the rock dike to create marsh substrate.

Figure 10: White Lake Shoreline Protection Completed Aug 2006

This shoreline protection design was used as the basis for estimating required lake shoreline protection. The breakwater would be located along the –1.5 foot NAVD 88 contour in approximately 2.0- to 3.0 feet of water, stage dependant. The dike crown would be 4.0 feet wide and would be set at an elevation of +3.5 feet NAVD 88 (figure 11). The breakwater would have side-slopes of 1.0 vertical on 1.5 horizontal. Gaps for fish access would be built at approximately 1,000-foot intervals, with a top width of 50 feet. Approximately 106 miles of proposed shoreline is estimated under this study effort.

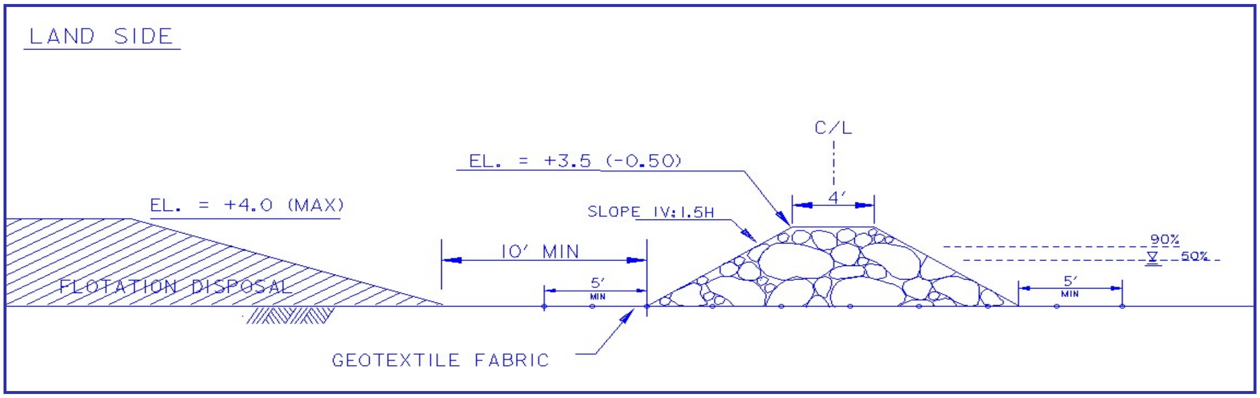


Figure 11: Near Shoreline Stabilization Section

Channel Stabilization, GIWW

Foreshore dike construction is proposed along both banks of the GIWW, from Freshwater Bayou to the Calcasieu River to halt shoreline erosion and widening of the channel. The rock dike would be aligned in the vicinity of the waters edge, assuring safe navigation and continued usage of the authorized channel. The template for this rock design would consist of a continuous nearshore dike section with a 4' crown, a 1.0 vertical on 2.0 horizontal channel side slopes, and a 1.0 vertical on 1.5 landside slope. The flatter channel side slope will be incorporated to minimize wave rollup and reduce maintenance requirements. The section will likely be tucked into the shoreline to minimize rock quantities while maximizing the navigation safety zone. Fetch driven waves are not likely a concern within this inland waterway. A crown height in the vicinity of +3.0 to +5.0 will be established as required to break vessel waves. The rock dike would be overlaid upon a base geotextile fabric. Approximately 205 miles of shoreline protection is estimated under this planning study.

CONCERNS

Significant concerns remain that have to be evaluated prior to final selection of a preferred plan of restoration. As previously stated, general assumptions were made regarding geotechnical and bathymetric conditions across these wide arrays of worksites. Site specific data collection will be required to verify settlement requirements and existing site conditions. Unanticipated stability berms, if required, as well as increases in anticipated settlement would increase these estimated rock quantities. Construction sequencing and duration will have to be further analyzed to assure adequate availability of materials and construction equipment. Access considerations as well as existing obstructions to construction will have to be considered during final plan selection. Construction production rates in the Gulf of Mexico will certainly be weather dependent. In addition this extensive proposal of rock structure construction will likely result in associated long-term maintenance needs not addressed in this report.

OTHER MEASURES

GENERAL

Some of the proposed measures have been investigated under other studies and programs such as the Louisiana Coastal Area (LCA), Ecosystem Restoration Study, the Coastal Wetlands Planning Protection and Reatoration Act (CWPPRA) and Louisiana's Comprehensive Master Plan for a Sustainable Coast. For these measures the existing cost estimates were used and were updated when necessary. These measures are described below.

PLANNING UNIT 3a

IHNC Lock Multi-purpose Operation

The measure would include development and implementation of a multi-purpose operational plan for the Houma Navigation Lock that would allow the lock to be utilized for coastal restoration purposes by making more efficient use of Atchafalya River water and sediment flow and maintaining salinity regimes favorable for wetlands in the Lake Boudreaux, Lake Mechant and Grand Bayou areas. The lock is proposed to be located on the Houma Navigation Canal (HNC), 1.75 miles south of the Bayou Sale intersection and is an integral part of the Morganza to the Gulf Hurricane Protection Project.

Costs associated with this measure would consist of additional O&M costs for the lock. There would be no modifications to the lock structure required. Estimates for O&M cost were taken from costs developed for Louisiana's Comprehensive Master Plan for a Sustainable Coast (Apr 07).

Convey Atchafalaya River Water via the GIWW

This measure includes increased flow of Atchafalaya River water via the Gulf Intracoastal Waterway into Terrebonne marshes from an area west of the Avoca Island Levee for freshwater and sediment delivery to enhance and sustain wetlands.

This feature would produce enhanced areas for both the Larose to Houma reach and Houma to Morgan City reach through feature components such as a small diversion in the Avoca Island levee, repairing eroding banks of the GIWW, enlarging constrictions in the GIWW below Gibson and in Houma, and Grand Bayou conveyance channel construction/enlargement. Cost for this feature were developed for the Louisiana Coastal Area (LCA), Ecosystem Restoration Study and were updated to current price levels.

Lapeyrouse Canal Diversion

The project area is experiencing marsh deterioration due to subsidence, rapid tidal exchange, and human-induced hydrologic changes that result in increased salinities. Saltwater intrusion has caused a shift in marsh type and a conversion of over 30 percent of emergent vegetation to open water habitat. Shoreline erosion along the south embankment of Lake De Cade threatens to breach the hydrologic barrier between the lake and interior marshes.

Proposed project components include installing three control structures along the south rim of Lake De Cade and enlarging Lapeyrouse Canal to allow the controlled diversion of Atchafalaya River water, nutrients, and sediments south into project area marshes. Outfall management structures are planned in the marsh interior to provide better distribution of river water. In addition, approximately 1.6 miles of foreshore rock dike is planned to protect the critical areas of the south lake shoreline from breaching (see figure 12). This project was selected as a part of CWPPRA Priority Project List 9. The cost estimate for this measure was taken from the Aug 08 CWPPR Project Manager's Technical Fact Sheet.

Upper Lake Boudreaux Basin Mississippi River Diversion, East Terrebonne Mississippi River Diversion, Grand Bayou & Jean LaCroix Basin Mississippi River Diversion

This measure is similar to the proposed Third Delta Project (diversion of Mississippi River water into the Terrebonne Basin by constructing a conveyance channel following the eastern slope of the natural Bayou Lafourche levee system and splitting into two channels near Raceland) except that the channels would not go as far south. Figure 13 shows the conceptual plan. A design and cost estimate were developed for the Third Delta Plan as part of the LCA study. This cost has been updated and modified to take into account the differences in the two plans.

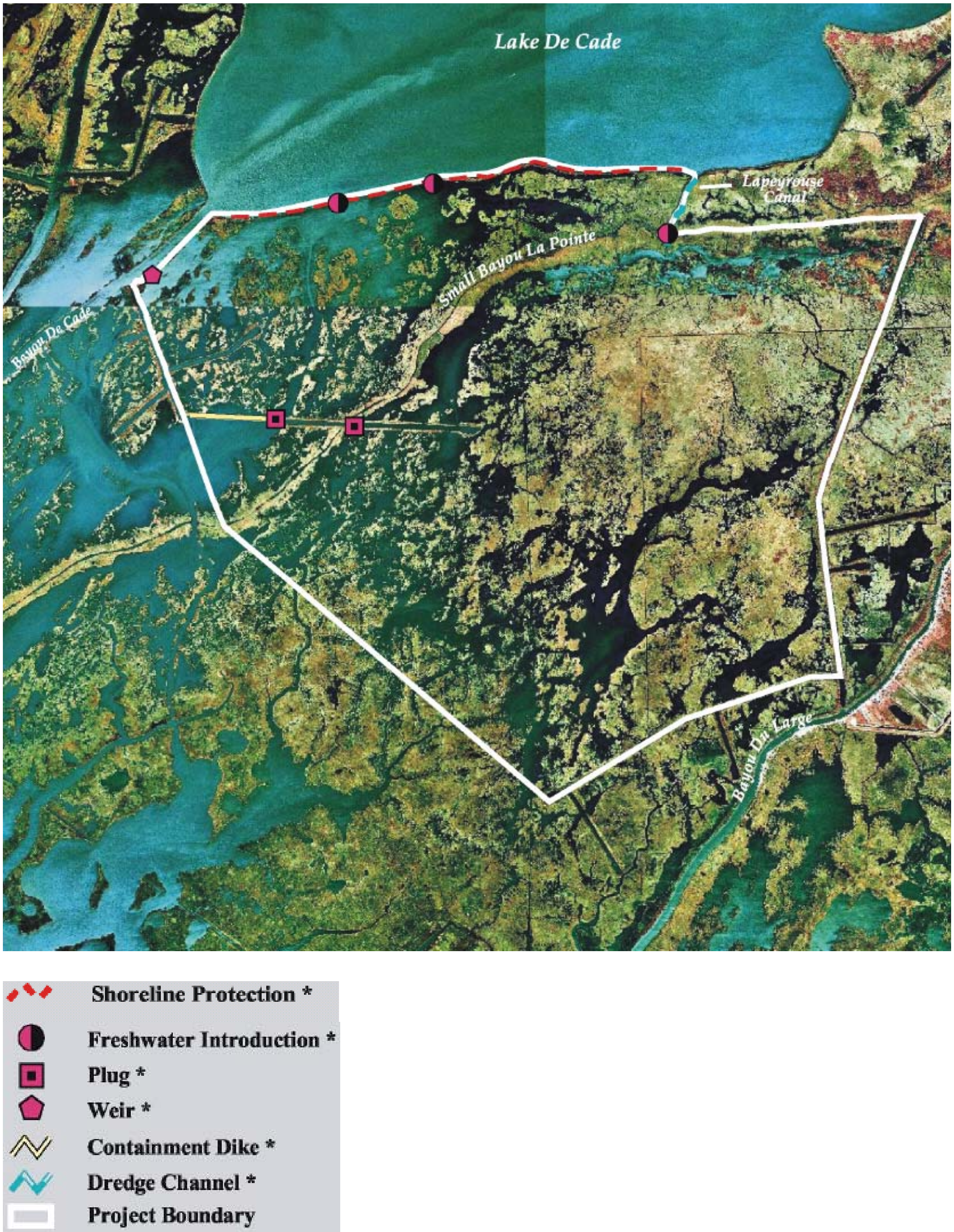


Figure 12: Laperouse Canal Diversion

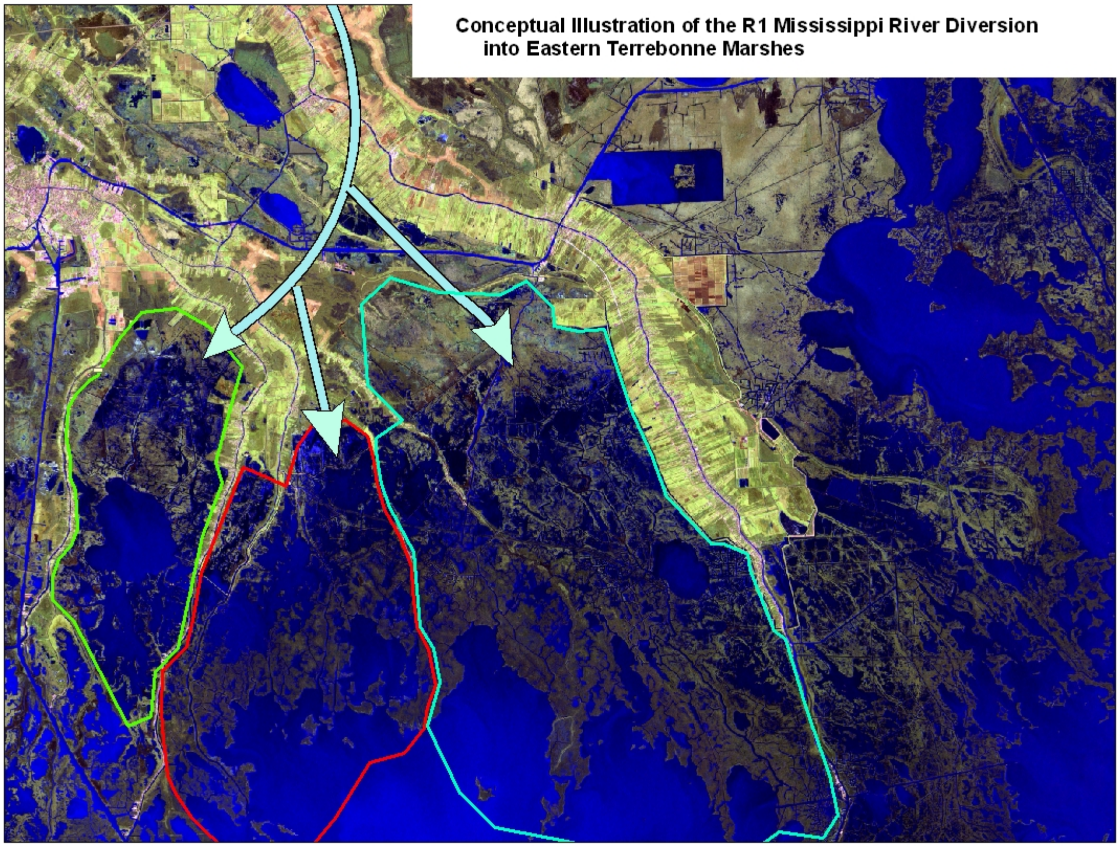


Figure 13: Mississippi River Diversion into Terrebonne

Blue Hammock Diversion

Grand Pass is a major tidal exchange point through the Bayou du Large ridge, which carries higher salinity water directly from Sister Lake into Lake Mechant and the surrounding marshes. Historically, this pass did not cut straight through the ridge and was a less efficient channel than it is now. Periodic increases in salinity in Lake Mechant are contributing to the loss of intermediate and brackish marshes in the basin. Freshwater input into the basin currently comes through the Gulf Intracoastal Waterway (GIWW) and the Penchant system on the north and Atchafalaya River input from Four League Bay via Bayous Carencro and Blue Hammock Bayou. However, the size of Blue Hammock Bayou decreases substantially west of Lake Mechant, which limits the easterly flow of sediment-laden river water into Lake Mechant and surrounding marshes.

The proposed project consists of the following components: construct a weir in Grand Pass; construct a weir in Buckskin Bayou; dredge Blue Hammock Bayou to increase the cross section; place 5 plugs in smaller channels; use material dredged from Blue hammock Bayou to restore surrounding marsh. These components can be seen in figure 14. Estimates were taken from costs developed for Louisiana’s Comprehensive Master Plan for a Sustainable Coast (Apr 07).

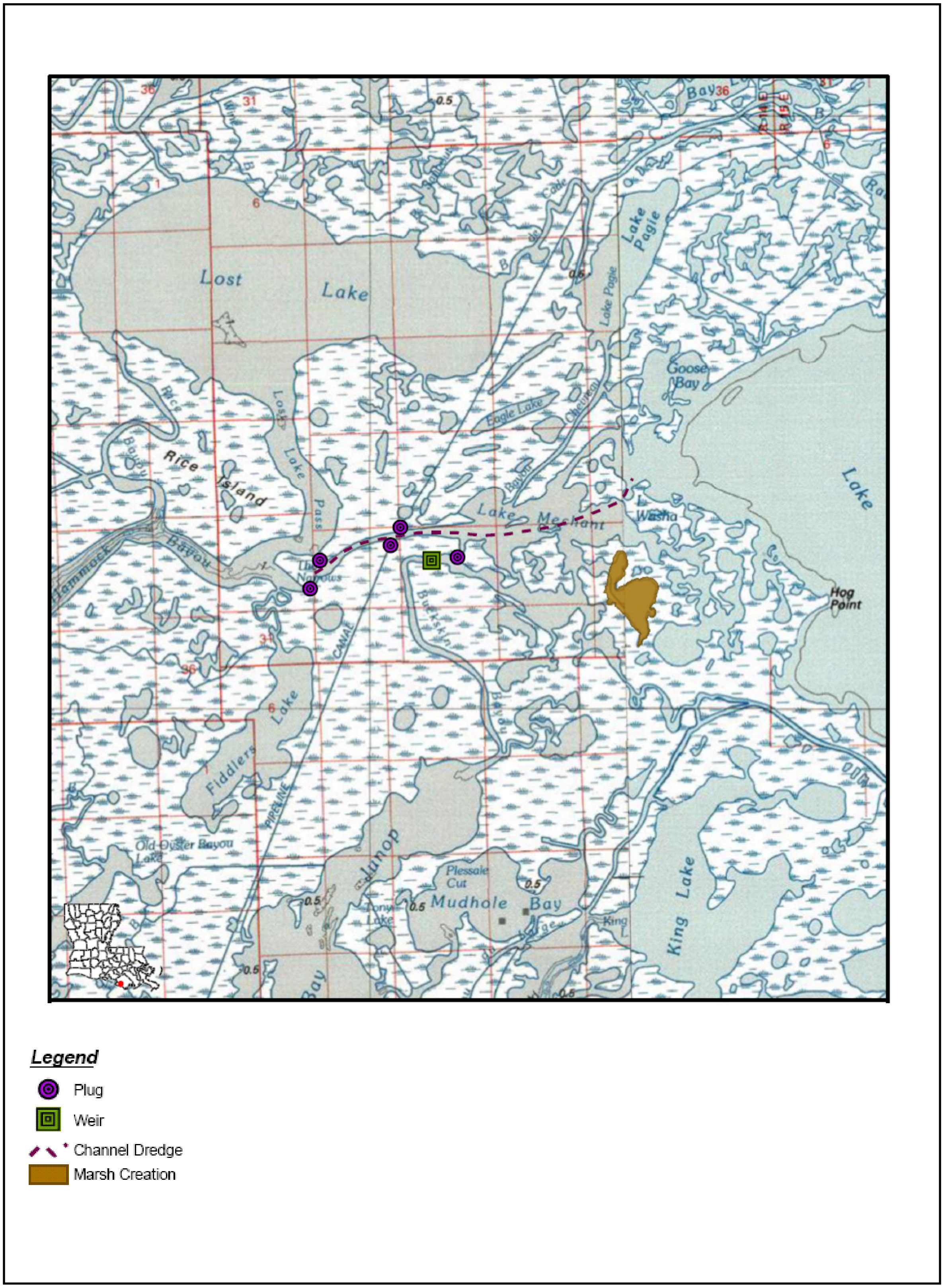


Figure 14: Blue Hammock Bayou

PLANNING UNIT 3b

Penchant Basin

Area problems include major hydrologic alterations, interior marsh erosion, subsidence, saltwater intrusion, herbivory, and hurricane damage. This project will combine the long-term realignment of Penchant Basin hydrology with restoration and protection measures aimed at maintaining the physical integrity of the area during the transition toward greater riverine influence.

Proposed project components include: a rock weir with a barge bay in the northern end of Big Carencro Bayou at its intersection with Bayou Penchant; a steel sheet-pile weir with variable crest sections and flapgates in the Bayou Mauvais Bois at its intersection with the Superior Canal; rock bank stabilization; dredging and marsh creation at the mouth of Bayou Penchant; a rock weir with a barge bay at the southern shoreline of Raccourci Bay; maintenance of existing weirs along Bayou De Cade; shell plugs with rock rip-rap cover along Bayou De Cade; three steel sheet-pile variable crest weirs along Bayou De Cade; two steel sheet-pile variable crest weirs with boat bays along Bayou De Cade; a rock liner in Little Deuce Bayou at its intersection with Bayou De Cade; a rock weir with barge bay in Bayou la Loutre at its intersection with the Superior Canal; a steel sheet-pile weir with boat bay and variable crest sections in Brady Canal at its intersection with Bayou Penchant; an earthen bank stabilization along Bayou De Cade; and bank maintenance. These features are shown in figure 15. Project cost was taken from the CWPPRA Project Manager's Technical Fact Sheet dated August 08.

Relocate the Navigation Channel through Lower Atchafalaya River Delta

This plan consists of relocating the end of the Atchafalaya River navigation channel through Shell Island Pass and to the West (see figure 16). The cost estimate was taken from the estimates done for the LCA study and updated to current price levels.

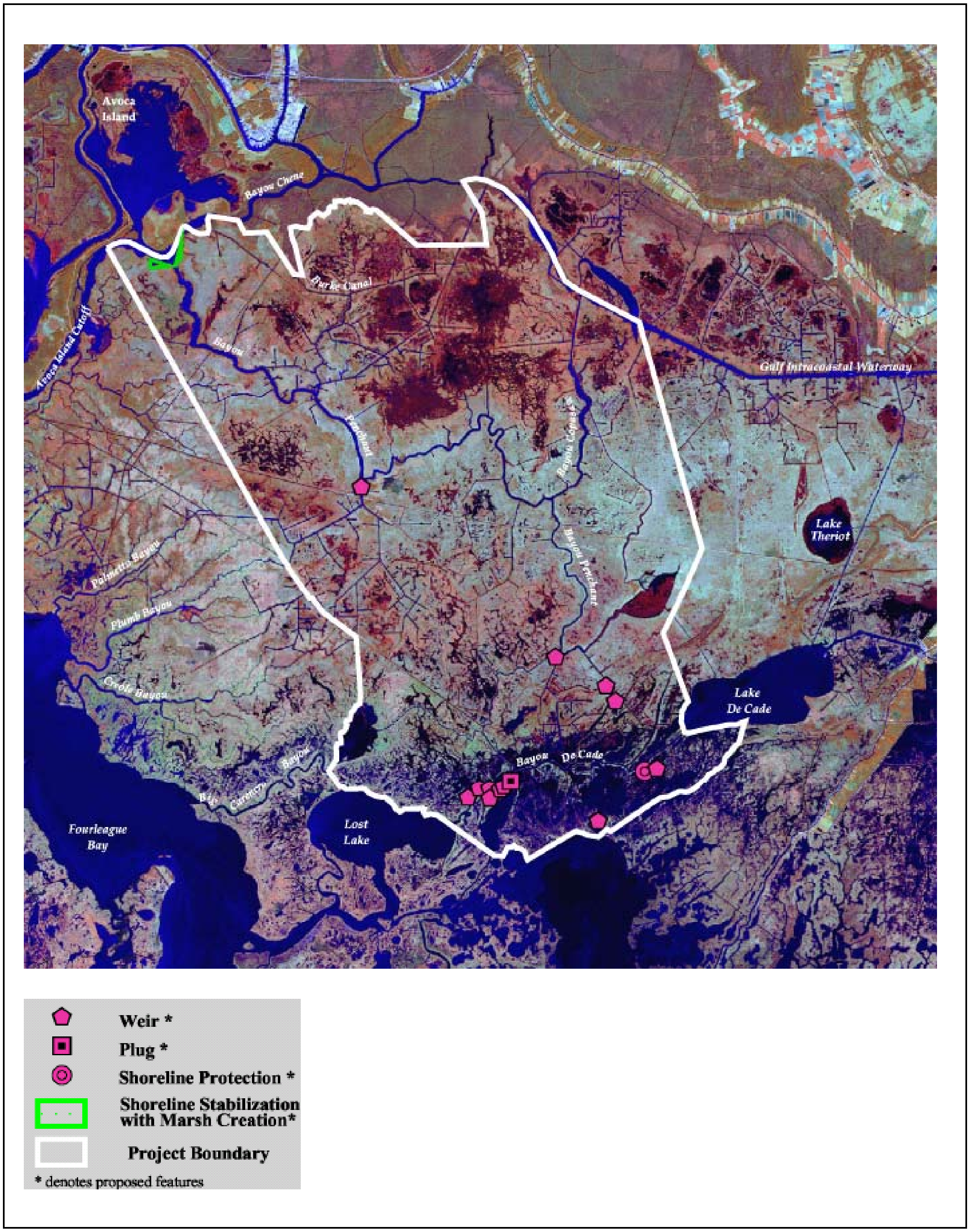


Figure 15: Penchant Basin Plan

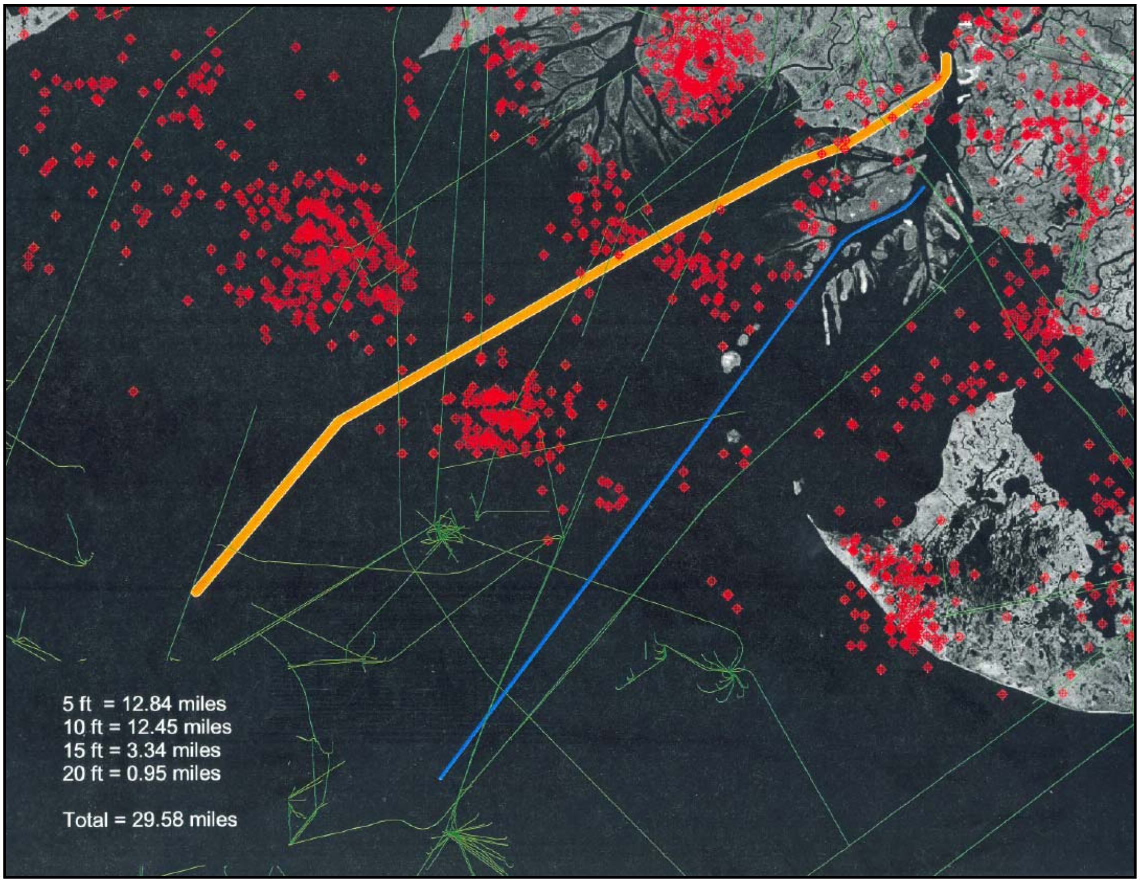


Figure 16: Relocate Atchafalaya Navigation Channel

Increase Sediment Transport Down Wax Lake Outlet

Wax Lake Outlet is located in St. Mary Parish at the eastern side of East Cote Blanche Bay. The outlet discharges water and sediment from the Atchafalaya River into a forming delta. The measure is to relocate the alignment of the Wax Lake Outlet inflow channel to a more direct route to the Atchafalaya River channel with a deeper inflow channel, capturing additional sediment with the deeper inflow channel to be deposited in the delta of Wax Lake (see figure 17). The proposed new channel would allow flow from the Lower Atchafalaya to by-pass Six Mile Lake. The proposed new channel would begin about mile 110 of LAR and extends to range 0.0 on WLO. The channel would be cut to an elevation of -38.0 feet with a bottom width of 800 feet and side slopes of 1 vertical on 5 horizontal. This measure was included as part of the Lower Atchafalaya Basin Reevaluation Study and the LCA study. The cost estimate was taken from estimates done for the LCA Study and updated to current price levels.

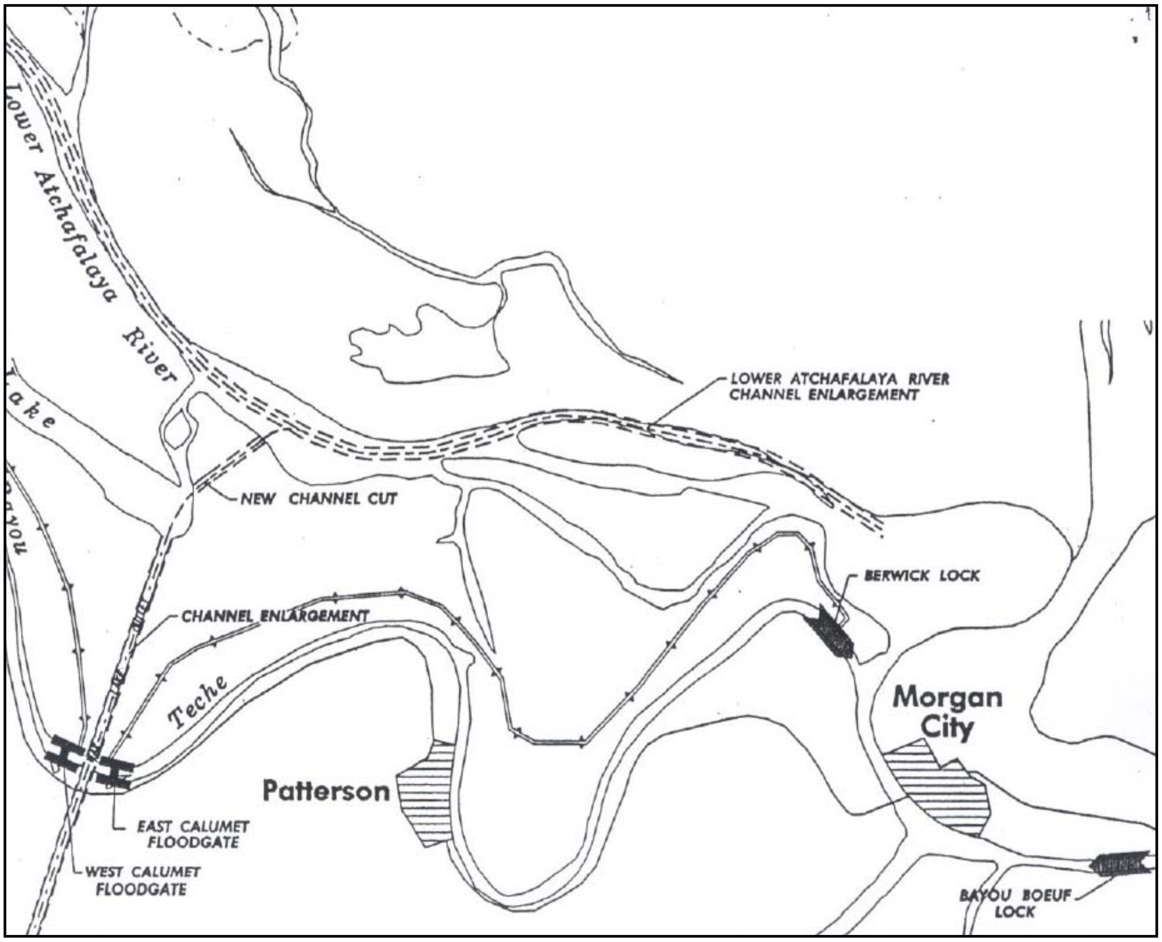


Figure 17: Wax Lake Outlet

Shoreline Protection

Freshwater Bayou Bank Stabibization,

The stabilization is located on the eastern bank of the Freshwater bayou Canal between Freshwater Bayou Canal and Belle Isle Bayou in Vermilion Parish. The canal bankline is experiencing significantly erosion from boat traffic in the canal. A 40,000-foot-long near-bank rock dike is to be constructed. The dike will be continuous except for openings left at the mouths of several oil-well canals where the dike will be tied into the bank on both sides of each canal.

Southwest Pass Bank Protection

Southwest Pass is an open channel located between the Gulf of Mexico and Vermilion Bay. The Pass has experienced significant erosion and is more than 10 meters deep.
The features would be a total of 9.0 miles of stone dike along the top bank of either side of the present channel (4.5 miles plus 4.5 miles). Dikes would be 6-feet high, 3-feet in

water and 3-feet above water. A 500-foot section on the west bank would be 33-feet in the water and 3-feet above water.

Marsh Island Shoreline Protection

The site is the gulf shoreline between the east bank of Freshwater Bayou (west end of Marsh Island) and South Point (eastern tip of Marsh Island). Stabilization would minimize loss of this gulf shoreline. Dredged sediment from off shore would be source material for this project. Material would be placed just into the marsh at 6 to 12-inches deep in thin layers.

Shoreline Protection and Vermillion Bay and West and East Cote Blanche Bays

This measure would provide shoreline protection at strategic locations in Vermilion Bay, West Cote Blanche Bay, and East Cote Blanche Bay using hard structure detached breakwaters**.**

Gulfshore Protection at Point Au Fer Island

Gulf shoreline of Point Au Fer Island is located in the southeastern area of St. Mary Parish, south and slightly east of the mouth of the Atchafalaya River. The stabilization will minimize annual losses along the gulf shoreline of the island. Stone segments 250-feet in length, 5-feet in height and 5-feet in top width with 50-foot gaps between segments will be placed in water two-feet deep approximately 100 feet from shoreline.

Estimates for all theses shoreline protection features were taken from costs developed for Louisiana's Comprehensive Master Plan for a Sustainable Coast (Apr 07).

BARRIER ISLANDS

Several studies have been and are being conducted on restoration of the Barataria and Terrebonne basin barrier islands. These include the Louisiana Coastal Area Ecosystem Restoration Study (LCA), the Barrier Island Feasibility Study and the ongoing Barataria Basin Barrier Island Feasibility Study. These existing costs and designs were used for this effort. Costs were updated to current price levels where necessary. Figures 18 and 19 show the location of the Barataria and Terrebonne barrier islands

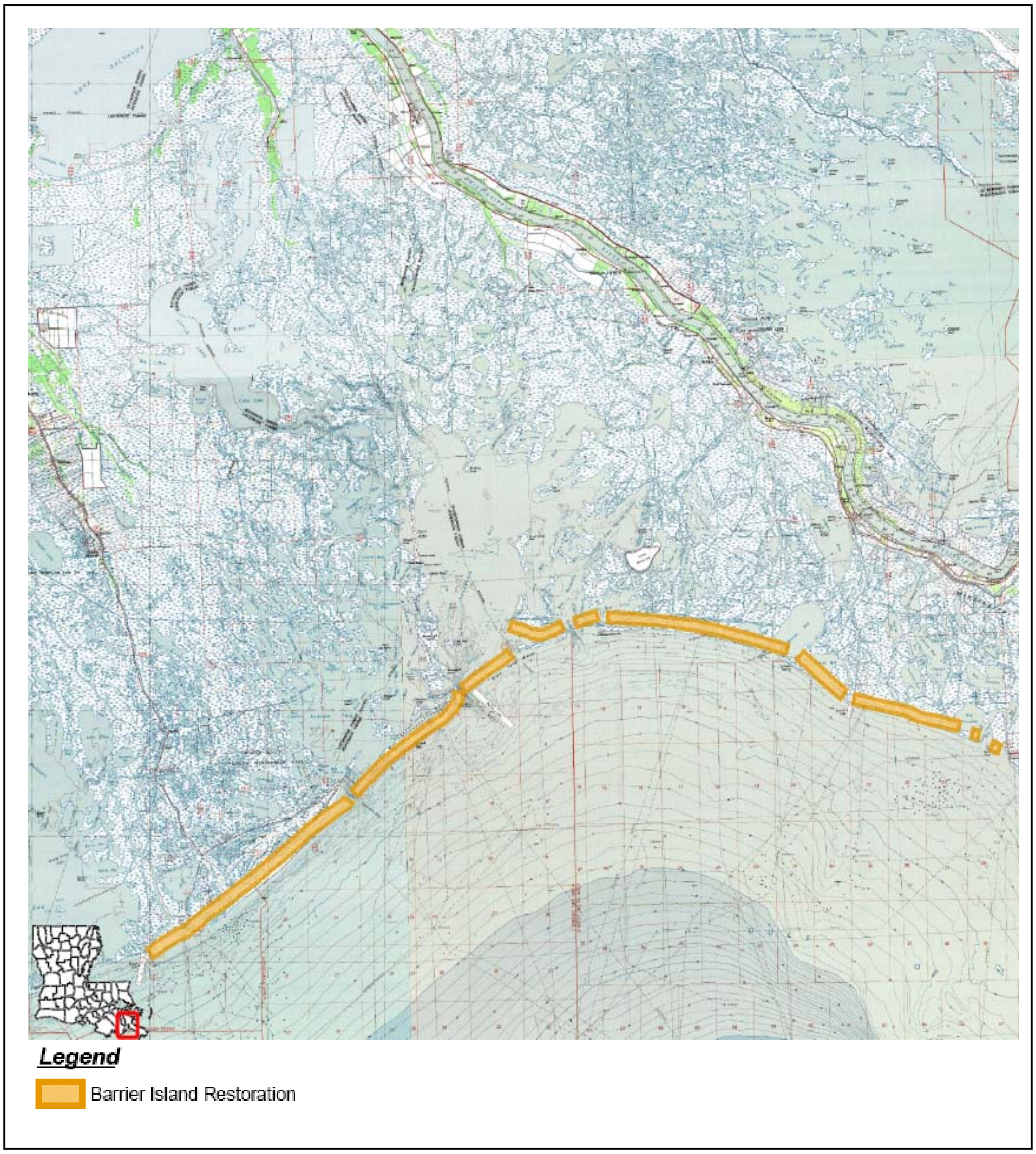


Figure 18: Barataria Basin Barrier Islands

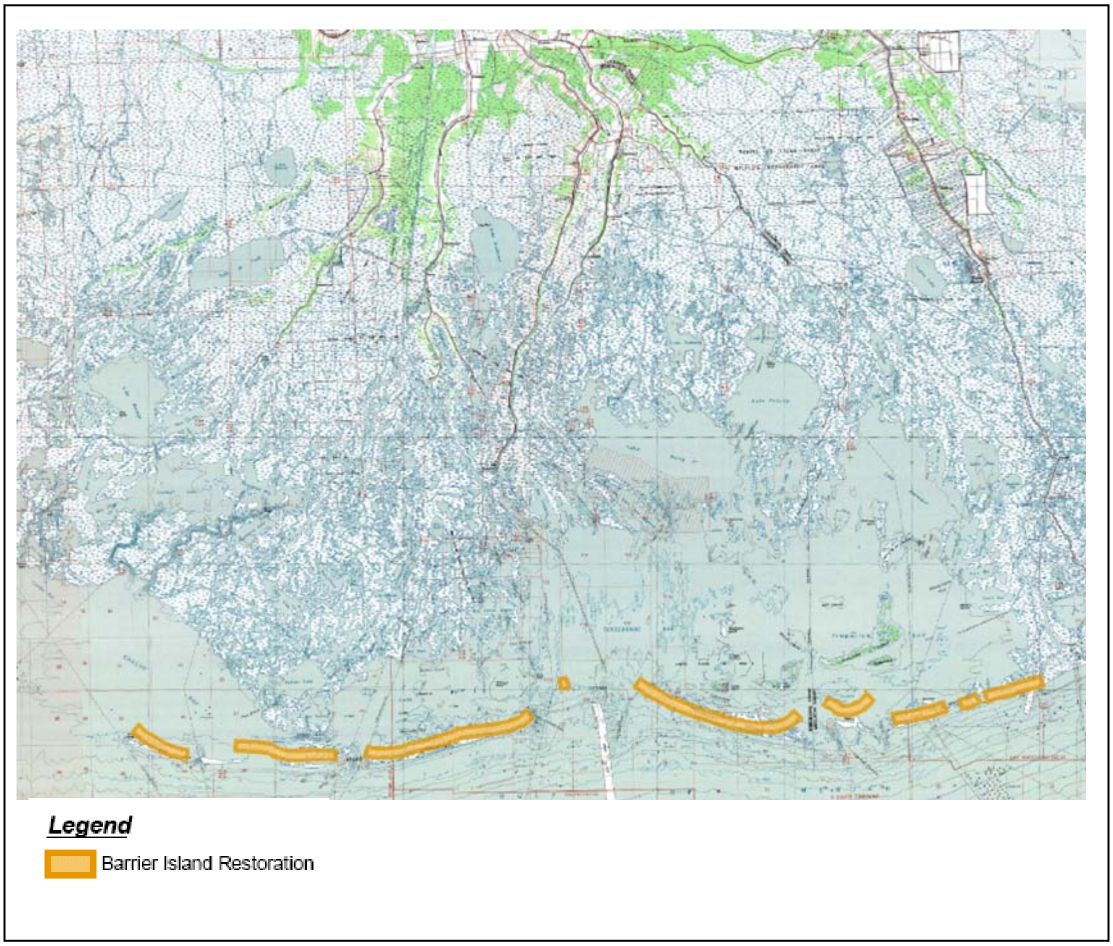


Figure 19: Terrebonne Basin Barrier Islands

COST ESTIMATES

GENERAL

Costs used for the MCDA analysis were developed by the HET based on costs for existing marsh creation, shore protection and diversion projects. These costs are included in the alternative costs shown in attachments 6 to 13 in Annex 2.

Subsequent to this analysis a detailed cost for each measure was developed for determining the cost for the final array of alternatives. The following discussion pertains to these more detailed estimates. The estimated costs were based upon an analysis of each line item evaluating quantity, production rate, and time, together with the appropriate equipment, labor and material costs. All of the construction work is generally common to the New Orleans District. Given the magnitude of this study, access to the construction sites is assumed to be available, either by land or water or both depending on the exact location of the feature.

Given the magnitude of the overall project, large quantities of equipment are assumed available based on adequate funding levels existing.

The costs prepared for and presented in this report are not to be used for making funding decisions. They are sufficient in detail for comparison of plans for initial screening, for use in performing MCDA and defining costs for the final array of alternatives. A more detailed cost estimate per regulation will be generated in the future upon completion of additional engineering analysis.

DIVERSIONS

The diversions were based on similar type structures previously built within the New Orleans District (Davis Pond Diversion and Old River Auxiliary Control Structure). Construction technique is basic to all large concrete structure construction. Costs for the structures were developed using recent historical data and by ratioing and indexing features from the original template structures. The project costs also include the channel excavation and channel rock armoring for the diversion structures. The channel material will either be placed adjacent for future levees or hydraulically dredged and pumped to create marsh. Major materials are assumed to be hauled in by truck or barged or combination.

MARSH CREATION

Marsh creation work was based on using standard industry techniques and equipment operating 24 hours per day 7 days per week. Due to the magnitude of the jobs and potential working environments, it is assumed the larger hydraulic dredges (cutterhead and/or hopper dredges) will be used for excavation and transporting material from borrow site to marsh creation areas. A general cost per distance method was used when specific placement-borrow site combinations were unknown along the Gulf area. Borrow sources include existing O&M, Mississippi River, Gulf of Mexico, and existing bays and lakes.

OTHER MEASURES

As stated above estimates for some of the proposed measures were originally developed for other efforts such as the Louisiana Coastal Area Ecosystem Restoration Study (LCA), the Coastal Wetlands Planning Protection and Restoration Act (CWPPRA) and Louisiana's Comprehensive Master Plan for a Sustainable Coast. For these measures an escalation factor was applied to update the existing cost estimates. This escalation was determined by using EM1110-2-1304, Civil Works Construction Cost Index System (CWCCIS).

CONTINGENCY

This study document represents many projects and alternatives that are very preliminary in nature, yet it was decided that it was necessary to present a contingency to better portray a likely cost value for the final array of alternatives. Since the projects are very preliminary, a risk-based study of the many alternatives would likely provide no better value or confidence in a contingency calculation. After much consideration, it was accepted that the contingency should be a value similar to the risk-based contingencies calculated on the GNO HSDRRS program. For this reason, a value of 50% was chosen as the likely value that can be supported through comparable studies on a similar program.

COASTAL ALTERNATIVE COST

Tables 5-9 show the first costs of each measure by Planning Unit. These costs apply to the low sea level rise scenario. Similar costs were developed for the high sea level rise scenario. These costs are combined with costs for other plan components (structural and nonstructural) to develop estimates for the final array of alternatives.

Table 5 - Coastal Restoration Plan Component – Representative Plan Features First Cost PU1

Measure #	Measure	Cost ($M)
2-1	Blind River Diversion	268.3
2-2	Hope Canal Diversion	311.3
2-3	Labranche Diversion	122.0
2-4	Bayou Bienvenue Diversion	331.6
2-5	East New Orleans Land Bridge Marsh Creation	1,851.2
2-6	Bayou LaLoutre Diversion	722.2
2-7	Biloxi Marshes Shore Protection	225.1
2-8	Biloxi Marshes Marsh Creation	10,726.4
2-9	Bayou Terre aux Bouefs Diversion	289.8
2-10	Bayou Terre aux Bouefs Marsh Creation	(included in 2-11)
2-11	Breton Sound Strategic Land Bridge	20,928.9
2-12	Caernarvon Diversion	324.3
2-13	Caernarvon Area Marsh Creation	(included in 2-11)
2-14	Bayou Lamoque Diversion	86.8
2-15	Grand Bay Diversion	29.5
TOTAL:		36,217.4

Table 6 - Coastal Restoration Plan Component – Representative Plan Features First Cost PU2		
Measure #	Measure	Cost ($M)
2-1	Lagan Diversion	256.2
2-2	Edgard Diversion	223.1
2-3	Davis Pond Freshwater Diversion Reauthorization	2.2
2-4	Naomi Diversion	119.4
2-5	Myrtle Grove Diversion	316.3
2-6	Strategic Marsh Creation in Lower Basin	1,675.6
2-7	North Bay Rim Marsh Creation /Protection	6,404.1
2-8	West Point a la Hache Diversion	130.7
2-9	Port Sulphur Diversion	54.9
2-10	Buras Diversion	42.6
2-11	Fort Jackson Diversion	46.5
2-12	Barrier Island Restoration	786.8
TOTAL:		10,058.4

Table 7 - Coastal Restoration Plan Component – Representative Plan Features First Cost PU3a		
Measure #	Measure	Cost ($M)
1-1	HNC Lock Multi-purpose Operation	0
1-2	Convey Atchafalaya River Water via the GIWW	329.6
1-3	Lapeyrouse Canal Diversion	6.8
1-4	Blue Hammock Diversion	43.6
1-5	Upper Lake Boudreaux Basin Mississippi River Diversion	4,296.5
1-6	East Terrebonne Mississippi River Diversion	(included in 1-5)
1-7	Grand Bayou & Jean LaCroix Basin Mississippi River Diversion	(included in 1-5)
1-8	Pipeline Conveyance Marsh Creation	53,965.2
1-9	North Terrebonne Bay Rim Marsh Creation	3,493.9
1-10	DuLarge to Grand Caillou Landbridge Marsh Creation	3,767.1
1-11	South Caillou Landbridge Marsh Creation	(included in 1-10)
1-12	Isles Dernieres Restoration	818.0
1-13	Timbalier Islands Restoration	(included in 1-12)
TOTAL:		66,720.7

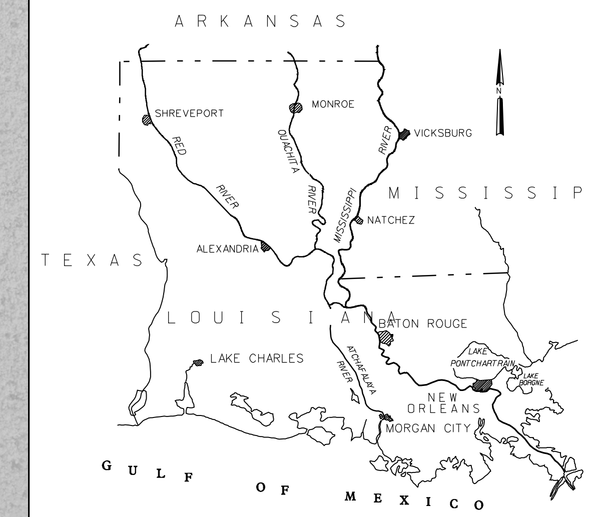
Table 8 - Coastal Restoration Plan Component – Representative Plan Features First Cost PU3b

Measure #	Measure	Cost ($M)
1-1	Penchant Basin Plan	17.9
1-2	Convey Atchafalaya River water via the GIWW	(see PU3a 1-2)
1-3	Relocate the Navigation Channel through Lower Atchafalaya River Delta	203.5
1-4	Increase Sediment Transport Down Wax Lake Outlet	27.3
1-5	Barrier Reef from Eugene Island to Pointe au Fer Island	135.8
1-6	Blue Hammock Bayou Freshwater Introduction	(See PU3a 1-4)
1-7	Gulfshore Protection at Point au Fer Island	81.3
1-8	Freshwater Bayou Bank Protection, Belle Isle to Lock	37.3
1-9	Southwest Pass Bank Protection	51.6
1-10	Marsh Island Shoreline Protection	8.0
1-11	Gulfshore Protection from Freshwater Bayou to Southwest Pass	56.7
1-12	Shoreline Protection at Vermillion Bay & West Cote Blanche Bay	94.9
1-13	East Cote Blanche Bay Shore Protection	(included in 1-12)
1-14	Bayou Decade Area Marsh Creation	1,231.2
1-15	Brady Canal Area Marsh Creation	928.7
1-16	Pointe au Fer Island Marsh Creation	745.6
1-17	Marsh Island Marsh Creation	1,475.1
1-18	Wax Lake Outlet Delta Marsh Creation	390.1
1-19	Bayou Penchant Area Marsh Creation	1,569.8
1-20	Terrebonne GIWW Area Marsh Creation	1,244.5
TOTAL:		8,299.3

Table 9 - Coastal Restoration Plan Component – Representative Plan Features First Cost PU4

Measure #	Measure	Cost ($M)
1-1	Marsh Creation at Mud Lake	504.7
1-2	Marsh Creation at South Grand Chenier	352.6
1-3	Marsh Creation at South Pecan Island	785.5
1-4	Marsh Creation at East Pecan Island	796.6
1-5	Marsh Creation at No-Name Bayou	517.7
1-6	Marsh Creation at NW Calcasieu Lake	5,726.2
1-7	Marsh Creation at East Calcasieu Lake	1,082.1
1-8	Marsh Creation at Black Bayou	2,328.1

Table 9 - Coastal Restoration Plan Component – Representative Plan Features First Cost PU4		
Measure #	Measure	Cost ($M)
1-9	Marsh Creation at Gum Cove	940.1
1-10	Marsh Creation at Cameron Meadows	188.9
1-11	Marsh Creation at Central Canal	585.2
1-12	GIWW bank Stabilization	790.6
1-13	Grand Lake Bank Stabilization	314.0
1-14	White Lake Bank Stabilization	234.3
1-15	Gulf Shoreline Stabilization (Sabine River to Calcasieu River)	107.4
1-16	Gulf Shoreline Stabilization (Calcasieu River to Freshwater Bayou)	316.5
TOTAL:		15,570.5



VICINITY MAP

SCALE OF MILES

40 0 40 80 120 160 200

ACRES = 200

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MARK	DESCRIPTION	DATE	APPR

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NEW ORLEANS, LOUISIANA

DESIGNED BY: KIM LESAICHERRE		DATE:
DWN BY: KML	CKD BY: JAB	SOLICITATION NO.:
SUBMITTED BY: J.A. BINET		CONTRACT NO.:
PLOT SCALE: 6,000:1	PLOT DATE: 11/21/08	FILE NUMBER:
SIZE: ANSI D	FILE NAME: BLIND RIVER DIVERSION.dgn	

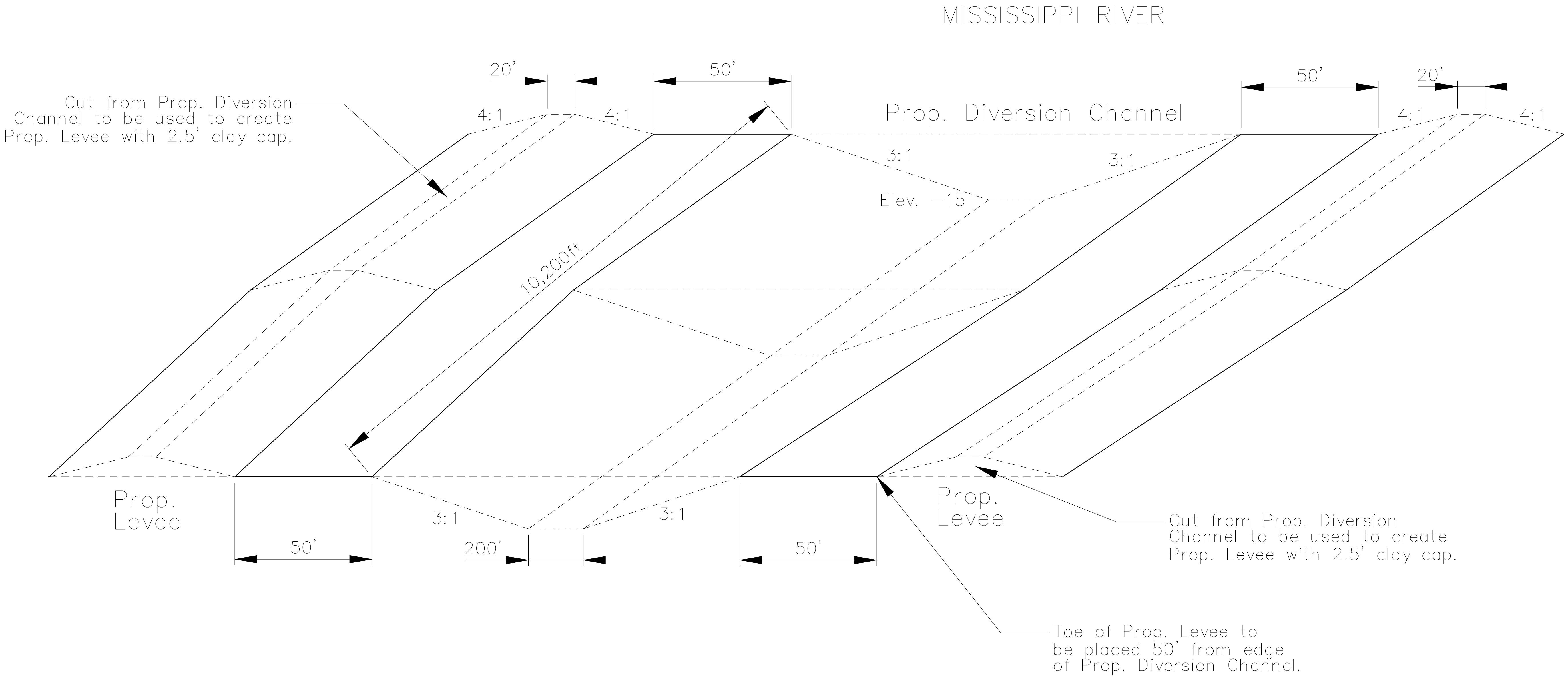
BLIND RIVER DIVERSION

PLAN VIEW

SHEET IDENTIFICATION
PLATE 1

BLIND RIVER DIVERSION

CROSS SECTION



NOTES:

River Mile: 159 East Bank
Outflow Channel Invert: -15ft to -2ft (NAVD 88)
Channel Width: 200ft
Channel Length: 10,200ft
Levee Crown: 20ft
Leve Elev.: +15ft (NAVD 88)

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DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
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BLIND RIVER DIVERSION
Cross Section

SHEET IDENTIFICATION
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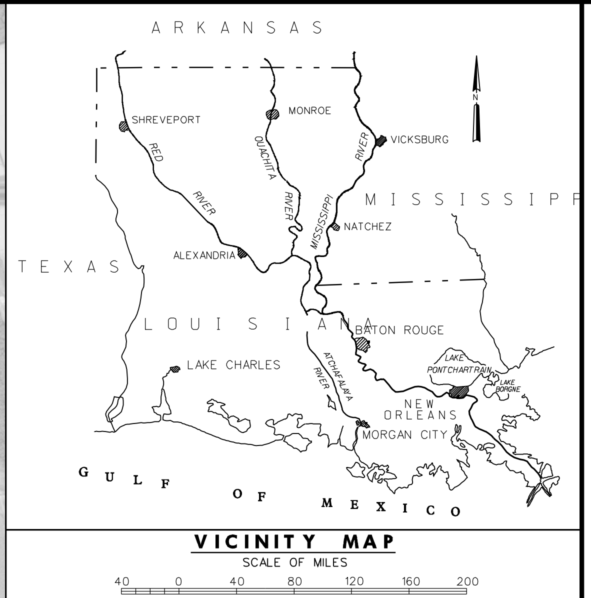

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SUBMITTED BY: J.A. BINET		CONTRACT NO.:
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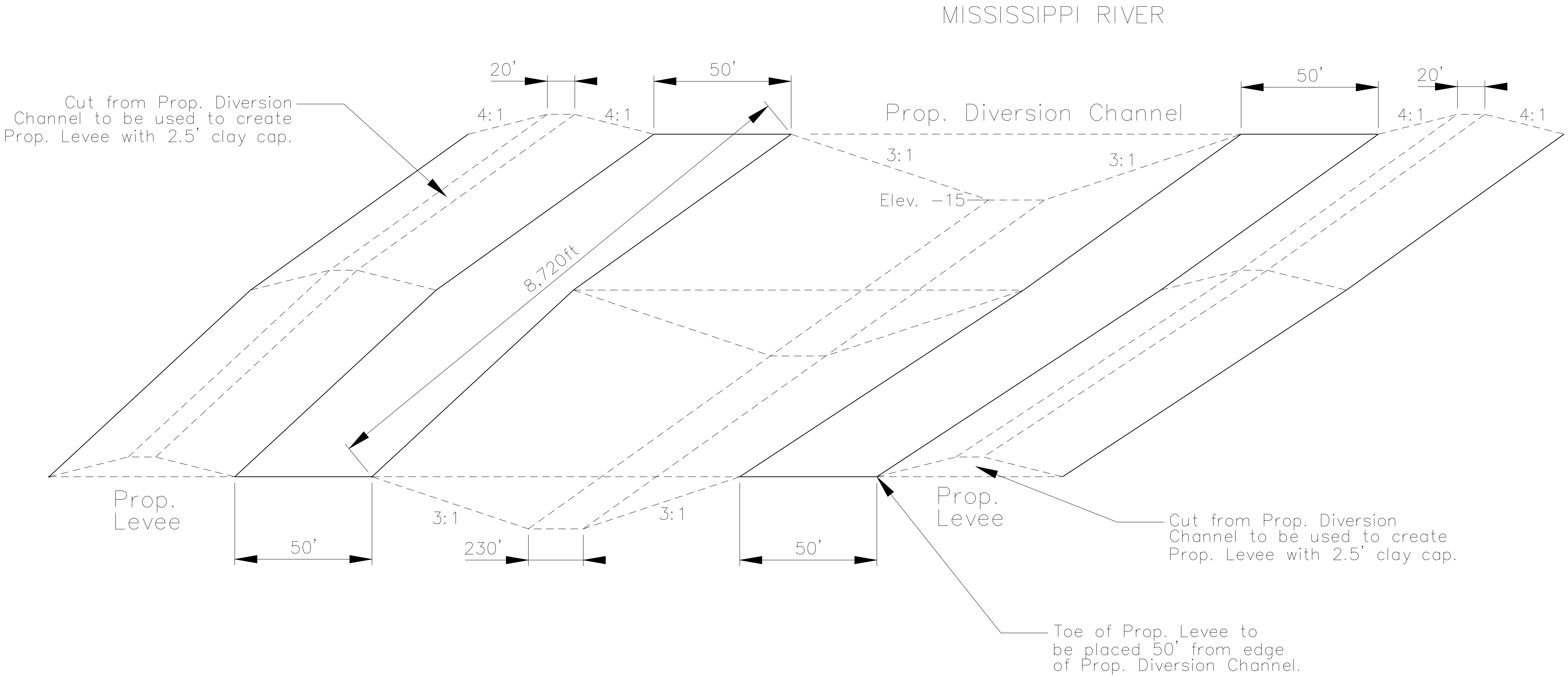
HOPE CANAL DIVERSION

PLAN VIEW

SHEET IDENTIFICATION
PLATE 2

HOPE CANAL DIVERSION

CROSS SECTION



NOTES:

River Mile: 144 East Bank
Outflow Channel Invert: −15ft to −2ft (NAVD 88)
Channel Width: 230ft
Channel Length: 8,720ft
Levee Crown: 20ft
Leve Elev.: +15ft (NAVD 88)

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SUBMITTED BY: PRG | CONTRACT NO.:
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NEW ORLEANS, LOUISIANA

HOPE CANAL DIVERSION
Cross Section

SHEET IDENTIFICATION
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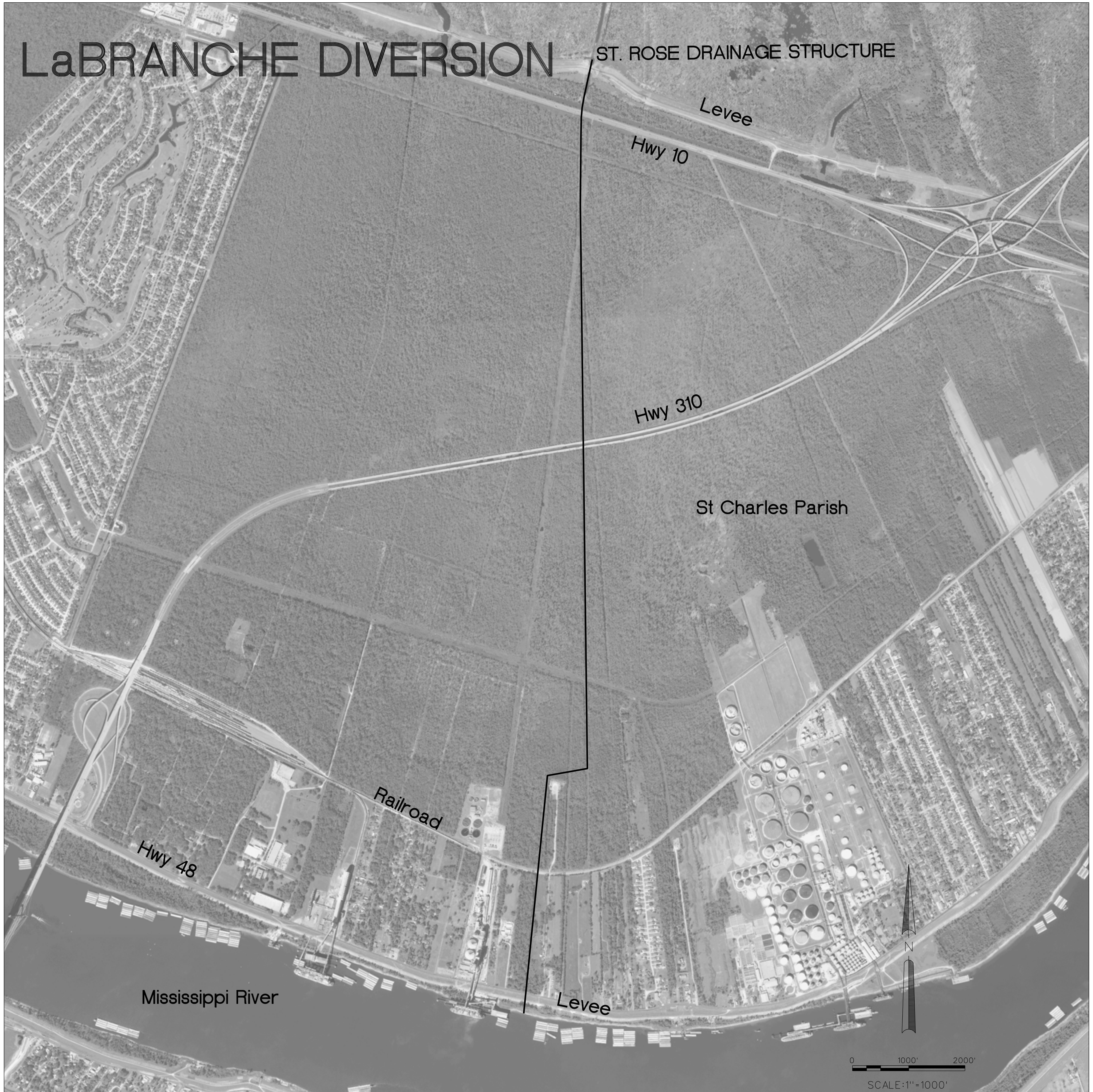

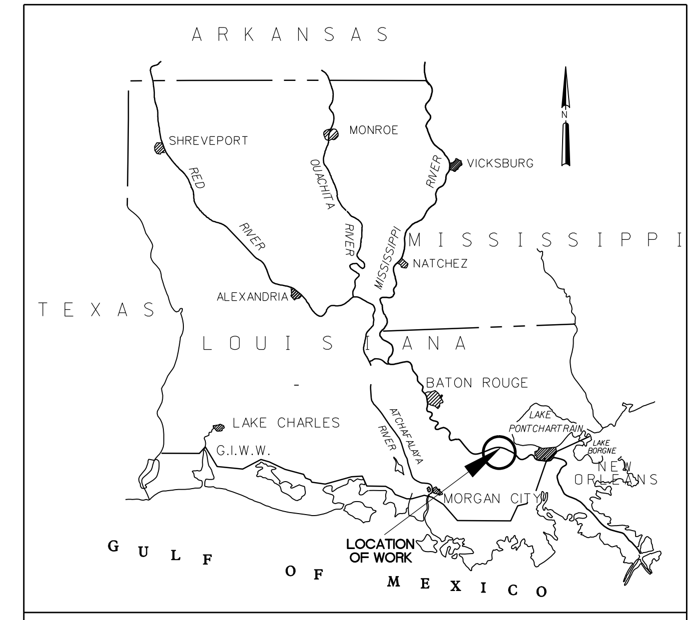

VICINITY MAP

NOTE:
1.) Approximately 170 ac needed.
2.) River Mile 116 (west bank).

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NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PATRICK R. GREY
DWN BY: PRG
CKD BY: KJO
SUBMITTED BY: PATRICK R. GREY
PLOT SCALE: 1000':1"
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CONTRACT NO.: W912P8-##-X-####
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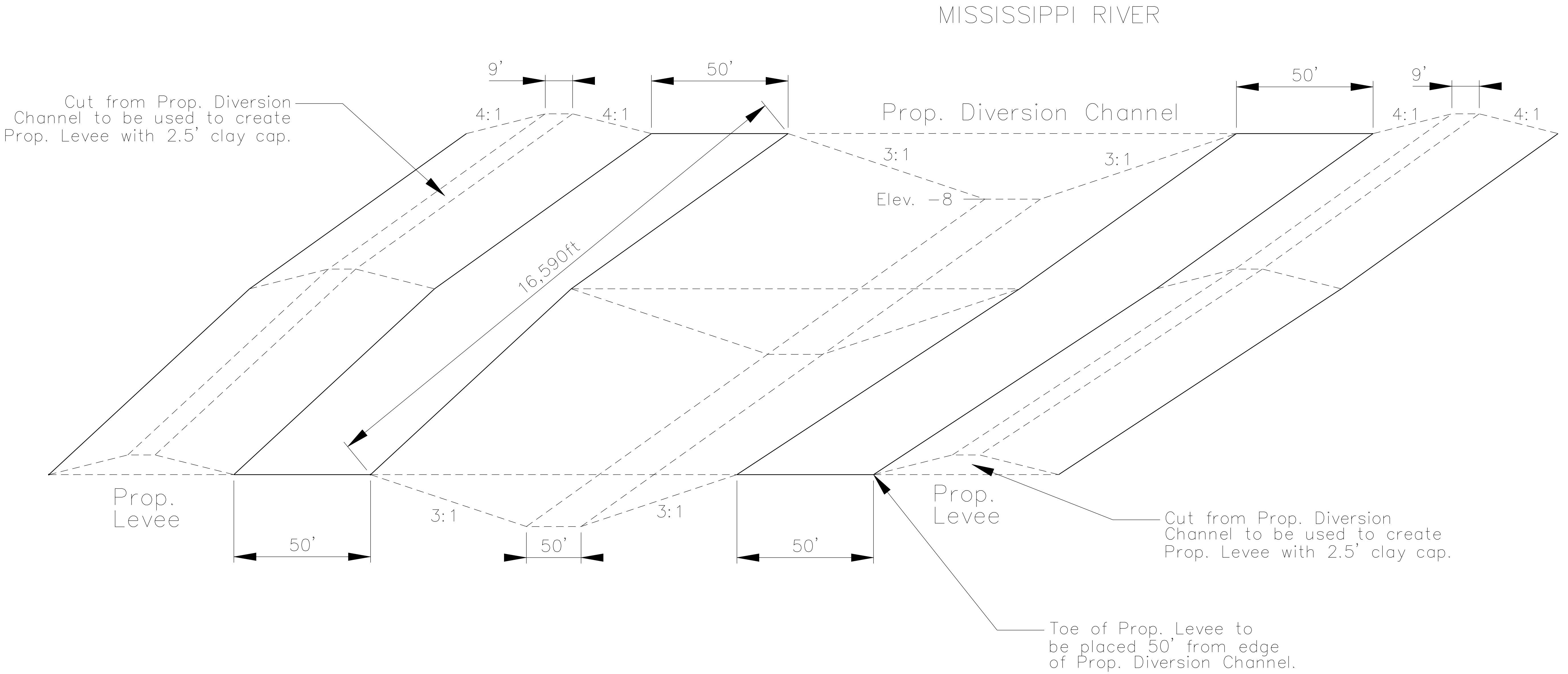
LABRANCHE DIVERSION
PLAN VEIW

SHEET IDENTIFICATION
PLATE 3

LABRANCHE DIVERSION

CROSS SECTION



NOTES:

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Channel Width: 50ft
Channel Length: 16,590ft
Levee Crown: 9ft
Leve Elev.: +15ft (NAVD 88)

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MARK	DESCRIPTION	DATE	APPR

DATE: 8/14/08
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NEW ORLEANS, LOUISIANA

LABRANCHE DIVERSION
Cross Section

SHEET IDENTIFICATION
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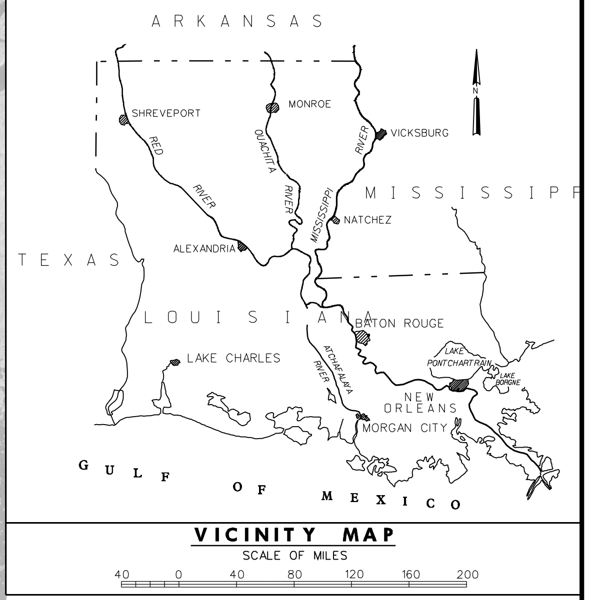

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DESIGNED BY: KIM LESAICHERRE
DATE:
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CKD BY: JAB
SOLICITATION NO.:
SUBMITTED BY: J. A. BINET
CONTRACT NO.:
PLOT SCALE: 6,000:1
PLOT DATE: 11/21/08
FILE NUMBER:
SIZE: ANSI D
FILE NAME: BAYOU BIENVENUE DIVERSION.dgn

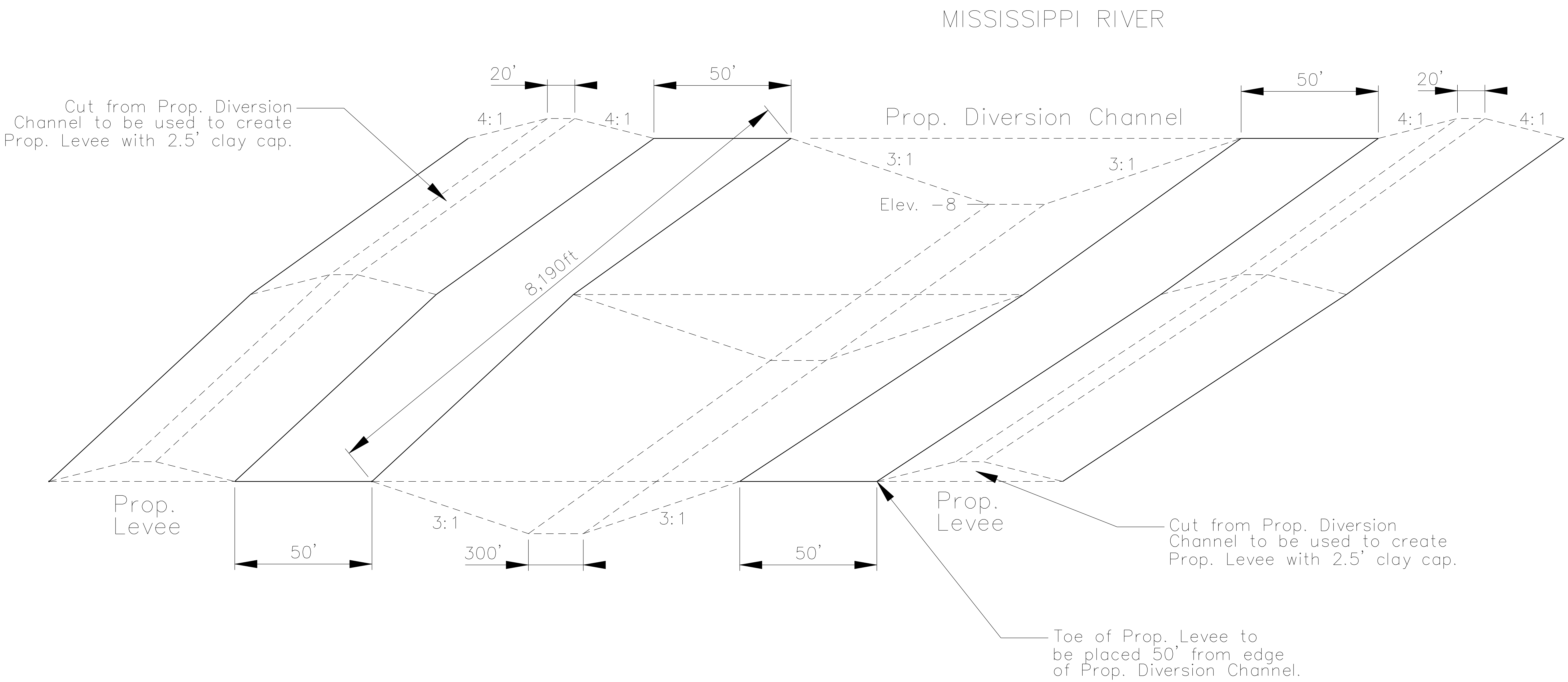
BAYOU BIENVENUE DIVERSION

PLAN VIEW

SHEET IDENTIFICATION
PLATE 4

BAYOU BIENVENUE DIVERSION

CROSS SECTION



NOTES:

River Mile: 92 East Bank
Outflow Channel Invert: -15ft to -2ft (NAVD 88)
Channel Width: 300ft
Channel Length: 8,190ft
Levee Crown: 20ft
Leve Elev.: +15tf (NAVD 88)

US Army Corps of Engineers®
NEW ORLEANS DISTRICT

MARK | DESCRIPTION | DATE | APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

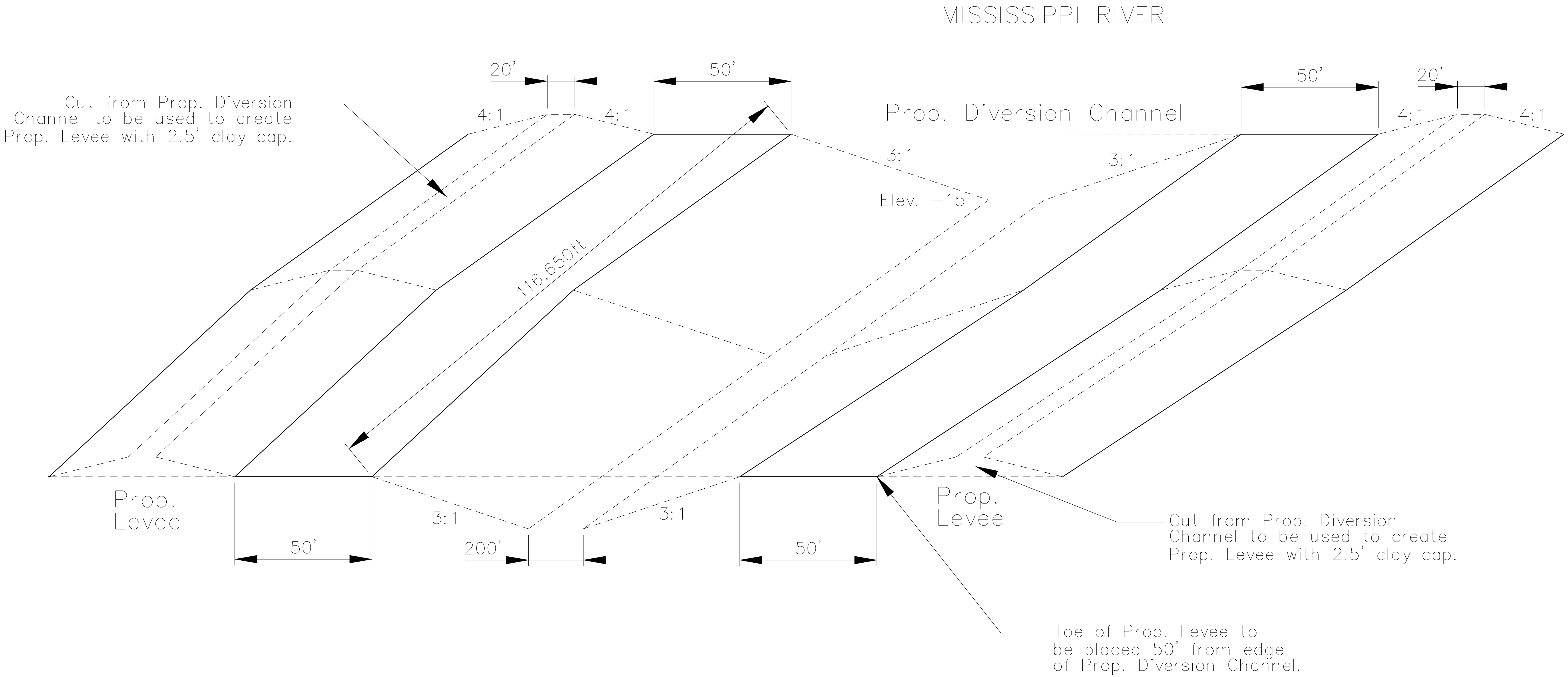
BAYOU BIENVANUE DIVERSION
Cross Section

SHEET IDENTIFICATION
04


BAYOU LALOUTRE DIVERSION
MISSISSIPPI RIVER
LAKE BORGNE
MRGO
BIG MAR
LAKE LERY
PLAN VIEW
4000' 0 4000' 8000' 12000' 16000'
VICINITY MAP
SCALE OF MILES
40 0 40 80 120 160 200
ARKANSAS
MISSISSIPPI
TEXAS
LOUISIANA
GULF OF MEXICO
SHREVEPORT
MONROE
VICKSBURG
NATCHEZ
ALEXANDRIA
BATON ROUGE
LAKE CHARLES
NEW ORLEANS
MORGAN CITY
ACRES = 2126
US Army Corps of Engineers®
NEW ORLEANS DISTRICT
MARK
DATE
DESCRIPTION
APPR
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA
DESIGNED BY: KIM LESAICHERRE
DATE:
DWN BY: KML
CKD BY: JAB
SOLICITATION NO.:
SUBMITTED BY: J.A. BINET
CONTRACT NO.:
PLOT SCALE: 6,000:1
PLOT DATE: 11/21/08
FILE NUMBER:
SIZE: ANSI D
FILE NAME: BAYOU LALOUTRE DIVERSION.dgn
PROJECT TITLE 3
SHEET TITLE 2
SHEET IDENTIFICATION
PLATE 5

BAYOU LALOUTRE DIVERSION

CROSS SECTION



NOTES:

River Mile: 83 East Bank
Outflow Channel Invert: -15ft to -2ft (NAVD 88)
Channel Width: 200ft
Channel Length: 116,650ft
Levee Crown: 20ft
Leve Elev.: +15ft (NAVD 88)

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NEW ORLEANS DISTRICT

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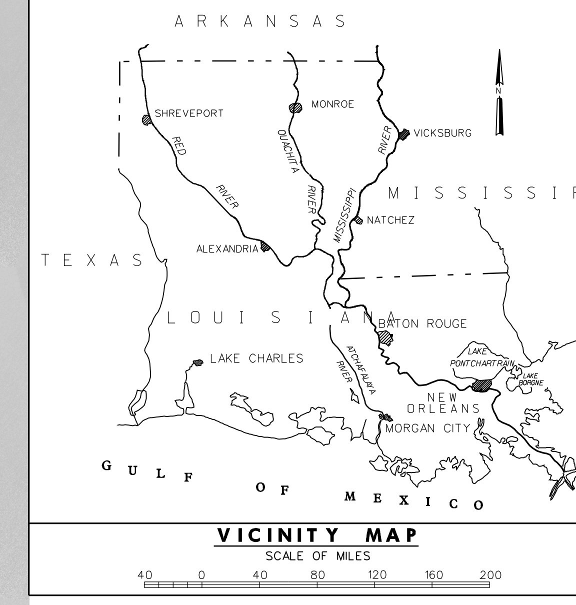
MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

BAYOU LALOUTRE DIVERSION
Cross Section

SHEET IDENTIFICATION
05



ACRES = 603

US Army Corps of Engineers®
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: KIM LESAICHERRE		DATE:
DWN BY: KML	CKD BY: JAB	SOLICITATION NO.:
SUBMITTED BY: J. A. BINET		CONTRACT NO.:
PLOT SCALE: 48,000:1	PLOT DATE: 11/21/08	FILE NUMBER:
SIZE: ANSI D	FILE NAME: BAYOU TERRE AUX BOEUFS DIVERSION.dgn	

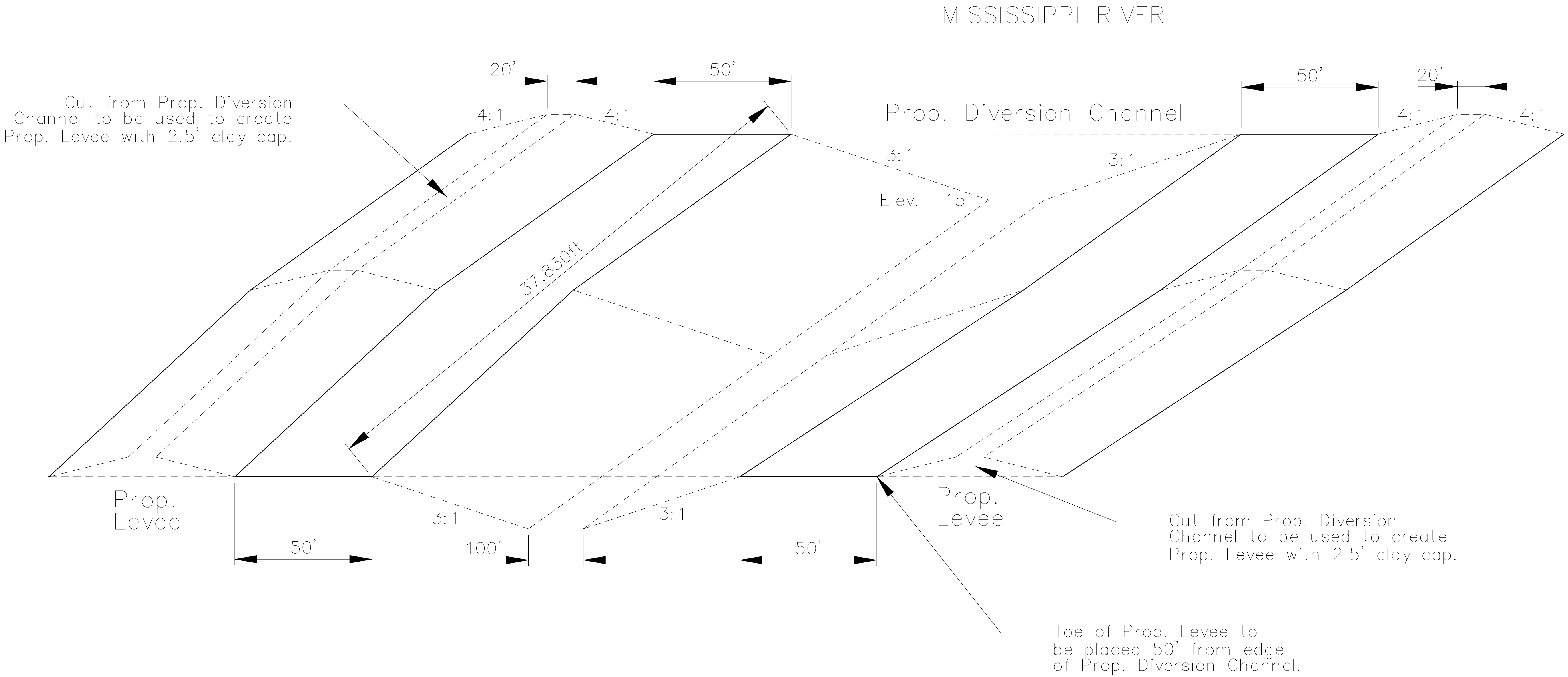
BAYOU TERRE AUX BOEUFS DIVERSION

PLAN VIEW

SHEET IDENTIFICATION
PLATE 6

BAYOU TERRE DIVERSION

CROSS SECTION



NOTES:

River Mile: 82 East Bank
Outflow Channel Invert: -15ft to -2ft (NAVD 88)
Channel Width: 100ft
Channel Length: 37,830ft
Levee Crown: 20ft
Leve Elev.: +15ft (NAVD 88)

US Army Corps of Engineers® NEW ORLEANS DISTRICT

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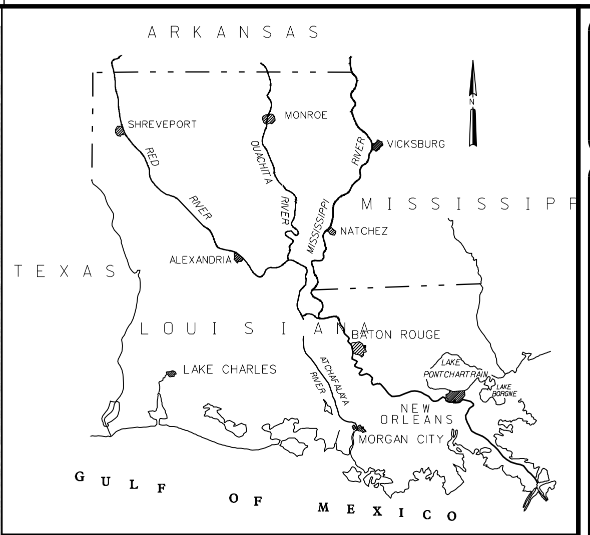
MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

BAYOU TERRE DIVERSION
Cross Section

SHEET IDENTIFICATION
06



VICINITY MAP

SCALE OF MILES

40 0 40 80 120 160 200

ACRES=85

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NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: KIM LESAUCHERRE
DATE:
DWN BY: KML
CKD BY: JAB
SOLICITATION NO.:
SUBMITTED BY: J.A. BINET
CONTRACT NO.:
PLOT SCALE: 12,000:1
PLOT DATE: 11/21/08
FILE NUMBER:
SIZE: ANSI D
FILE NAME: CAERNARVON DIVERSION.dgn

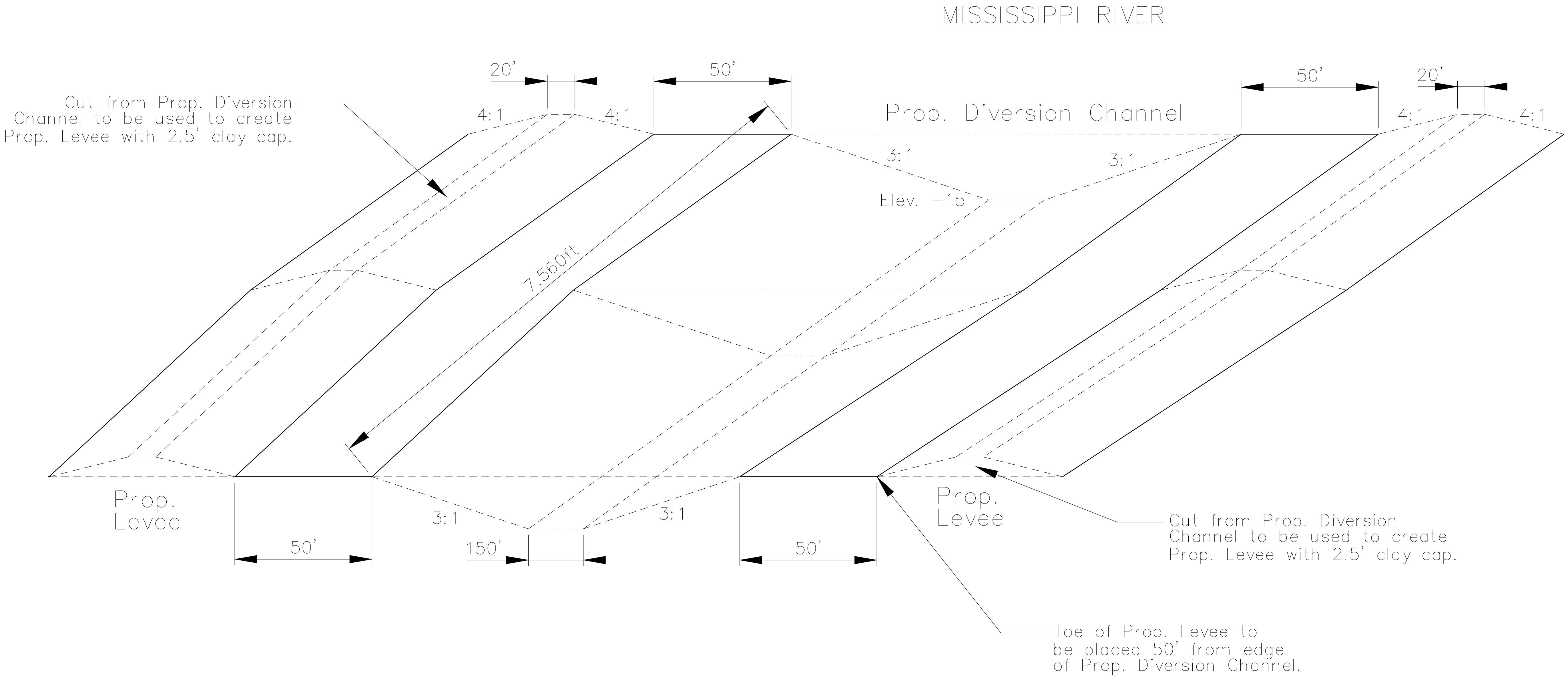
CAERNARVON DIVERSION

PLAN VIEW

SHEET IDENTIFICATION
PLATE 7

CAERNARVON DIVERSION

CROSS SECTION



NOTES:

River Mile: 81 East Bank
Outflow Channel Invert: -2ft to -15ft (NAVD 88)
Channel Width: 150ft
Channel Length: 7,560ft
Levee Crown: 20ft
Levee Elev.: +15ft (NAVD 88)

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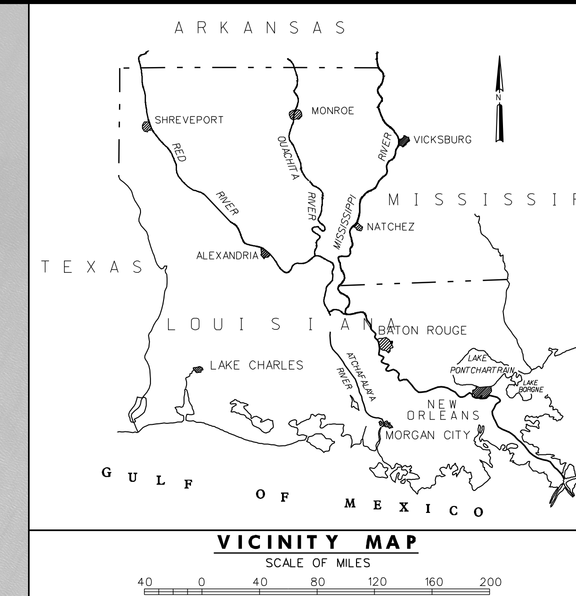
MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

CAERNARVON DIVERSION
Cross Section

SHEET IDENTIFICATION
07



ACRES = 93

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MARK	DESCRIPTION	DATE	APPR.

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NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: KIM LESAICHERRE
DWN BY: KML
CKD BY: JAB
SUBMITTED BY: J.A. BINET
PLOT SCALE: 12,000:1
PLOT DATE: 11/21/08
SIZE: ANSI D
FILE NAME: BAYOU LAMOQUE DIVERSION.dgn
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

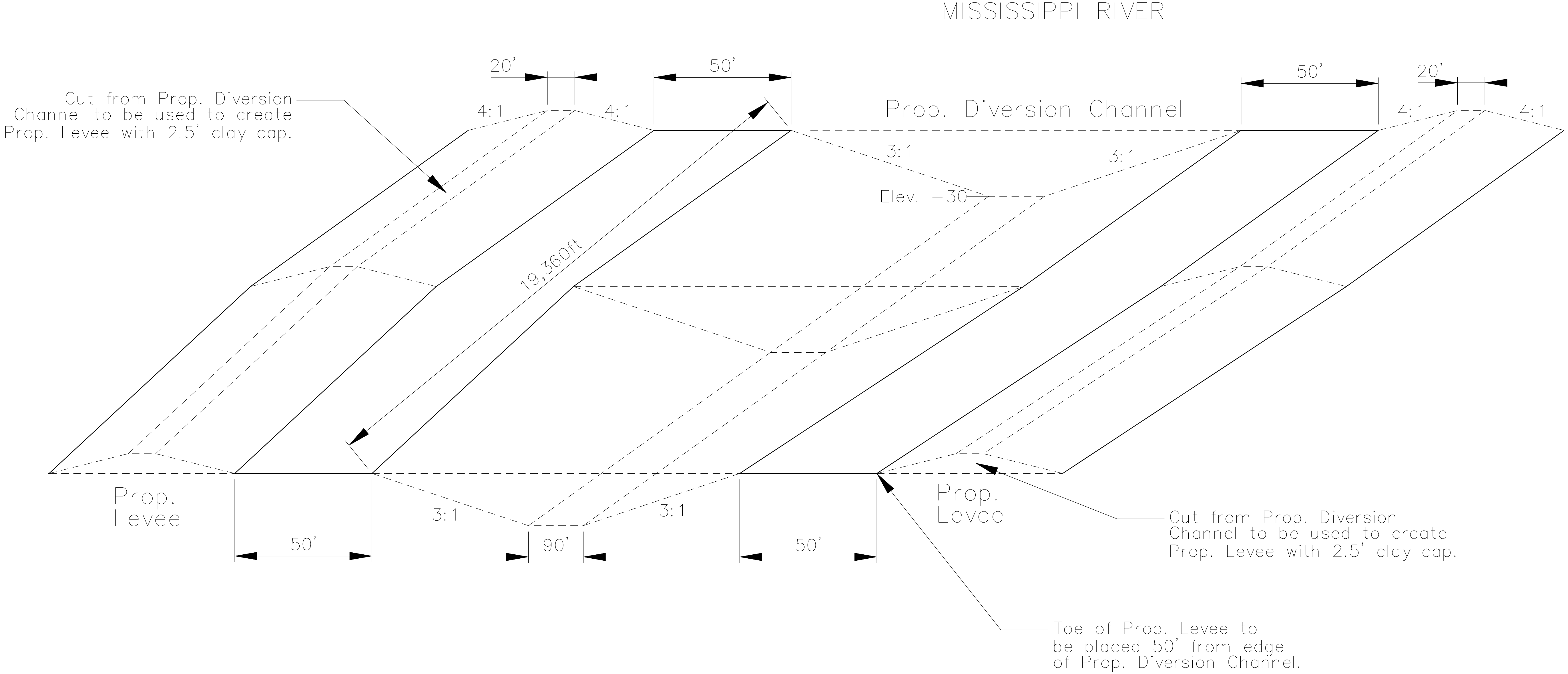
BAYOU LAMOQUE DIVERSION

PLAN VIEW

SHEET IDENTIFICATION
PLATE 8

LAMOQUE DIVERSION

CROSS SECTION



NOTES:
River Mile: 33 East Bank
Outflow Channel Invert: -30ft to -30ft (NAVD 88)
Channel Width: 90ft
Channel Length: 19,360ft
Levee Crown: 20ft
Levee Elev.: +15ft (NAVD 88)

US Army Corps of Engineers®
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR

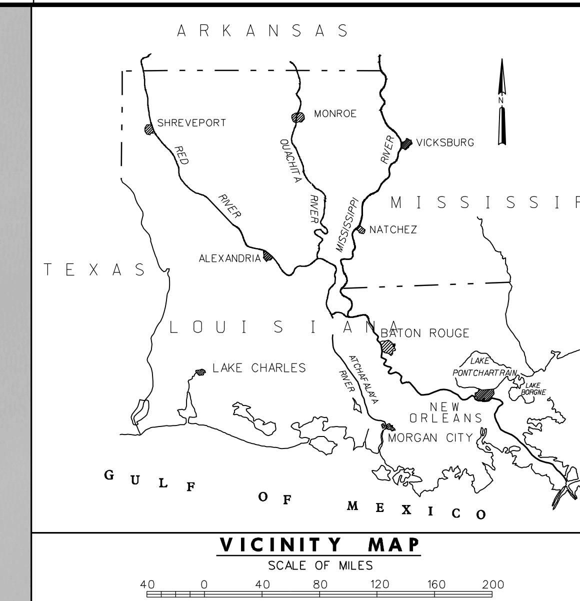
MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

LAMOQUE DIVERSION
Cross Section

SHEET IDENTIFICATION
08



ACRES = 32

US Army Corps of Engineers®
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: KIM LESAICHERRE		DATE:
DWN BY: KML	CKD BY: JAB	SOLICITATION NO.:
SUBMITTED BY: J.A. BINET		CONTRACT NO.:
PLOT SCALE: 6,000:1	PLOT DATE: 11/21/08	FILE NUMBER:
SIZE: ANSI D	FILE NAME: GRAND BAY DIVERSION.dgn	

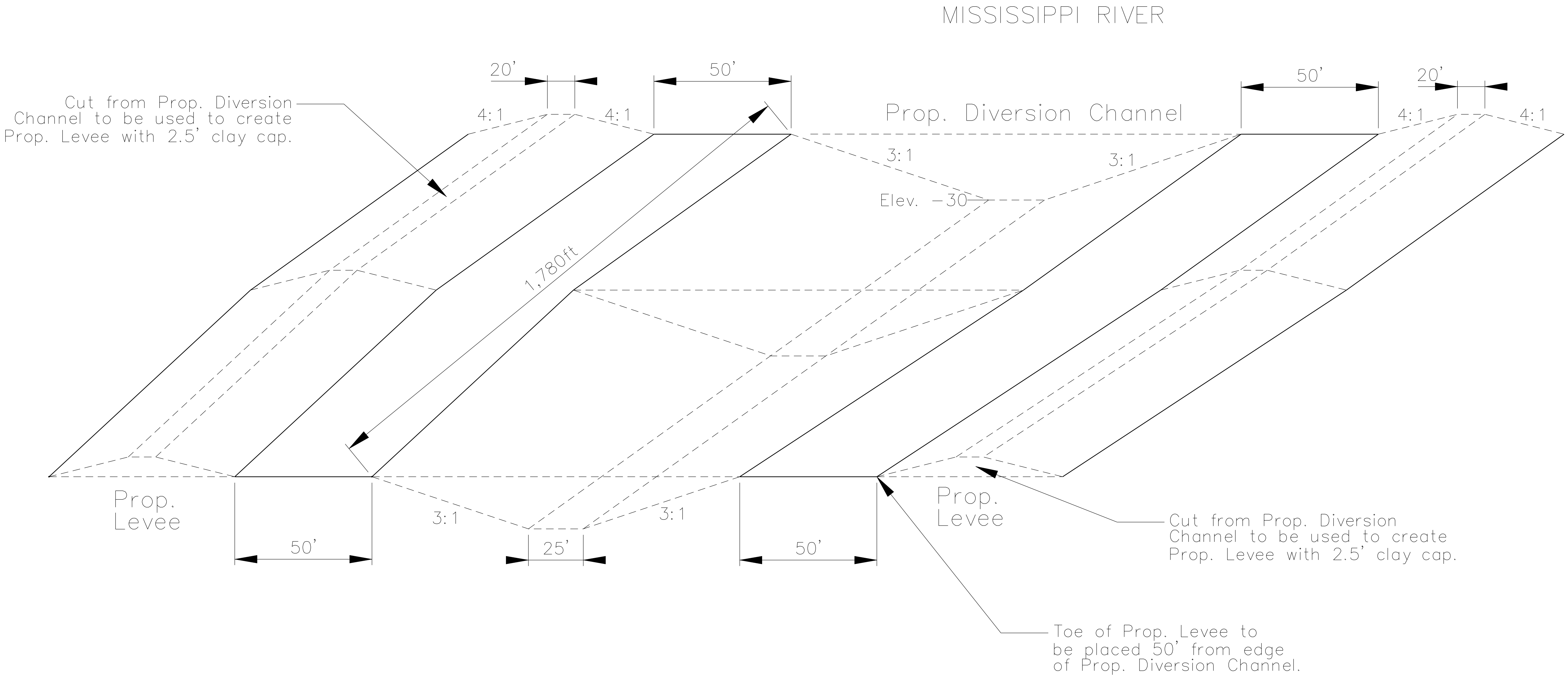
GRAND BAY DIVERSION

PLAN VIEW

SHEET IDENTIFICATION
PLATE 9

GRAND BAY DIVERSION

CROSS SECTION



NOTES:

River Mile: 16 East Bank
Outflow Channel Invert: -30ft to -30ft (NAVD 88)
Channel Width: 25ft
Channel Length: 1,780ft
Levee Crown: 20ft
Leve Eleve.: +15ft (NAVD 88)

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NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

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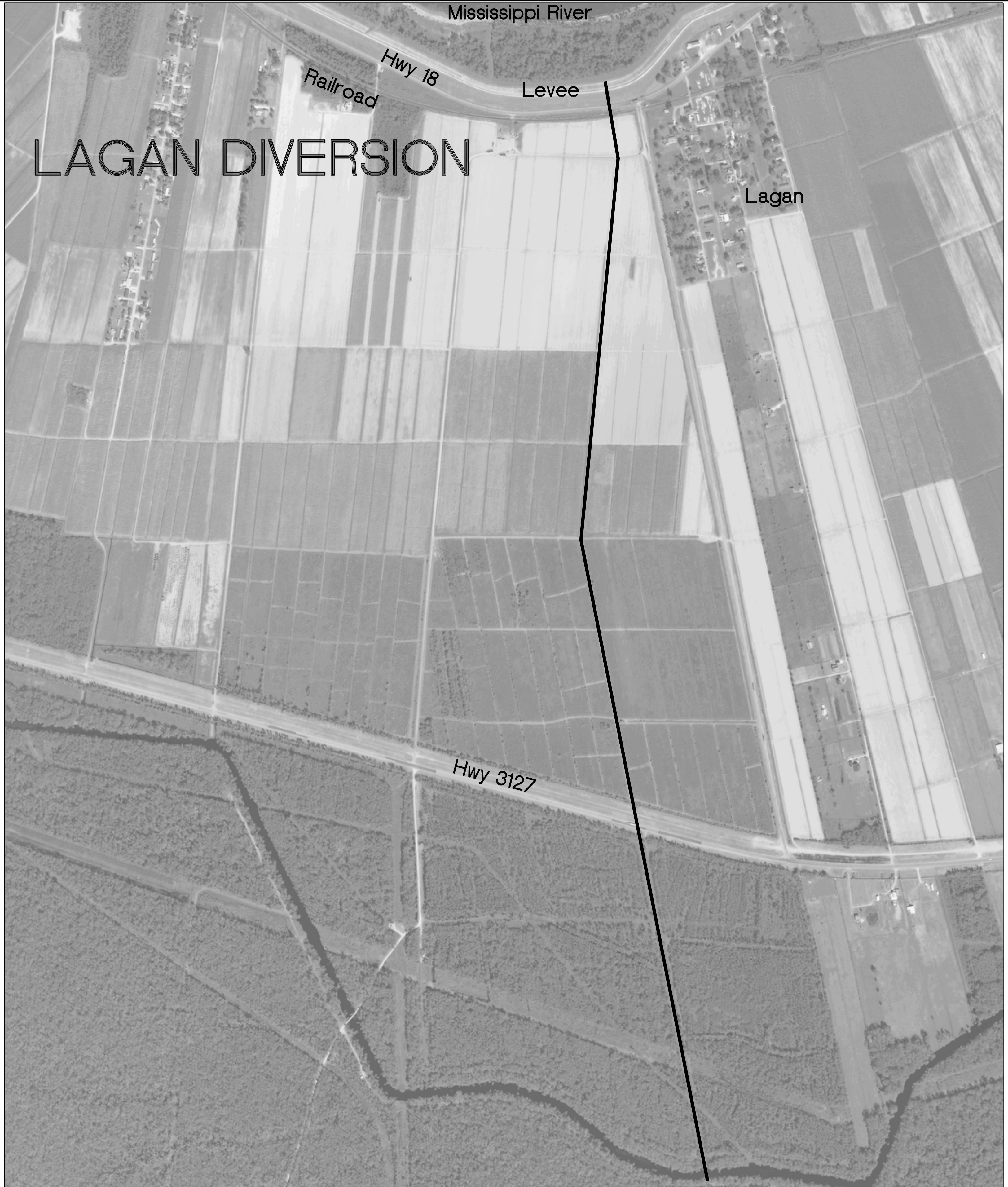
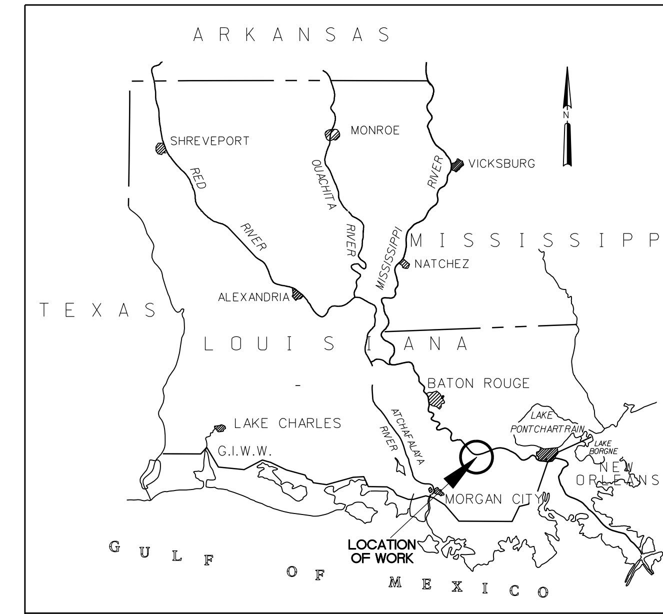
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

GRAND BAY DIVERSION
Cross Section

SHEET IDENTIFICATION
09





VICINITY MAP

0 500' 1000'

SCALE:1"=500'

US Army Corps of Engineers
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

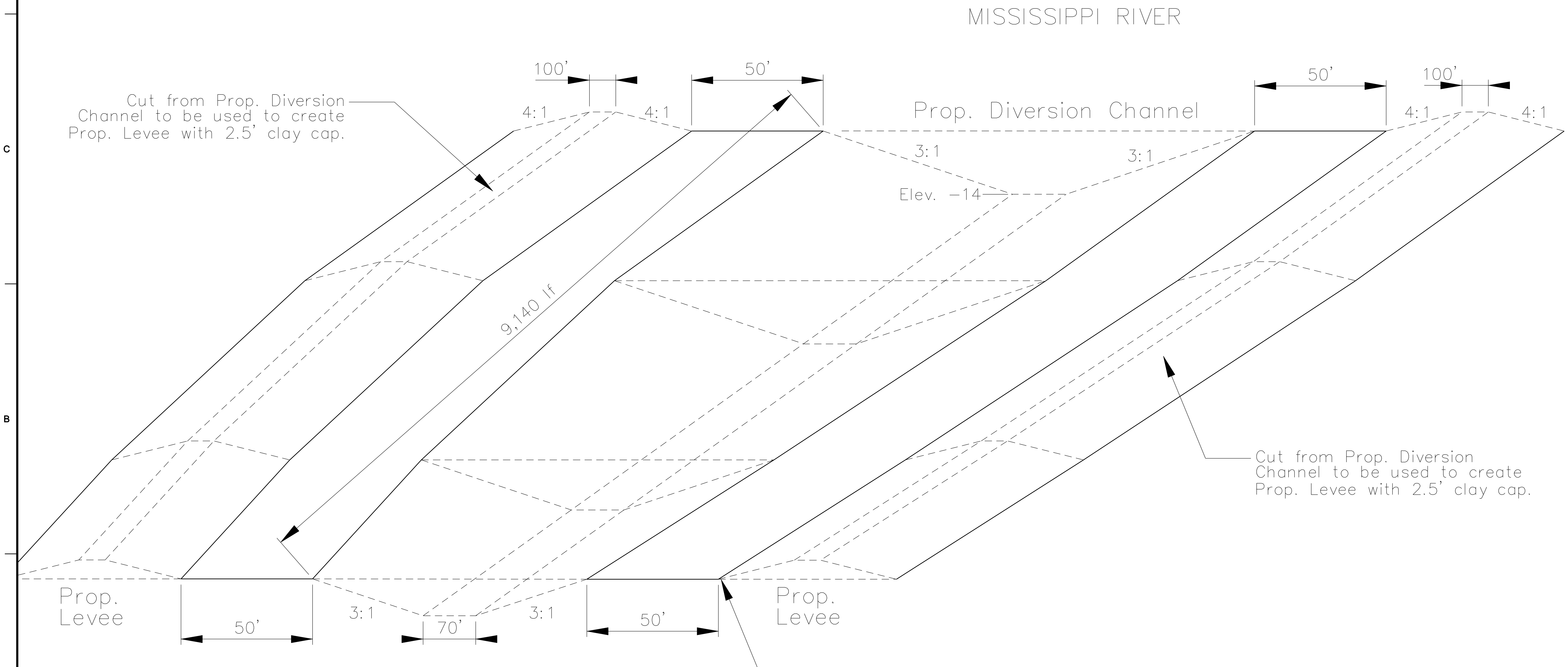
DESIGNED BY: PRG
DWN BY: PRG
CKD BY:
SUBMITTED BY: PRG
PLOT SCALE: 1"=500'
PLOT DATE:
SIZE:
FILE NAME:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

LAGAN DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 10

LAGAN DIVERSION

CROSS SECTION



NOTES:

River Mile:156 West Bank
Outflow Channel Invert: -14ft to -2ft (NAVD 88)
Channel Width: 70ft
Channel Length: 9,140ft
Levee Crown: 100ft
Levee Elev. +10ft (NAVD 88)

US Army Corps of Engineers®
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

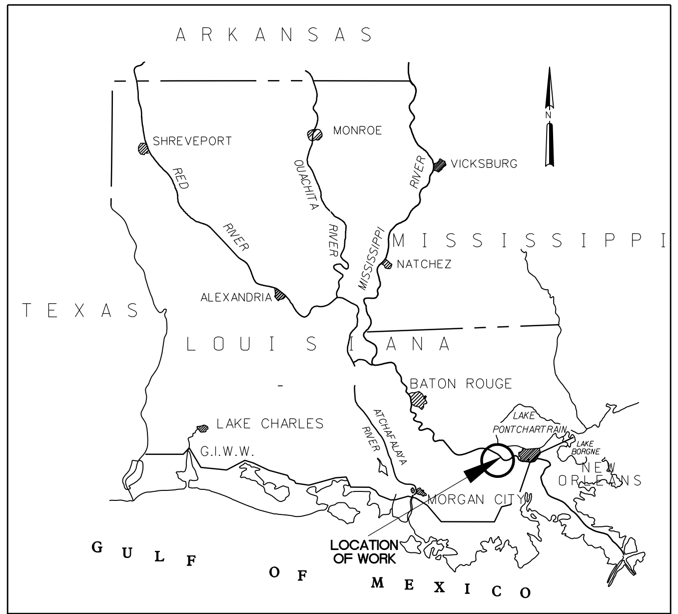
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

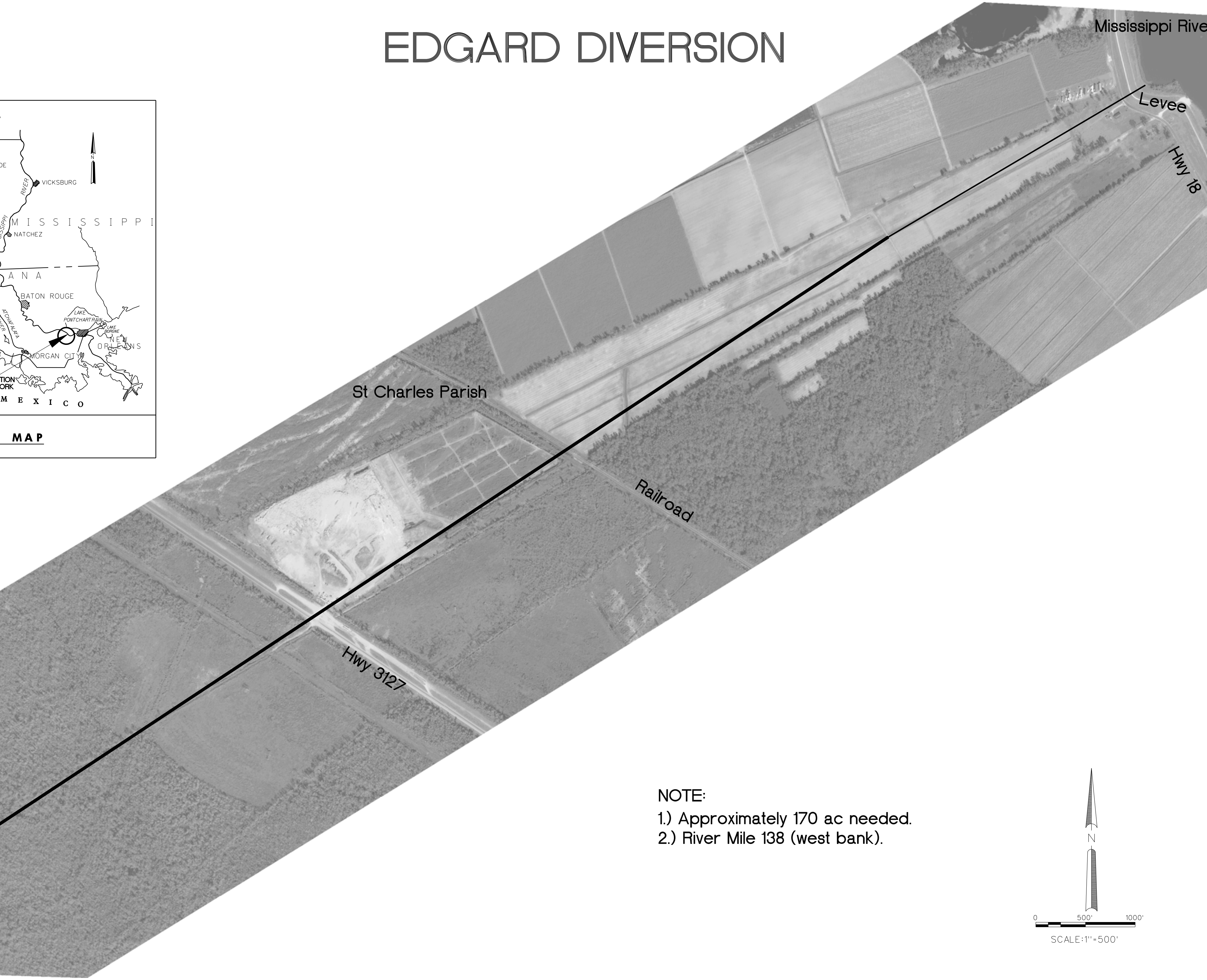
LAGAN DIVERSION
Cross Section

SHEET IDENTIFICATION
10

EDGARD DIVERSION



VICINITY MAP



NOTE:
1.) Approximately 170 ac needed.
2.) River Mile 138 (west bank).

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NEW ORLEANS DISTRICT

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

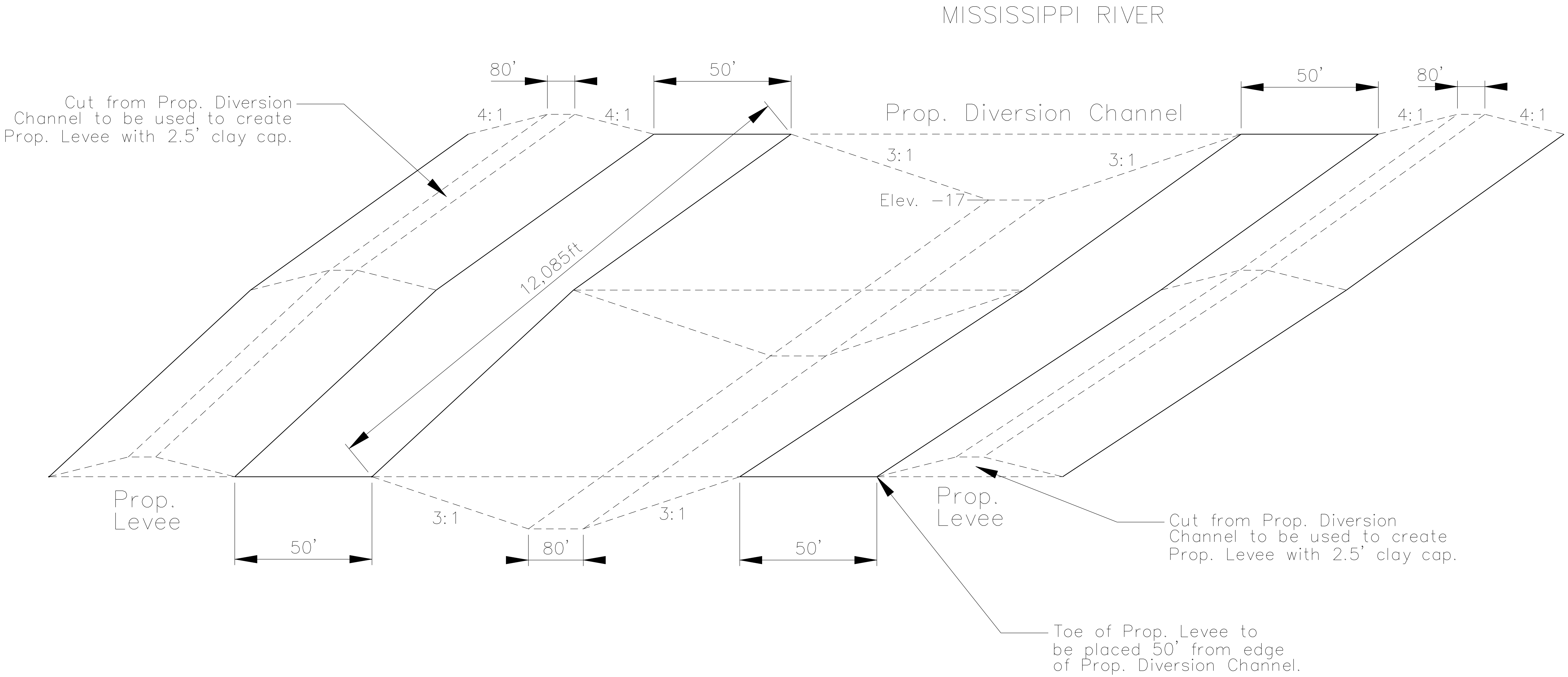
DESIGNED BY: PRG | DWN BY: PRG | CKD BY: | SUBMITTED BY: | PLOT SCALE: 1"=500' | PLOT DATE: 08/20/2008 | FILE NAME: EDGARD DIVERSION

EDGARD DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 11

EDGARD DIVERSION

CROSS SECTION



NOTES:

River Mile:138 West Bank
Outflow Channel Invert: -17ft to -2ft (NAVD 88)
Channel Width: 80ft
Channel Length: 12,085ft
Levee Crown: 80ft
Levee Elev: +10ft (NAVD 88)

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NEW ORLEANS DISTRICT

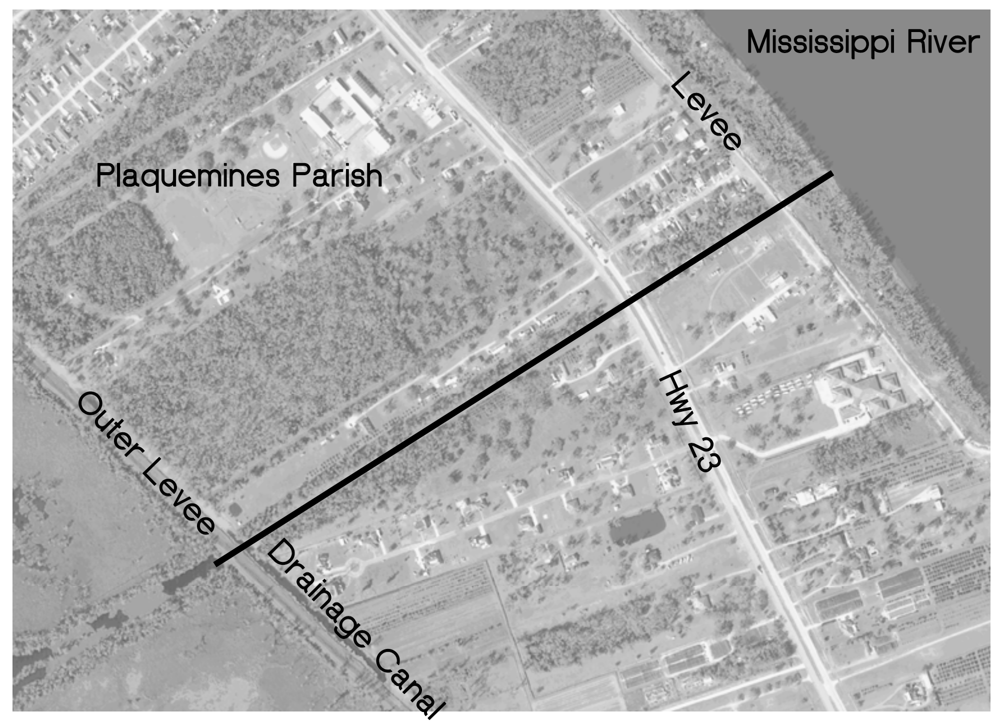
DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

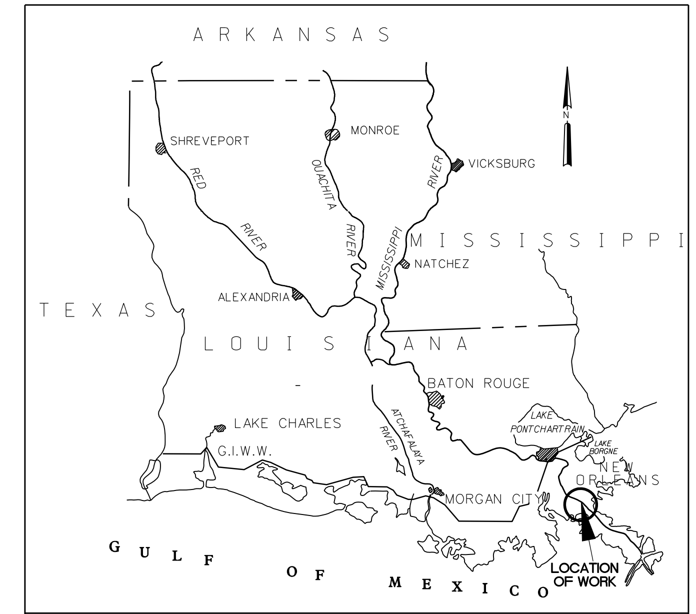
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

EDGARD DIVERSION
Cross Section

SHEET IDENTIFICATION
11

NAOMI DIVERSION





VICINITY MAP

NOTE:
1.) Approximately 33 ac needed.
2.) River Mile 65 (west bank).

SCALE:1"=500'

US Army Corps of Engineers® NEW ORLEANS DISTRICT

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

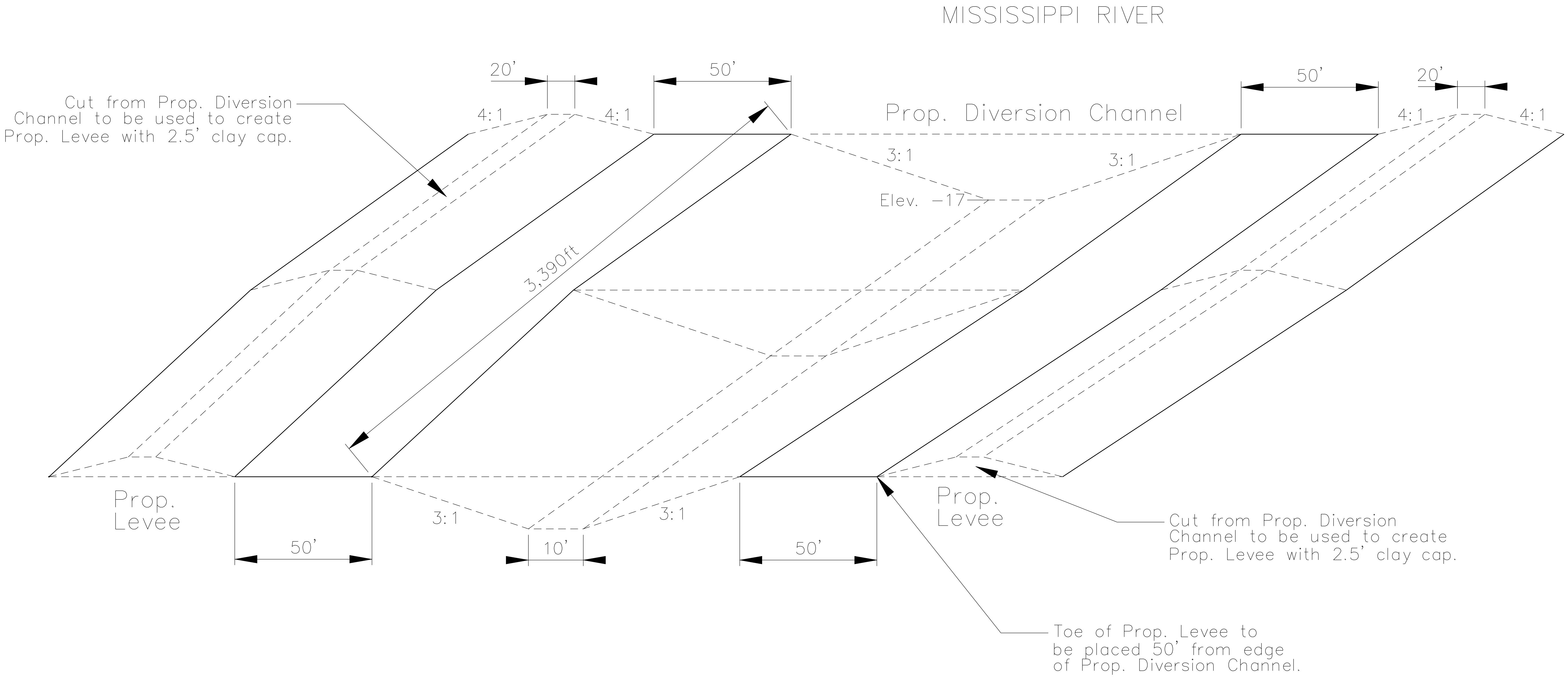
DESIGNED BY: PRG
DWN BY: PRG
CKD BY:
SUBMITTED BY: PRG
PLOT SCALE: 1"=500'

NAOMI DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 12

NAOMI DIVERSION

CROSS SECTION



NOTES:

River Mile: 65 West Bank
Outflow Channel Invert: −17ft to −2ft (NAVD 88)
Channel Width: 10ft
Channel Length: 3,390ft
Levee Crown: 20ft
Leve Elev.: +10tf (NAVD 88)

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NEW ORLEANS DISTRICT

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

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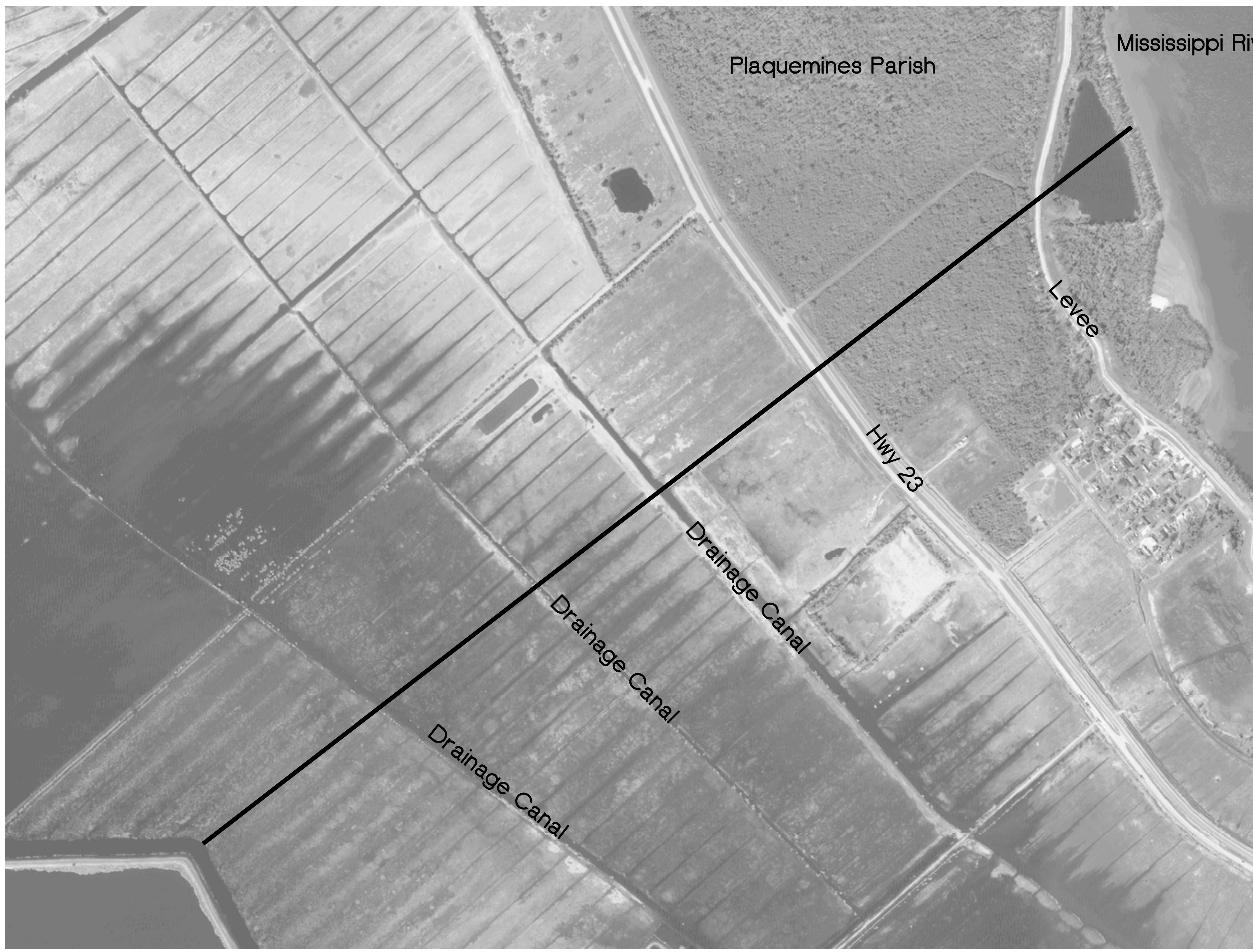
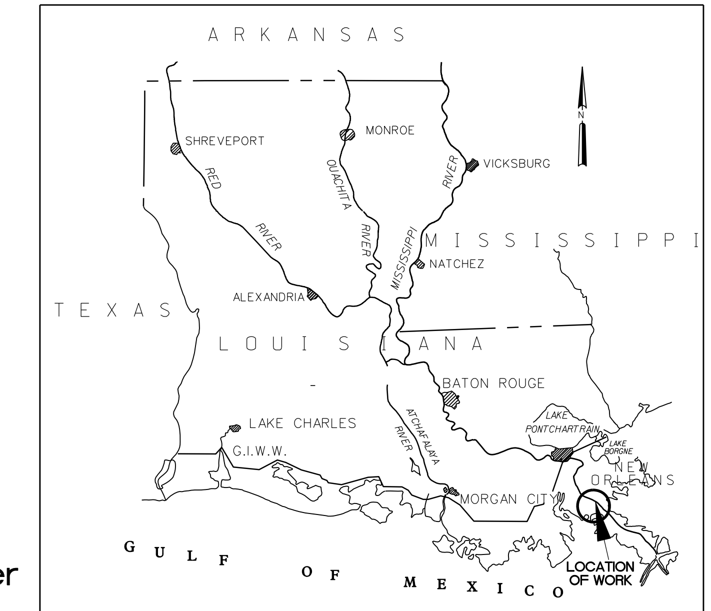
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

NAOMI DIVERSION
Cross Section

SHEET IDENTIFICATION
12

MYRTLE GROVE DIVERSION





VICINITY MAP

NOTE:

1.) Approximately 217 ac needed.

2.) River Mile 59 (west bank).

SCALE:1"=500'

US Army Corps of Engineers
NEW ORLEANS DISTRICT

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG
DWN BY: PRG
CKD BY:
SUBMITTED BY:
PLOT SCALE: 1"=500'
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:
PLOT DATE:
FILE NAME:
SIZE:

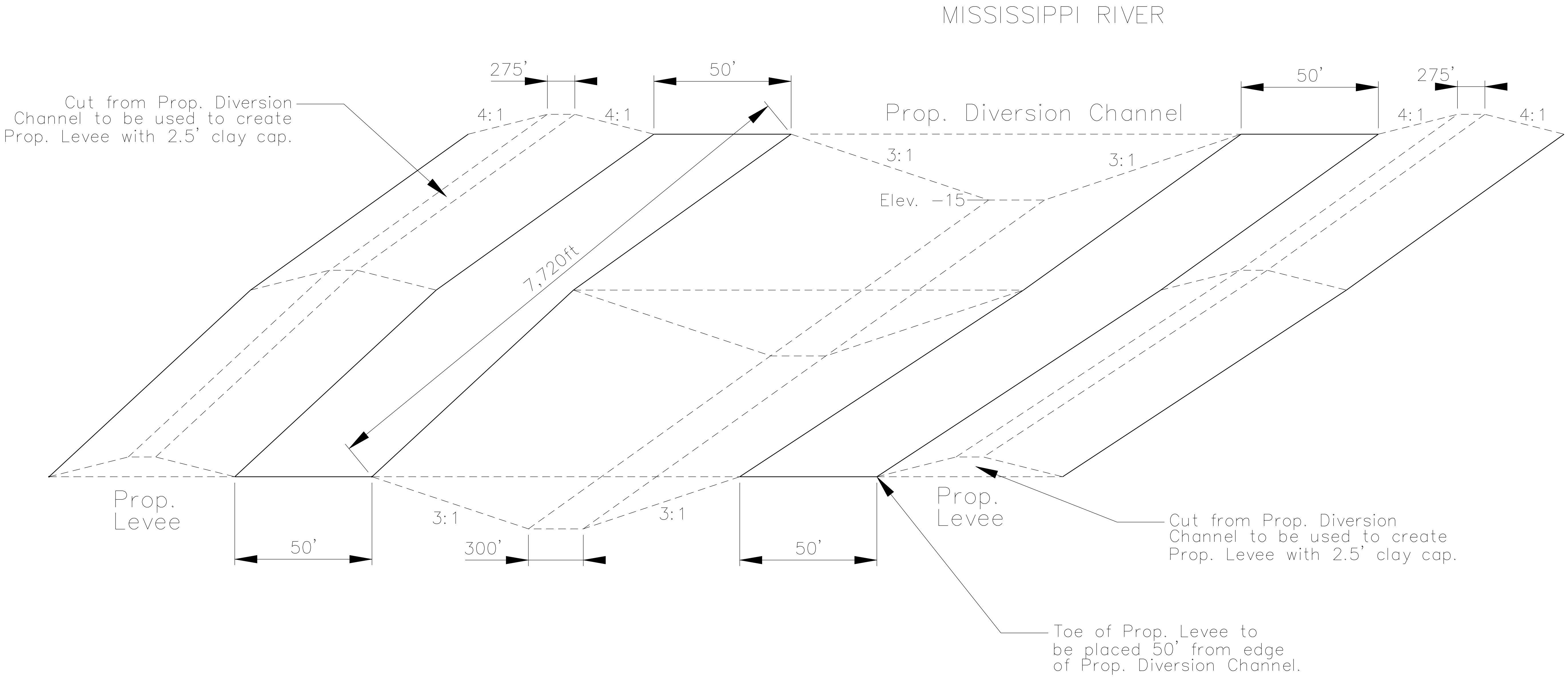
MARK	DESCRIPTION	DATE	APPR

MYRTLE GROVE DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 13

MYRTLE GROVE DIVERSION

CROSS SECTION



NOTES:

River Mile: 59 West Bank
Outflow Channel Invert: -15ft to -2ft (NAVD 88)
Channel Width: 300ft
Channel Length: 7,720ft

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NEW ORLEANS DISTRICT

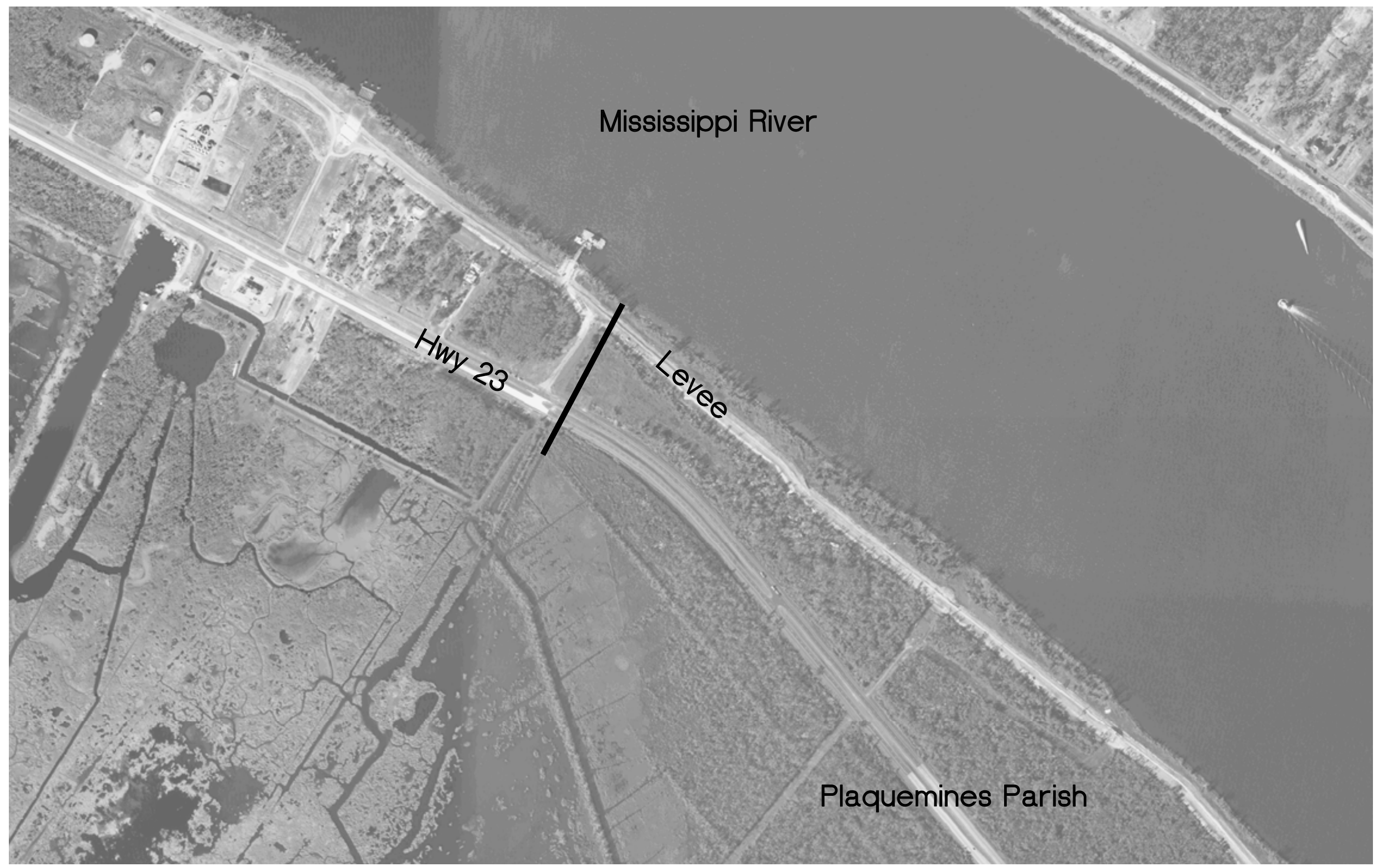
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

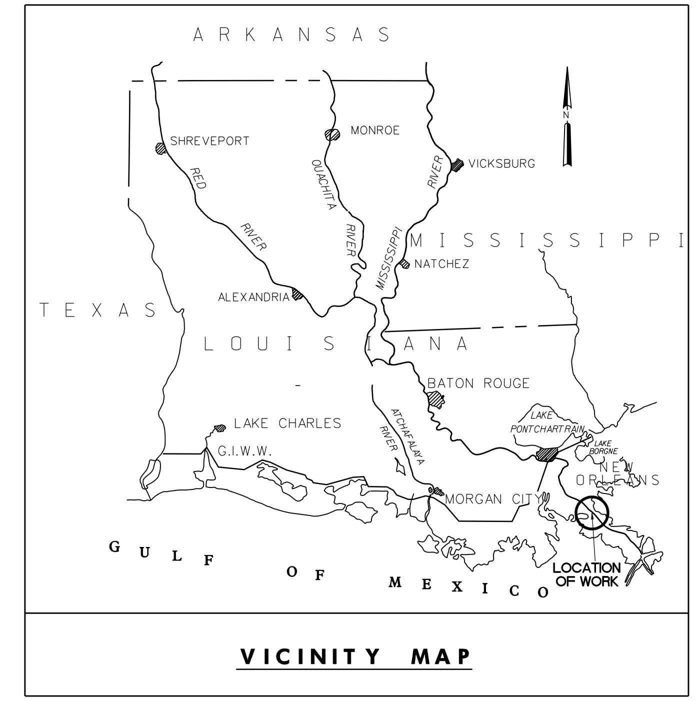
DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

MYRTLE GROVE DIVERSION
Cross Section

SHEET IDENTIFICATION
13

WEST POINT A LA HACHE DIVERSION





NOTE:
1.) Approximately 9 ac needed.
2.) River Mile 49 (west bank).

SCALE:1"=500'

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NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

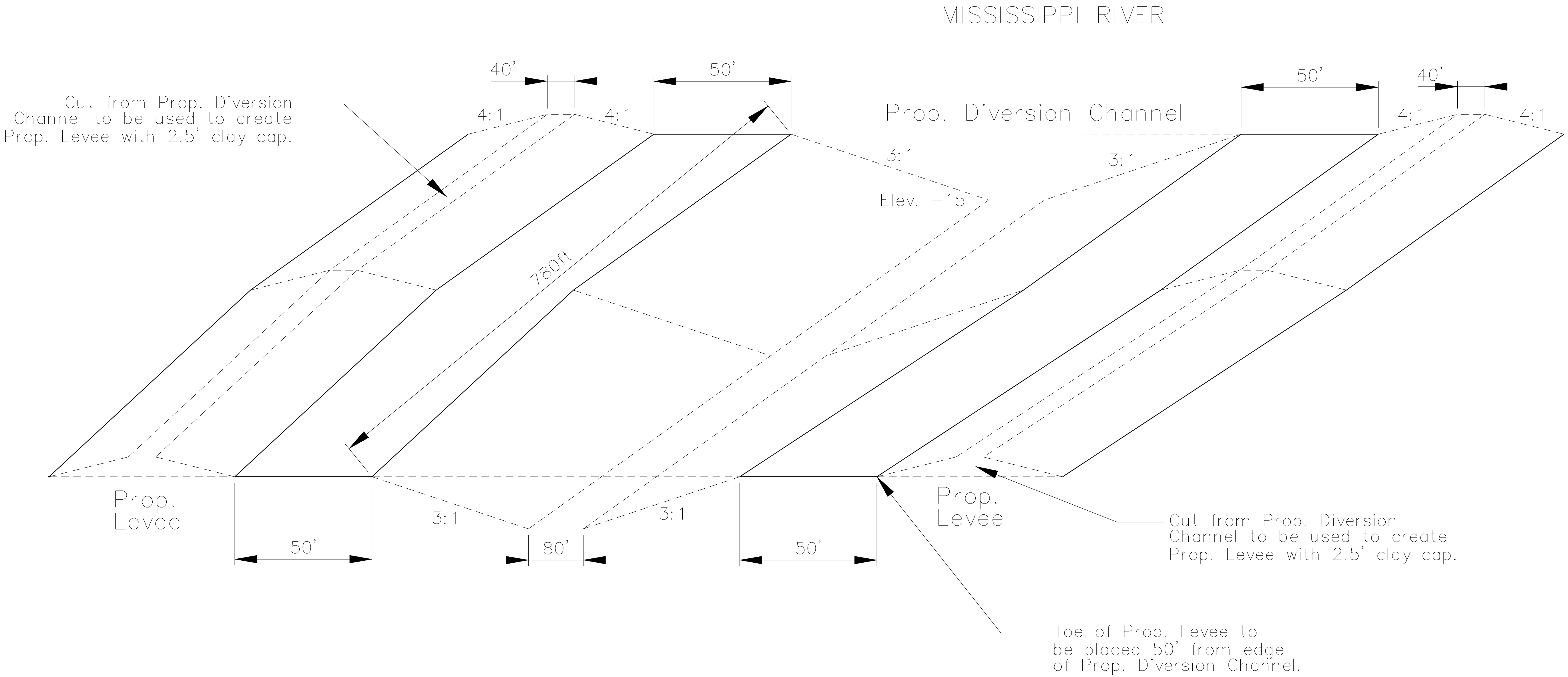
DESIGNED BY: PRG
DWN BY: PRG
SUBMITTED BY: PRG
PLOT SCALE: 1"=500'

WEST POINT A LA HACHE DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 14

WEST POINT LA HACHE DIVERSION

CROSS SECTION



NOTES:

River Mile: 49 West Bank
Outflow Channel Invert: -12.5ft to -2ft (NAVD 88)
Channel Width: 80ft
Channel Length: 780ft
Levee Crown: 40ft
Levee elev.: 10ft

US Army Corps of Engineers® NEW ORLEANS DISTRICT

U.S. ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT NEW ORLEANS, LOUISIANA

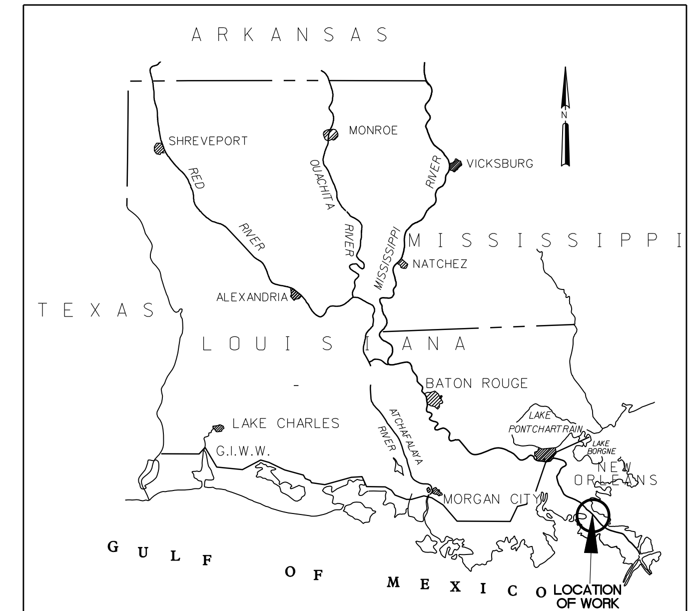
DESIGNED BY: PRG | DATE: 8/14/08 | DWN BY: PRG | CKD BY: | SUBMITTED BY: PRG | PLOT SCALE: NTS

WEST POINT LA HACHE DIVERSION

Cross Section

SHEET IDENTIFICATION 14

PORT SULPHUR DIVERSION



VICINITY MAP

NOTE:
1.) Approximately 7 ac needed.
2.) River Mile 39 (west bank).

SCALE:1"=500'

US Army Corps of Engineers®
NEW ORLEANS DISTRICT

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

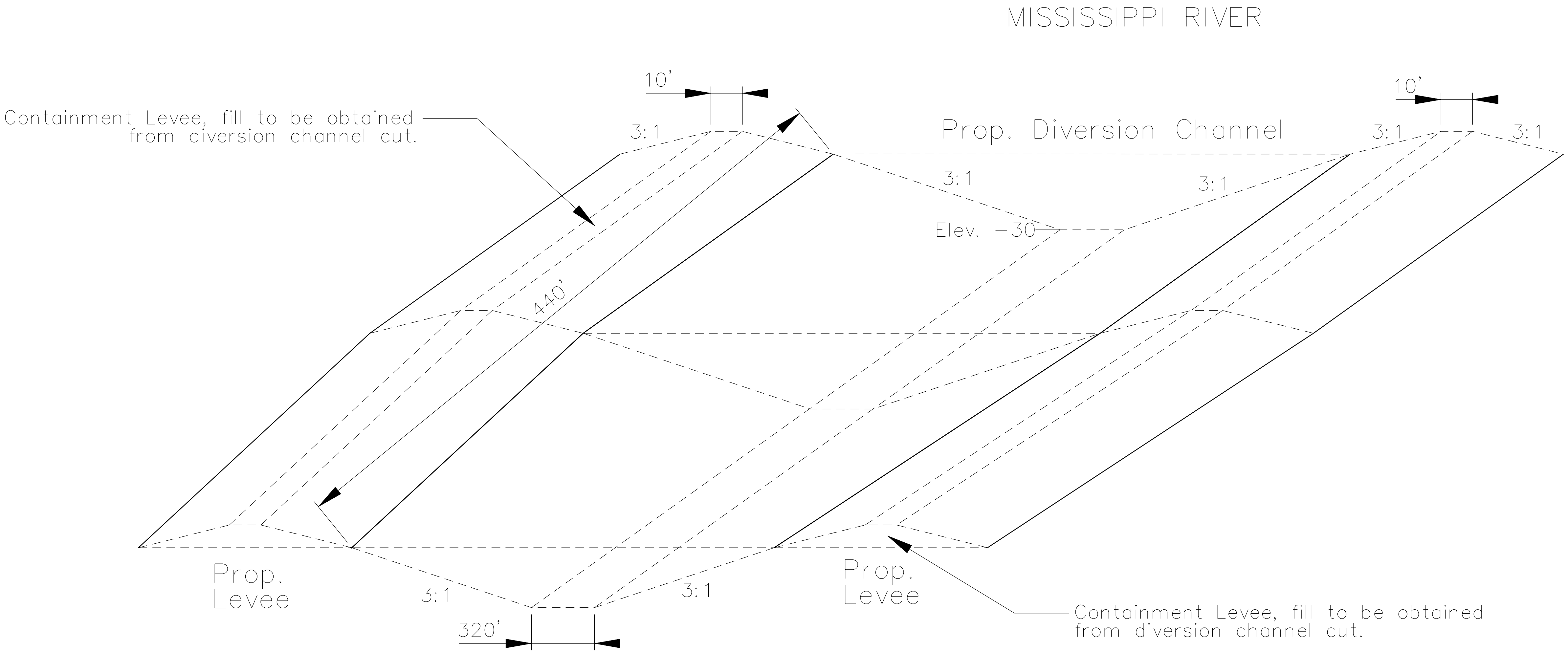
DESIGNED BY: PRG
DWN BY: PRG

PORT SULPHUR DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 15

PORT SULPHER DIVERSION

CROSS SECTION



NOTES:
River Mile: 39 West Bank
Outflow Channel Invert: −30ft to −2ft (NAVD 88)
Channel Width: 320ft
Channel Length: 440ft
Levee Crown: 10ft
Levee Elev.: +5ft (NAVD 88)

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NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR

MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

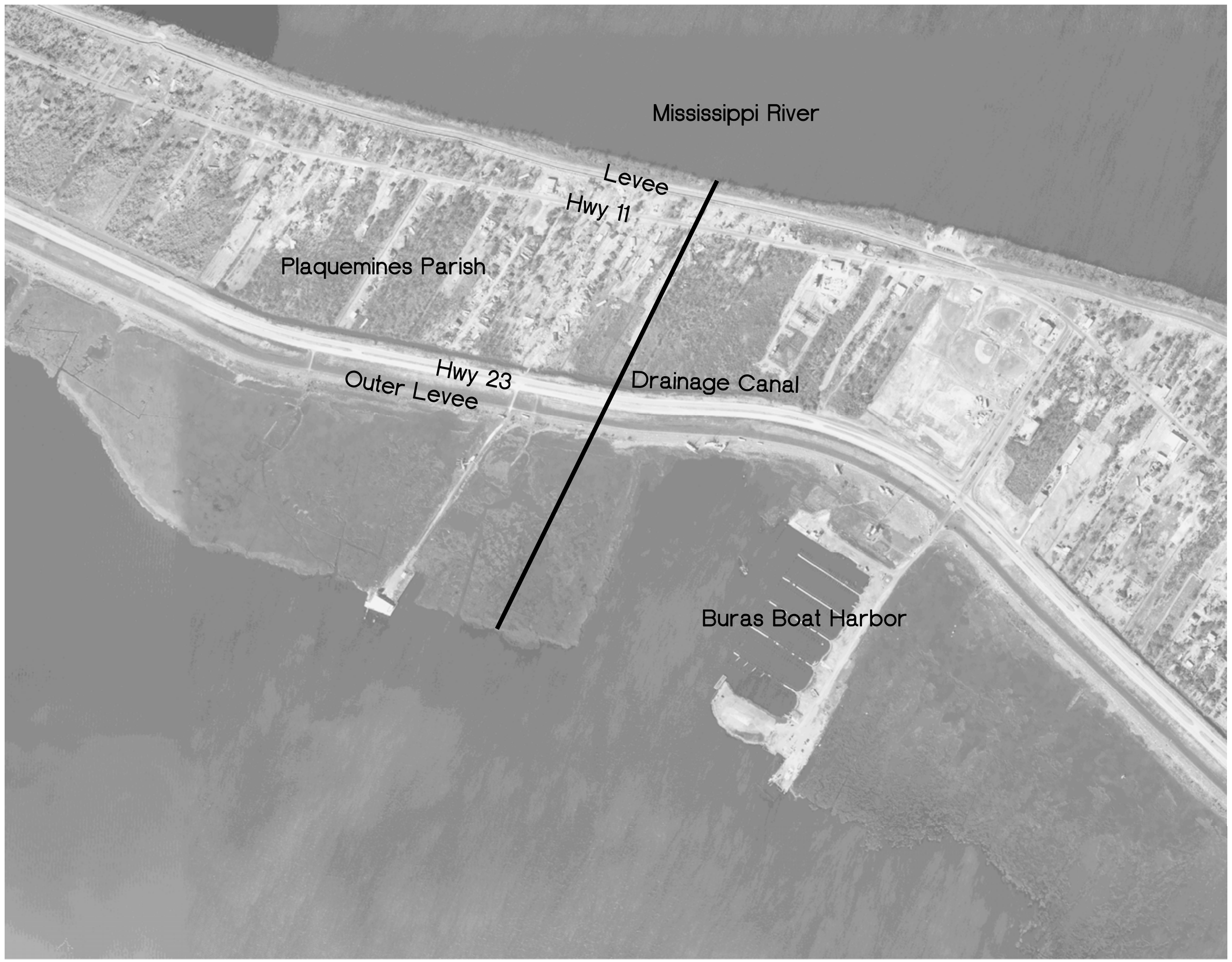
PORT SULPHER DIVERSION
Cross Section

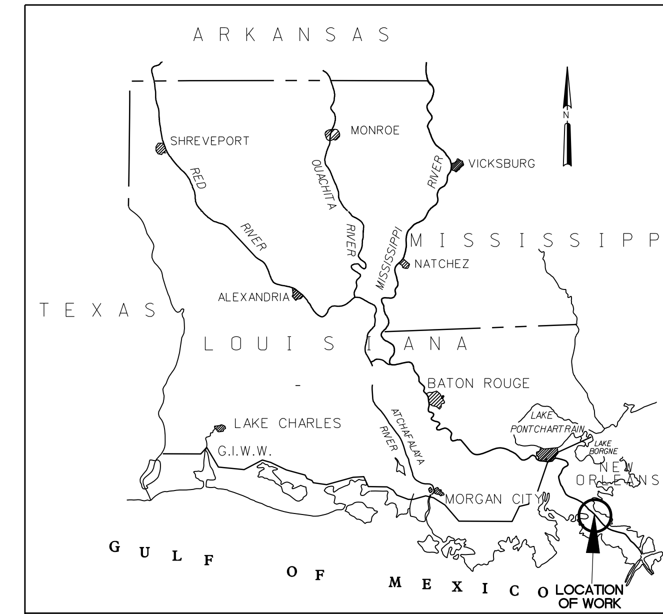
SHEET IDENTIFICATION
15

1 2 3 4 5

D C B A

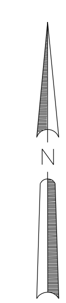
BURAS DIVERSION





VICINITY MAP

NOTE:
1.) Approximately 85 ac needed.
2.) River Mile 25 (west bank).



0 500' 1000'
SCALE:1"=500'

US Army Corps of Engineers®
NEW ORLEANS DISTRICT

MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: PRG
DWN BY: PRG
CKD BY:
SUBMITTED BY: PRG
PLOT SCALE: 1"=500'
PLOT DATE:
SIZE:
FILE NAME:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

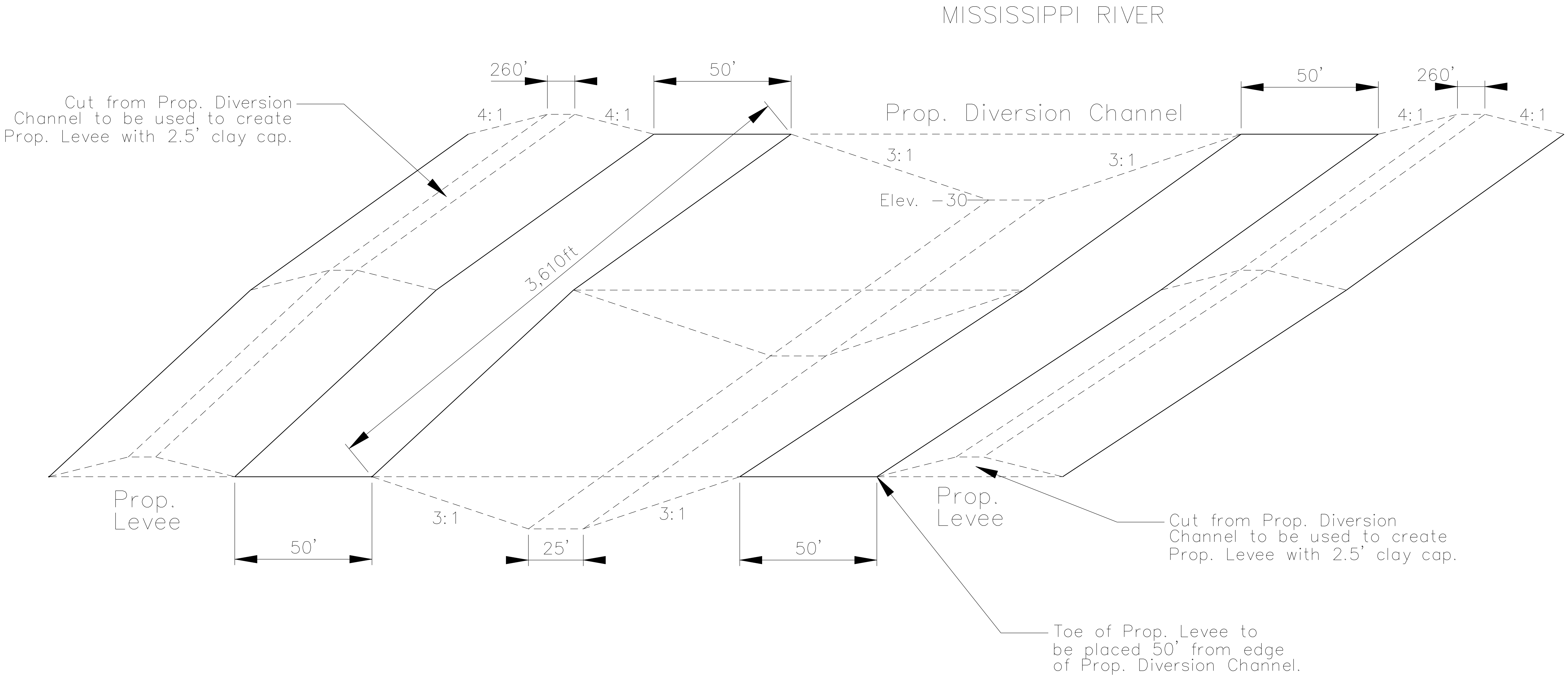
U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

BURAS DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 16

BURAS DIVERSION

CROSS SECTION



NOTES:

River Mile: 25 West Bank
Outflow Channel Invert: -30ft to -2ft (NAVD 88)
Channel Width: 3,610ft
Channel Length: 25ft
Levee Crown: 260ft
Levee Elev.: +10ft (NAVD 88)

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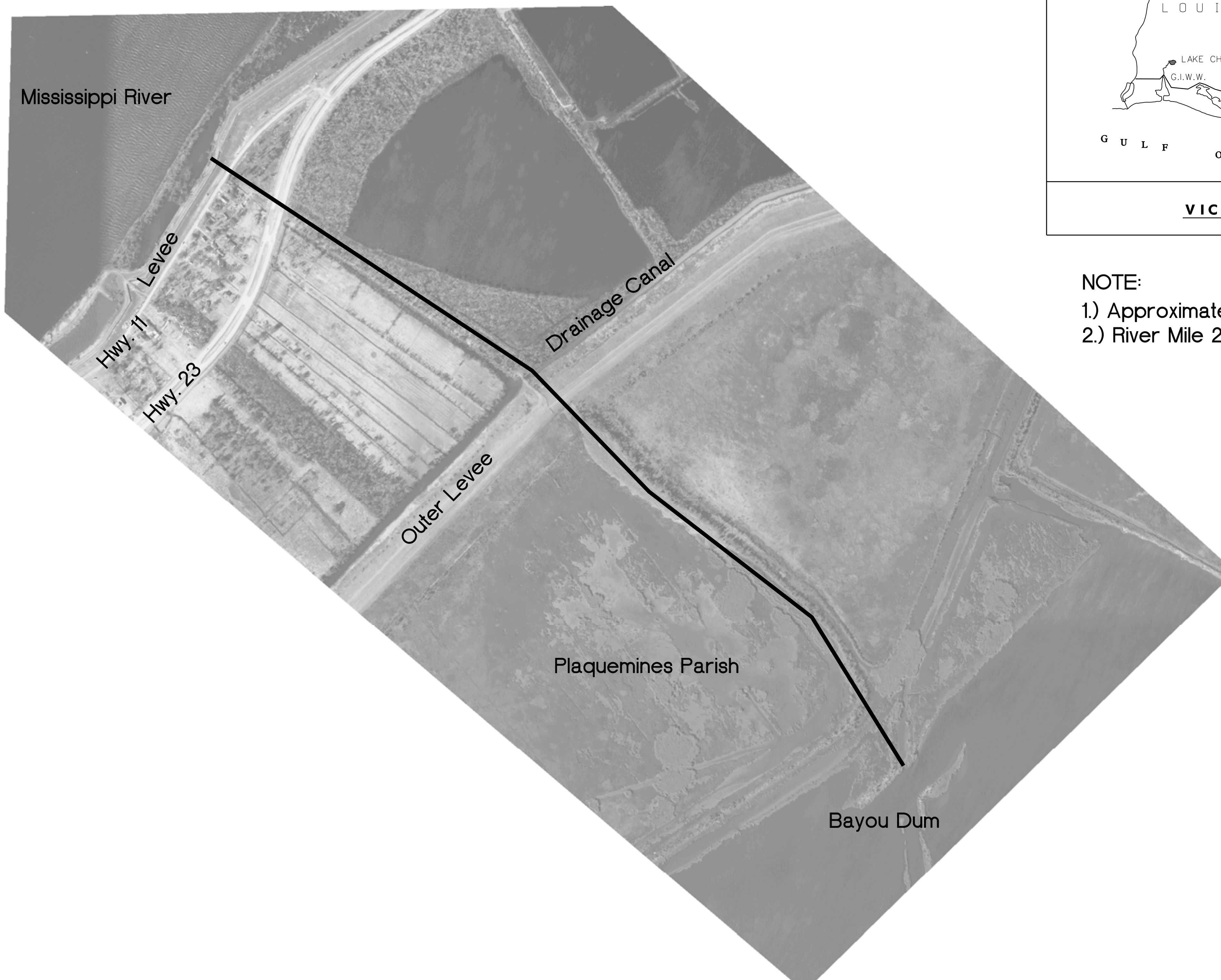
NEW ORLEANS, LOUISIANA

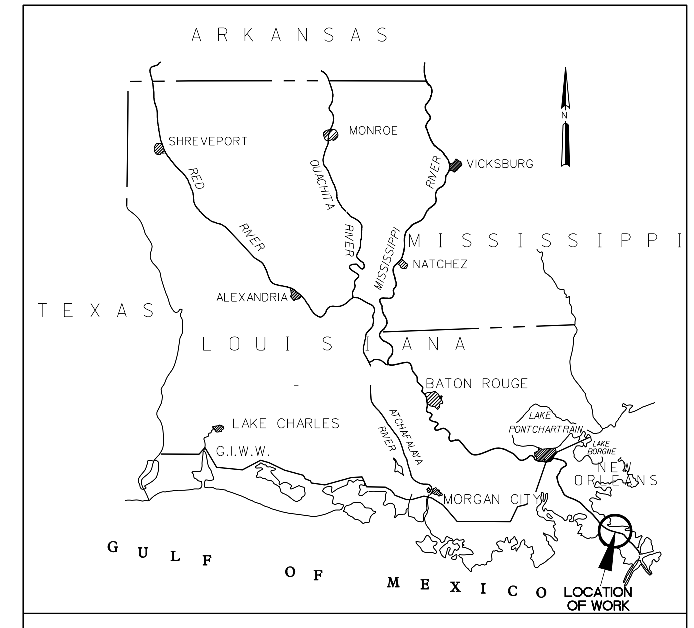
DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

BURAS DIVERSION
Cross Section

SHEET IDENTIFICATION
16

FT. JACKSON DIVERSION





VICINITY MAP

NOTE:
1.) Approximately 85 ac needed.
2.) River Mile 25 (west bank).

SCALE:1"=500'

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MARK	DESCRIPTION	DATE	APPR

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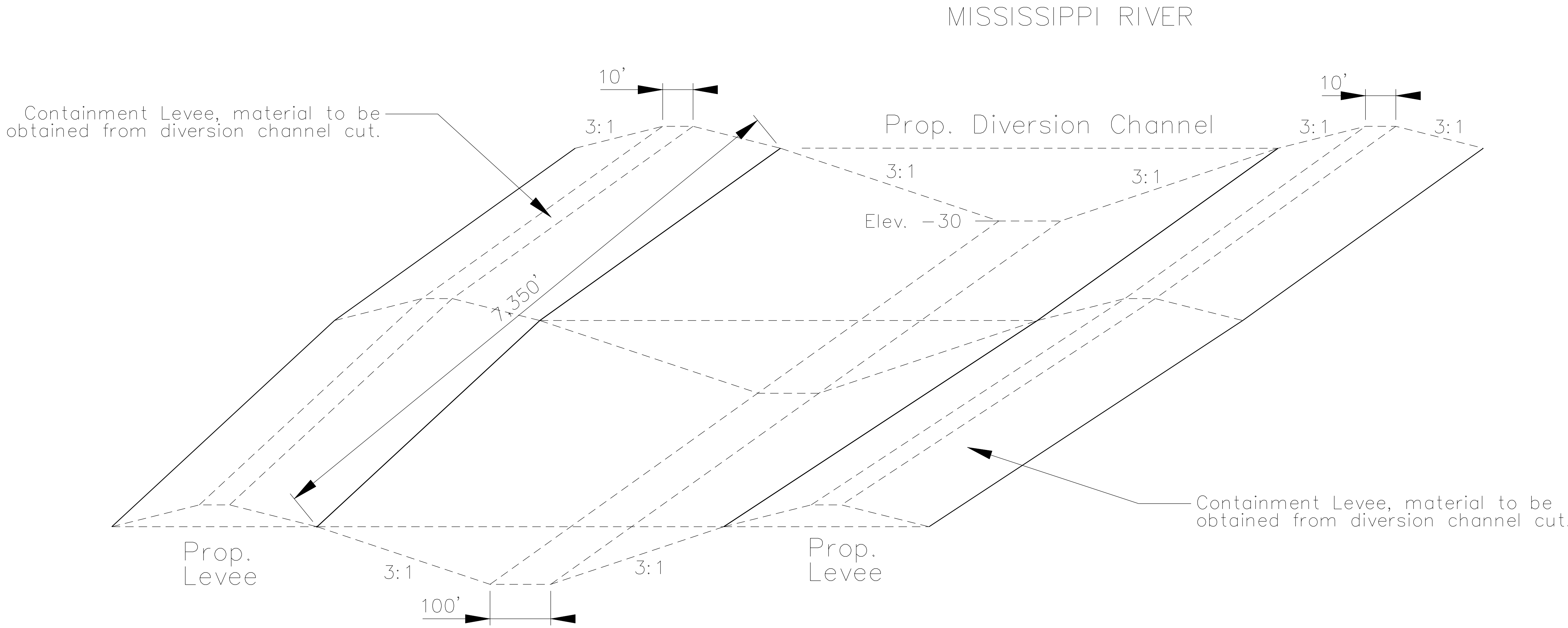
DESIGNED BY: PRG
DWN BY: PRG
CKD BY:
SUBMITTED BY: PRG
PLOT SCALE: 1"=500'
PLOT DATE:
SIZE:
FILE NAME:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
FILE NUMBER:

FT. JACKSON DIVERSION
Plan View

SHEET IDENTIFICATION
PLATE 17

FORT JACKSON DIVERSION

CROSS SECTION



NOTES:
River Mile: 20 West Bank
Outflow Channel Invert: -30ft to -2ft (NAVD 88)
Channel Width: 7,350ft
Channel Length: 100ft
Levee Crown: 10ft
Levee Elev.: +5ft (NVAD 88)

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MARK	DESCRIPTION	DATE	APPR

DESIGNED BY: PRG | DATE: 8/14/08
DWN BY: PRG | CKD BY: | SOLICITATION NO.:
SUBMITTED BY: PRG | CONTRACT NO.:
PLOT SCALE: NTS | PLOT DATE: | FILE NUMBER:
SIZE: | FILE NAME:

U.S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT
NEW ORLEANS, LOUISIANA

FT JACKSON DIVERSION
Cross Section

SHEET IDENTIFICATION
17

ANNEX 2

COST ESTIMATES

ANNEX 2
Table of Contents

LIST OF ATTACHMENTS

ANNEX 2
COST ESTIMATES

GENERAL

This annex provides more information on the development of cost estimates for the alternatives for the LACPR investigation. Cost estimates were developed for the many potential features of the LACPR study which include levees, flood control structures, rock protection, diversion structures, clearing, soil mixing, marsh creation and nourishment, beach nourishment, and ridge restoration. The estimated costs were based upon an analysis of each line item evaluating quantity, production rate, and time, together with the appropriate equipment, labor and material costs. All of the construction work is generally common to the New Orleans District. In addition, all labor, equipment and materials are typical of this type of construction. Given the magnitude of this study, access to the construction sites is assumed to be available, either by land or water or both depending on the exact location of the feature.

Given the magnitude of the overall project, larger quantities of equipment are assumed available based on adequate funding levels existing.

Due to time constraints on this study, the delay in developing final design data, and the number of alternatives, a parametric matrix approach was used to combine and ratio the various individual features that were estimated into the costs for each structural alternative. A structural alternative is an alternative consisting solely of structural measures. Structural measures for LACPR primarily consist of physical structures that reduce surge and wave run-up, such as continuous or ring levees on land connected to floodgates acting as waterway barriers, where necessary. For example, detailed calculations and costs were done for levee templates at El. 25, 30, and 40. When the final design elevations for the different alternatives were determined, a ratio of the base costs was used to determine the cost for the alternatives.

The cost estimates for large structures which are a part of the structural alternatives (locks, closure gates, and pump stations) were developed as part of this study. Information on the development of these costs can be found in the report titled "Preliminary Technical Report for the Louisiana Coastal Protection and Restoration Study Structural Components" dated May 2006. These costs were also done using a parametric approach where detailed calculations and costs were done for structures at El. 30, 35 and 40 and interpolated to determine costs for required final design elevations.

The costs prepared for and presented in this report are not to be used for making funding decisions. They are sufficient in detail for comparison of plans for initial screening, for use in performing MCDA and presenting the final array of alternatives. A more detailed cost estimate per regulation will be generated in the future upon completion of additional engineering analysis.

PLANS OF OPERATION

Levees

The levee construction plan was developed based on the cross section and location of the particular alignment. Construction technique on each reach was split between combinations of truck hauling, barge hauling, and casting from adjacent borrow. Some moisture control work was assumed to be needed on 90 percent of the levee embankment. The majority of all other materials (rock, sand, geotextile, etc.) were assumed to be hauled in by truck or barge/truck combination.

Diversions

The diversions were based on similar type structures previously built within the New Orleans District (Davis Pond Diversion and Old River Auxiliary Control Structure). Construction technique is basic to all large concrete structure construction. Costs for the structures were developed using recent historical data and by ratioing and indexing features from the original template structures. The project costs also include the channel excavation and channel rock armoring for the diversion structures. The channel material will either be placed adjacent for future levees or hydraulically dredged and pumped to create marsh. Major materials are assumed to be hauled in by truck or barged or combination.

Marsh Creation

Marsh creation work was based on using standard industry techniques and equipment operating 24 hours per day 7 days per week. Due to the magnitude of the jobs and potential working environments, it is assumed the larger hydraulic dredges (cutterhead and/or hopper dredges) will be used for excavation and transporting material from borrow site to marsh creation areas. A general cost per distance method was used when specific placement-borrow site combinations were unknown along the Gulf area. Borrow sources include existing O&M, Mississippi River, Gulf of Mexico, and existing bays and lakes.

QUANTITIES

For the levee portions, typical design cross sections with varying heights and foundation types were developed for the various reaches across the State and used to calculate the cost of construction. Based on meetings with PDT members, major assumptions were developed for likely locations of borrow and probable methods of construction.

For the coastal restoration work (marsh creation/beach nourishment), most measurements were based on the excavation quantities and not in-place quantities.

WORK SCHEDULE

For the levee and associated features construction, 2 – 12 hour shifts, 7 days a week were assumed.

EQUIPMENT

Rates used were based on the USACE EP-1110-1-8, Region III and contractor furnished data for specialized equipment.

LABOR

Labor rates were based on historical rates taken from contractor payrolls for similar type work. For the levee and associated work, a labor premium and per diem were assumed.

MATERIAL QUOTES

Current price quotes were obtained from local suppliers.

CONTRACTING PLAN

The estimates assume that there will be one prime contractor that performs the work on each contract. At this time, the acquisition plans are unknown.

INDIRECT COSTS

Overhead, profit, and bond were assessed as one total percentage markup to the direct costs based on historical data and current market conditions for the various features of work.

CONTINGENCY

This study document represents many projects and alternatives that are very preliminary in nature, yet it was decided that it was necessary to present a contingency to better portray a likely cost value for the final array of alternatives. Since the projects are very preliminary, a risk-based study of the many alternatives would likely provide no better value or confidence in a contingency calculation. It was realized that the majority of alternatives are similar in nature to those included within the Greater New Orleans Hurricane and Storm Damage Risk Reduction System (GNO HSDRRS) program. After much consideration, it was accepted that the contingency should be a value similar to the risk-based contingencies calculated on the GNO HSDRRS program. For this reason, a value of 50% was chosen as the likely value that can be supported through comparable studies on a similar program. Initial screening and MCDA analysis were run using estimates with a 25% contingency based on USACE guidance in ER1110-2-1302 for Recon level projects. The revised 50% contingency was then applied to the final array of alternatives based on the results of the contingency development.

COST UNCERTAINTY

This section addresses the risk and uncertainty analysis of the design and cost estimate components of the study. We do recognize the many areas of risk and uncertainty inherent in this study. Some of the major areas of risk and uncertainty are listed below.

a. Survey Information. No additional surveys were taken for the LACPR technical evaluation. Elevations were taken from existing LIDAR surveys and other existing survey information. Construction quantities could be affected by elevation assumptions.

b. Geotechnical Information. No additional borings were taken for LACPR. Assumptions made about foundation conditions could affect channel and structure excavation slopes, foundation requirements for structures, and levee stability and settlement estimates. Estimates of future maintenance requirements could also be affected.

c. Borrow Material. Using available data, assumptions were made about the availability and suitability of borrow material for construction of levees, marsh, and barrier islands. Unit prices would be affected if material for construction is not available as anticipated.

d. Relocations. Estimates of required pipeline relocations were developed using existing pipeline maps. Other relocations such as water, sewerage, gas, electric, cable, etc. were estimated. Road and railroad relocations were also estimated using existing maps. Other pipelines, roads and railroads may exist that are not located on the maps. These are not expected to be significant and opportunities exist for avoidance of at least some of these relocations.

e. Project effects. An attempt was made to identify and quantify effects of the features on other areas such as drainage, navigation, flood protection, etc. These costs are included in the total cost. Because of the limited nature of this analysis, all project impacts may not have been accounted for.

f. HTRW. Because of the magnitude of the areas covered no HTRW investigations of specific measure sites were conducted. There should be enough latitude in the location of specific measures to avoid most HTRW problems.

STRUCTURAL ALTERNATIVE MEASURES

LEVEES

Cost estimates were developed for each of the levee sections shown on Plates 1,2 and 3. for 25 foot, 30 foot and 40 foot elevations for both soil mixing and geotextile designs. No geotextile sections were developed for soil reaches 1 and 2 for the 40 foot elevation levee because the anticipated settlement was large enough to make constructing this levee impractical. Existing LIDAR information was used to determine the approximate ground elevation for each section.

These estimates were interpolated/extrapolated to provide estimates for levee elevations not specifically estimated. Estimates were also developed for lift construction necessary due to settlement (lifts 2 to 5 as required) in the same fashion as the initial costs. These estimates were also interpolated/extrapolated to provide additional estimates as necessary. For revised alignments such as those shown on Plates 4 and 5 already developed cost per mile estimates were used based on the developed section's assumed ground elevation and proximity to the revised section.

STRUCTURES

Estimates for structures were taken from a report produced in May 2006 by the URS Group in association with Brown Cunningham & Gannuch, Inc. for the New Orleans District titled "Preliminary Technical Report for the Louisiana Coastal Protection and Restoration Study Structural Components". Costs were developed for structure elevations of 30 feet, 35 feet and 45 feet because it was assumed that the structures would need to be 5 feet higher than the adjacent levees. These costs were also interpolated/extrapolated to provide estimates for additional elevations. A determination was made as to which structures fit into which levee sections and these costs were added to come up with a structure cost for each section.

ENVIRONMENTAL STRUCTURES

It was assumed that water control structures would need to be placed in the levee to mitigate for disruption of normal flow. These structures would be sluice gated box culvert structures and would be placed every 5 miles. These structures were assumed to be of a consistent size. The cost for these structures was taken from those developed for the May 2006 report described above.

REAL ESTATE

Real Estate costs were provided based on estimates of Right-of-Way acreage needed for the 25', 30' and 40' elevation levee sections .These estimates were interpolated/extrapolated as needed to develop real estate costs for design elevations.

SECTION COSTS

Costs for each section needed for the proposed levee alignments were developed for the high level, barrier and barrier weir costs for 100-yr, 400-yr and 1000-yr design levels based on the levee design elevations obtained from hydrodynamic modeling results for both the soil mix and geotextile levees. These section costs include real estate, levee, structures and environmental structures. A 25% contingency and 12% E&D was applied to all levee estimates when the costs were added to individual section sections. Mitigation costs were not included as environmental impacts are being analyzed separately. Costs for required lift construction were also prepared in this manner. Lift costs assume no additional right of way will be required.

RELOCATIONS

Costs were developed for facility relocations. An estimate was made of the number of facilities in different levee reaches and unit costs for the different types of facilities were applied. Summary costs for alternatives were provided and are added in when alignment costs were developed.

ENGINEERING AND DESIGN

Engineering and design (12%) was applied to all levee estimates. Structures estimates already had 6% E&D added so an additional 6% was added to those estimates. E&D was applied when coming up with section costs.

CONSTRUCTION MANAGEMENT

Construction Management costs (8%) were applied to all levee and structure estimates. Construction Management was added when the section costs were combined to make alternatives for first costs and with section costs for lift construction.

ALTERNATIVE COSTS

A determination was made as to which levee sections comprised each alternative. Section costs were combined to provide costs for identified alternatives. Attachment 1 is a chart showing how individual cost components are added together to form structural alternatives and comprehensive plan alternatives. For ease of analysis estimates used for the initial screening and MCDA assumed a geotextile levee section would be used for all sections with elevations of 30 ft or less and a soil mix section would be used for levees with elevations over 30 ft. This process was also followed to determine the costs of additional lift construction for the alternatives. Construction Management and Relocations costs are added during this step. First lift costs and costs for additional lifts required due to settlement were provided for preliminary screening. Attachment 2 gives the description of codes used to identify alignments. Attachments 3-5 show the screening level costs.

ALTERNATIVES SELECTED FOR MCDA

After the preliminary screening, alternatives were selected to carry forward into the Multi- Criteria Decision Analysis (MCDA). Construction schedules were developed and costs by year were provided for the 50 year planning cycle. These costs included lift construction and OMRR&R costs. The final round of MCDA used the present value estimates for alternatives that included the new north shore levees. These estimates were converted to present worth for the MCDA. The present value estimates for all structural alternatives for the two sea level rise scenarios (high sea level rise and low sea level rise) used in the MCDA are shown in attachment 6. An explanation of how costs were developed for the future sea level rise scenarios is given in the Future Scenarios section below. Present value estimates for the other components of the comprehensive alternatives can be found in the Evaluation Results Appendix.

OPERATION AND MAINTENANCE

Estimates of operation and maintenance cost were prepared based on data from existing locks, structures and barriers of similar size, maintenance requirements and operating criteria (number of hours/days/months, staffing level, 10- to 12-year major rehabilitation cycle, etc.). These costs include yearly operation and maintenance costs as well as refurbishment and major rehabilitation (every 10 to 12 years for major structures).

FUTURE SCENARIOS

For PU1 and PU2 costs were developed for five future scenarios (sea level rise alternative 1, sea level rise alternative 2, degraded coastline, degraded coastline with sea level rise altervative1 and degraded coastline with sea level rise alternative 2). Estimates of future lifts needed for the 5 future degraded coastline and sea level rise scenarios were developed based on information provided by the hydrodynamic modeling group for PU1 and PU2. Similar costs were developed for alternatives for PU3a, PU3b and PU4. Cost estimates were developed by applying a percentage to the initial construction estimates for each section. These percentages were developed based on the fully developed estimates for lifts necessary due to settlement. For purposes of the MCDA it was assumed that these costs would be spread out over a 5 year period starting at year 28 for most cases. Costs per year for each scenario for each alternative were converted into present worth for the MCDA. No future lifts were assumed for 100-yr plans for existing levees. It was assumed that those levees would be raised as needed under current authorization.

INDUCED SURGE LEVEL

Construction of the barriers in PU1 and PU2 increases the surge level in some areas of Plaquemines Parish. Costs were developed for raising levees up to provide the same level of design. These costs were added to the barrier alternatives when the 50 yr schedules were developed.

COASTAL ALTERNATIVE FEATURES

Initial costs for coastal features were developed by the Habitat Evaulation Team based on costs for previous diversion, marsh creation and shore protection projects. These costs were used in the MDCA. Subsequent to this analysis a detailed cost for each measure was developed for determining the cost for the final array of alternatives. Costs were developed for each measure contained in the coastal alternative designated as the representative plan. Details of this plan and the development of these cost estimates can be found in Annex 1.

MITIGATION

Direct construction impact acreages for each alternative were provided to the Habitat Evaluation Team (HET). The HET developed an estimate of total wetland impacts (acres) for each alternative considered in the MCDA analysis. These acres are mitigated at a rate of 1.5 times the wetland impacts at a per acre cost of $80,000.

NON STRUCTURAL MEASURES

Estimates were developed for nonstructural components of the project alternatives. These components included stand alone nonstructural alternatives for each planning unit and complementary nonstructural measures which combine with structural alternatives. Details of these plans and their costs can be found in the Nonstructural Plan Component Appendix.

COMPREHENSIVE ALTERNATIVES

Attachments 7 to 14 show the first costs for each alternative considered for the final round of MCDA. These tables show the total first costs of the plan components (structural, nonstructural, coastal features, mitigation) for each of four scenarios (1)Low Sea Level Rise, High Employment, Dispersed Population; (2)High Sea Level Rise, High Employment, Dispersed Population; (3) Low Sea Level Rise, Business-as-Usual, Compact Population; (4) High Sea Level Rise, Business-as-Usual, Compact Population. More information on these secenarios can be found in the Evaluation Results Appendix.

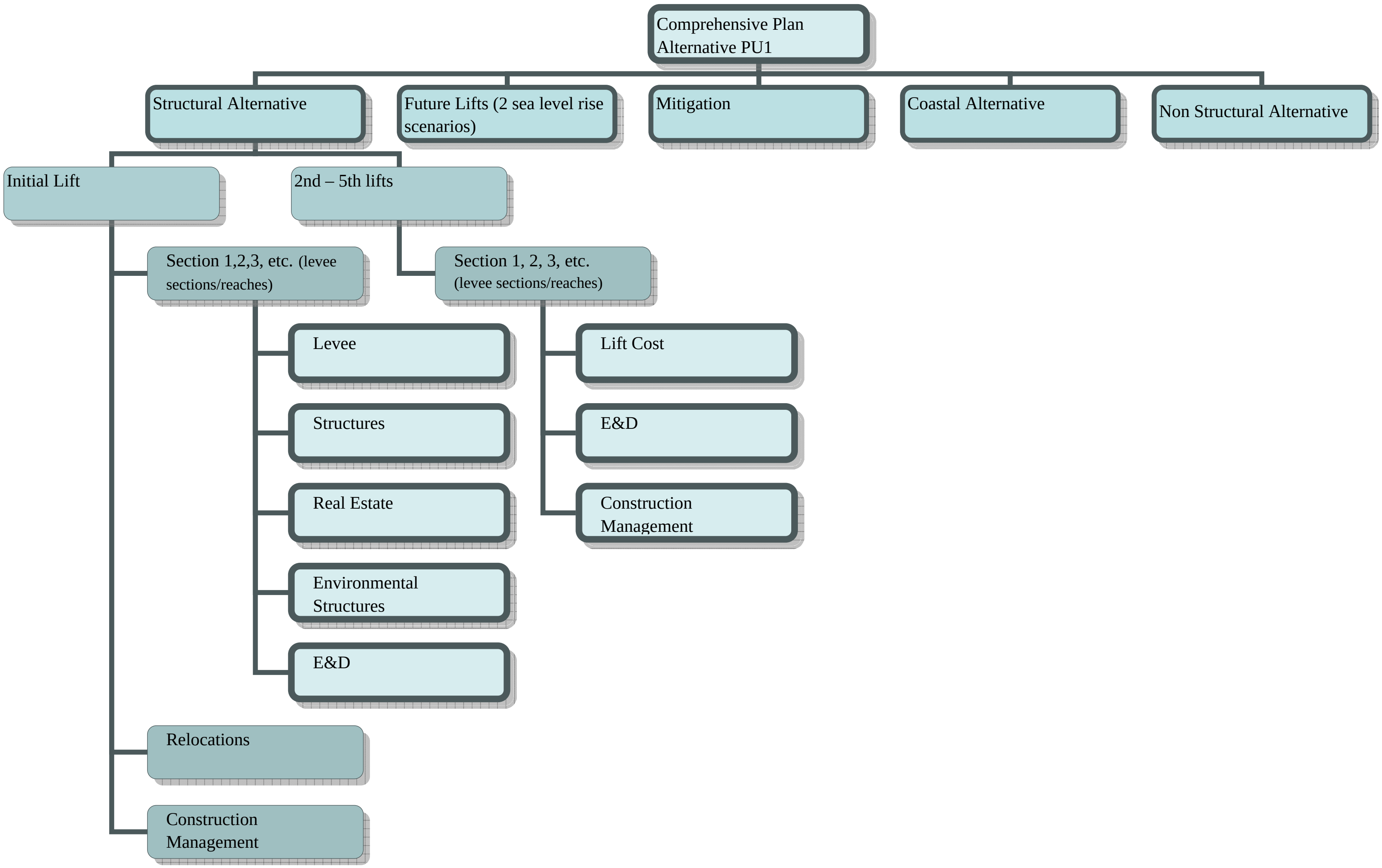
FINAL ARRAY OF ALTERNATIVES

Based on the MCDA analysis and other factors described in detail in the alternatives run through the MCDA analysis were narrowed down to a final array. Tables showing the first cost of the final array of alternatives for the 4 scenarios are attachments 15 to 22. The fully funded costs for these alternatives are shown in attachments 23 to 30. Because of the number of alternatives and measures included in the alternatives escalation was conducted on a broad basis (i.e. the initial lift costs for all structural measures were escalated based on a 14 yr construction period).

ANNEX 2

ATTACHMENTS

HOW INDIVIDUAL COST COMPONENTS ARE ADDED TOGETHER TO FORM COMPREHENSIVE PLAN ALTERNATIVES



Structural Alternative Code Descriptions	
Code	Description
-100-	100-year design level
-400-	400-year design level
-1000-	1000-year design level
PU1	
-HL-	High level alignment (raise existing levees)
-LP-	Lake Pontchartrain Barrier (barrier along eastern edge of Lake Pontchartrain)
-a-	Golden Triangle alignment at the confluence of the GIWW and MRGO
-b-	Alignment at the edge of the Golden Triangle and Lake Borgne
-1	All PU1 primary alternatives include the Lake Pontchartrain and Vicinity Project levees and upper Plaquemines levees. The primary alignments for 'LP' also include a barrier-weir across the mouth of Lake Pontchartrain with a tieback to high ground east of Slidell.
-2	Primary alignment plus North Shore and West Shore levees
-3	Primary alignment plus Slidell and West Shore levees
PU2	
-WBI-	West Bank Interior Plan
-R-	Ridge Alignment Plan
-G-	GIWW Alignment Plan
-1	All PU2 primary alignments include West Bank and Vicinity levees with new sector gate and Larose to Golden Meadow levees. Primary alignments for 'R' and 'G' also include Lafitte ring levees.
-2	Primary alignment plus Boutte levee.
-3	Primary alignment plus Boutte and Des Allemands levee
-4	Primary alignment plus Boutte, Des Allemands and Bayou Lafourche levees.
PU3a	
-M-	Morganza levee alignment
-G-	GIWW alignment with Morganza Levee at 100-year design
-1	Morganza alignment with tieback to high ground west of Morgan City
-2	Morganza alignment with tieback to high ground south of Thibodaux and ring levee around Morgan City
PU3b	
-G-	GIWW levee alignment
-F-	Franklin to Abbeville alignment (inland of the GIWW)
-RL-	Ring levee alignment
-1	Primary alignment for each plan strategy
PU4	
-G-	GIWW levee alignment
-RL-	Ring levee alignment

Structural Alternative Code Descriptions	
Code	Description
-1	For the ‘G’ alignments, the primary alignment follows the GIWW across the planning unit boundaries.
-2	GIWW alignment with tieback to high ground near Kaplan
-3	GIWW alignment with the levee set at a height of 12 feet.

PU1 STRUCTURAL ALTERNATIVE SCREENING LEVEL DATA
(These costs include the New North Shore Alignments)

Alternative	Initial Construction Cost	Lift Construction Cost
2010 Baseline	0	
HL-1b-100-1	1,745,520,495	1,514,764,657
HL-1a-100-2	8,785,325,555	6,638,900,403
HL-1b-100-2	10,451,476,288	8,041,460,271
HL-1a-100-3	7,020,279,684	6,107,035,746
HL-1b-100-3	8,686,430,418	7,509,595,614
HL-1a-100-4	4,313,385,022	5,122,811,304
HL-1a-400-1	15,791,309,415	11,394,598,771
HL-1b-400-1	14,412,236,305	11,043,782,266
HL-1a-400-2	29,383,241,603	17,519,204,126
HL-1b-400-2	28,004,168,492	17,168,387,622
HL-1a-400-3	26,957,939,133	16,367,085,234
HL-1b-400-3	25,578,866,023	16,016,268,730
HL-1a-400-4	23,487,611,756	14,630,495,855
HL-1a-1000-1	20,001,517,951	15,401,335,856
HL-1b-1000-1	18,457,832,188	14,932,325,865
HL-1a-1000-2	35,834,701,360	23,412,571,422
HL-1b-1000-2	34,291,015,597	22,943,561,431
HL-1a-1000-3	33,016,749,826	21,978,519,543
HL-1b-1000-3	31,473,064,063	21,509,509,553
HL-1a-1000-4	29,297,994,287	19,581,622,737
LP-1a-100-1	3,913,267,880	1,266,286,707
LP-1b-100-1	5,279,572,967	3,671,592,713
LP-1a-100-2	13,082,781,122	2,314,576,101
LP-1b-100-2	14,449,086,209	4,719,882,107
LP-1a-100-3	12,392,322,793	2,259,394,192
LP-1b-100-3	13,758,627,880	4,664,700,198
LP-1a-100-4	10,572,049,851	2,114,953,320
LP-1a-400-1	17,408,404,328	5,094,366,089
LP-1b-400-1	16,095,014,421	4,580,563,907
LP-1a-400-2	31,171,401,963	8,934,582,866
LP-1b-400-2	29,858,012,056	8,420,780,683
LP-1a-400-3	29,166,432,193	8,602,634,333
LP-1b-400-3	27,853,042,286	8,088,832,150
LP-1a-400-4	26,520,710,449	7,906,969,423
LP-1a-1000-1	21,409,906,460	10,340,036,147
LP-1b-1000-1	19,932,291,750	9,910,423,985
LP-1a-1000-2	36,353,467,466	15,627,083,879
LP-1b-1000-2	34,875,852,757	15,197,471,717
LP-1a-1000-3	34,101,023,511	15,159,757,685
LP-1b-1000-3	32,623,408,801	14,730,145,524
LP-1a-1000-4	31,080,352,153	14,230,333,829

PU2 STRUCTURAL ALTERNATIVE SCREENING LEVEL DATA

Alternative	Initial Construction Cost	Lift Construction Cost
2010 Baseline	0	
WBI-1-100-1	558,079,147	0
WBI-1-400-1	8,414,926,201	7,590,582,401
WBI-1-1000-1	10,590,318,061	12,844,897,722
G-1-100-1	3,215,062,909	1,228,353,096
G-1-100-4	6,735,120,146	1,648,013,229
G-1-400-1	10,399,234,254	10,236,300,436
G-1-400-4	14,212,938,761	11,040,446,367
G-1-1000-1	14,479,468,256	8,108,646,906
G-1-1000-4	18,966,804,676	9,092,888,840
S-1-100-2	2,028,604,710	85,022,985
S-1-100-3	3,488,507,563	181,640,090
S-1-100-4	5,250,970,064	264,064,692
S-1-400-2	9,923,789,500	7,793,906,097
S-1-400-3	11,434,191,684	8,082,076,283
S-1-400-4	13,270,561,770	8,252,921,259
S-1-1000-2	12,142,175,542	13,295,249,810
S-1-1000-3	13,703,077,057	13,655,462,542
S-1-1000-4	15,576,400,935	13,840,615,785
G-1-100-1 Mod	3,834,105,224	2,246,646,259
G-1-100-4 Mod	7,354,162,461	2,666,306,393
G-1-400-1 Mod	11,795,497,304	11,704,146,647
G-1-400-4 Mod	15,609,201,810	12,508,292,578
G-1-1000-1 Mod	16,505,376,386	9,888,779,256
G-1-1000-4 Mod	20,992,712,806	10,873,021,190

PU3a, PU3b and PU4 Structural AlternativeScreening Level Data

Planning Unit	Alternative	Initial Construction Cost	Lift Construction Cost
3a	PU3a-M-100-1	8,834,444,198	7,599,927,934
	PU3a-M-400-1	18,069,117,800	10,393,265,664
	PU3a-M-1000-1	26,998,357,687	11,037,462,960
	PU3a-R-100-1	7,369,391,402	7,395,065,187
	PU3a-R-400-1	15,756,864,767	8,544,050,766
	PU3a-R-1000-1	23,524,427,673	7,994,583,399
	PU3a-R-400-2	9,747,971,436	9,555,950,789
	PU3a-R-1000-2	10,436,693,037	10,598,592,632
3b	PU3b-G-100-1	5,775,808,324	5,350,086,236
	PU3b-G-400-1	9,541,382,432	9,309,375,473
	PU3b-G-1000-1	13,575,608,293	12,942,754,321
	PU3b-F-100-1	5,749,115,798	4,568,436,658
	PU3b-F-400-1	9,965,622,237	9,386,033,450
	PU3b-F-1000-1	13,669,716,330	12,974,456,701
	PU3b-R-100-1	4,989,399,196	3,682,421,491
	PU3b-R-400-1	7,644,559,713	7,344,209,324
	PU3b-R-1000-1	10,033,658,198	10,030,286,233
4	PU4-G-100-1	5,660,473,640	2,673,206,892
	PU4-G-400-1	8,310,791,762	4,844,934,065
	PU4-G-1000-1	11,332,561,787	6,286,248,875
	PU4-G-100-2	5,514,130,296	2,873,115,070
	PU4-G-400-2	8,017,760,861	5,125,563,727
	PU4-G-1000-2	11,015,781,189	6,653,758,502
	PU4-G-400-3	5,479,989,968	2,638,928,792
	PU4-G-1000-3	5,681,635,608	2,784,026,967
	PU4-R-100-1	1,449,786,807	162,548,182
	PU-R-400-1	1,825,499,941	467,024,587
	PU-R-1000-1	2,012,766,425	620,455,594

Present Value Estimates for LACPR Structural Alternatives Carried Forward for MCDA Analysis

This table shows the present value estimates for those alternatives for which the 50-yr cost were developed (see attachment 25 and attachment 35)

Present value estimates are presented for two scenarios for each alternative - degraded coastline with a low future relative sea level rise and degraded coastline with a high future sea level rise

Planning Unit	Alternative	Scenario (H=high sea level rise, L=low sea level rise)	Present Value Cost of Structural Measures $ (Billions)
1	PU1-LP-a-100-1	L	7.02
		H	7.13
	PU1-LP-a-100-2	L	22.44
		H	22.58
	PU1-LP-a-100-3	L	21.09
		H	21.28
	PU1-LP-b-400-1	L	25.54
		H	25.62
	PU1-LP-b-400-3	L	45.08
		H	45.24
	PU1-LP-b-1000-1	L	33.33
		H	33.56
	PU1-LP-b-1000-2	L	59.40
		H	59.61
	PU1-HL-a-100-3	L	15.89
		H	15.93
	PU1-HL-a-100-2	L	19.19
		H	19.25
	PU1-HL-b-400-2	L	49.57
		H	49.81
	PU1-HL-b-400-3	L	44.90
		H	45.10
2	PU2-WBI-100-1	L	1.00
		H	1.02
	PU2-R-100-2	L	7.73
		H	7.77
	PU2-R-400-2	L	25.41
		H	25.52
	PU2-R-100-4	L	13.35
		H	13.42

Planning Unit	Alternative	Scenario (H=high sea level rise, L=low sea level rise)	Present Value Cost of Structural Measures $ (Billions)
	PU-2-R-400-4	L	31.47
		H	31.61
	PU2-G-1000-4	L	42.34
		H	42.46
	PU2-G-100-1	L	7.60
		H	7.75
	PU2-G-100-4	L	14.52
		H	14.70
	PU2-G-400-4	L	34.75
		H	34.88
	PU2-R-1000-4	L	39.17
		H	39.77
	PU2-R-100-3	L	10.15
		H	10.20
	PU2-WBI-400-1	L	18.29
		H	18.32
	PU2-R-400-3	L	28.32
		H	28.44
3a	PU3a-M-100-1	L	21.41
		H	21.93
	PU3a-M-100-2	L	18.98
		H	19.10
	PU3a-G-400-2	L	25.21
		H	25.28
	PU3a-G-1000-2	L	27.63
		H	27.70
3b	PU3b-G-100-1	L	15.21
		H	15.24
	PU3b-F-100-1	L	13.92
		H	13.95
	PU3b-F-400-1	L	23.44
		H	23.64
	PU3b-F-1000-1	L	31.07
		H	31.09
	PU3b-RL-100-1	L	11.58
		H	11.61
	PU3b-RL-400-1	L	18.00
		H	18.02

Planning Unit	Alternative	Scenario (H=high sea level rise, L=low sea level rise)	Present Value Cost of Structural Measures $ (Billions)
4	PU4-G-100-1	L	11.99
		H	12.27
	PU4-G-100-2	L	11.78
		H	12.07
	PU4-G-400-3	L	11.73
		H	12.01
	PU4-G-1000-3	L	12.21
		H	12.49
	PU4-RL-100-1	L	2.70
		H	2.72
	PU4-RL-400-1	L	3.47
		H	3.49
	PU4-RL-1000-1	L	3.76
		H	3.80

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	9,448,607,969	9,448,607,969
NS-100	0	0	0	4,528,178,444	9,448,607,969	13,976,786,412
NS-400	0	0	0	16,540,266,776	9,448,607,969	25,988,874,745
NS-1000	0	0	0	26,978,007,723	9,448,607,969	36,426,615,692
HL-a-100-2	15,424,225,958	3,437,769,526	498,840,000	0	9,448,607,969	28,809,443,453
HL-a-100-3	13,127,315,431	2,611,728,059	434,280,000	0	9,448,607,969	25,621,931,458
HL-b-400-2	45,172,556,114	7,798,380,255	720,480,000	0	9,448,607,969	63,140,024,338
HL-b-400-3	41,595,134,753	6,663,338,700	655,800,000	0	9,448,607,969	58,362,881,421
LP-a-100-1	5,179,554,587	1,369,386,540	117,600,000	0	9,448,607,969	16,115,149,095
LP-a-100-2	15,397,357,222	4,384,071,019	496,440,000	0	9,448,607,969	29,726,476,210
LP-a-100-3	14,651,716,985	4,498,121,995	438,840,000	0	9,448,607,969	29,037,286,948
LP-b-400-1	20,675,578,328	4,615,035,804	508,560,000	0	9,448,607,969	35,247,782,100
LP-b-400-3	35,941,874,436	8,309,389,865	902,880,000	0	9,448,607,969	54,602,752,270
LP-b-1000-1	29,842,715,735	5,622,186,542	612,000,000	0	9,448,607,969	45,525,510,246
LP-b-1000-2	50,073,324,474	10,731,555,892	1,092,000,000	0	9,448,607,969	71,345,488,335
C-HL-a-100-2	15,424,225,958	3,437,769,526	498,840,000	2,032,064,365	9,448,607,969	30,841,507,818
C-HL-a-100-3	13,127,315,431	2,611,728,059	434,280,000	2,176,427,081	9,448,607,969	27,798,358,539
C-HL-b-400-2	45,172,556,114	7,798,380,255	720,480,000	2,226,391,741	9,448,607,969	65,366,416,079
C-HL-b-400-3	41,595,134,753	6,663,338,700	655,800,000	2,385,407,606	9,448,607,969	60,748,289,027
C-LP-a-100-1	5,179,554,587	1,369,386,540	117,600,000	2,715,056,941	9,448,607,969	18,830,206,036
C-LP-a-100-2	15,397,357,222	4,384,071,019	496,440,000	1,978,506,595	9,448,607,969	31,704,982,805
C-LP-a-100-3	14,651,716,985	4,498,121,995	438,840,000	2,088,918,473	9,448,607,969	31,126,205,421
C-LP-b-400-1	20,675,578,328	4,615,035,804	508,560,000	4,071,547,228	9,448,607,969	39,319,329,328
C-LP-b-400-3	35,941,874,436	8,309,389,865	902,880,000	2,219,853,100	9,448,607,969	56,822,605,370
C-LP-b-1000-1	29,842,715,735	5,622,186,542	612,000,000	4,478,468,683	9,448,607,969	50,003,978,929
C-LP-b-1000-2	50,073,324,474	10,731,555,892	1,092,000,000	2,412,785,037	9,448,607,969	73,758,273,372

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	11,290,051,065	11,290,051,065
NS-100	0	0	0	2,991,213,525	11,290,051,065	14,281,264,591
NS-400	0	0	0	10,717,863,605	11,290,051,065	22,007,914,671
NS-1000	0	0	0	20,231,577,299	11,290,051,065	31,521,628,364
G-100-1	6,080,751,483	1,040,725,735	116,315,116	0	11,290,051,065	18,527,843,400
G-100-4	10,020,468,854	2,438,283,154	268,943,346	0	11,290,051,065	24,017,746,420
G-400-4	28,117,494,389	5,640,029,388	891,803,099	0	11,290,051,065	45,939,377,941
G-1000-4	31,865,733,996	6,992,208,363	1,134,996,570	0	11,290,051,065	51,282,989,993
R-100-2	2,113,627,695	523,680,206	84,540,000	0	11,290,051,065	14,011,898,966
R-100-3	3,670,147,652	1,093,042,318	119,220,000	0	11,290,051,065	16,172,461,036
R-100-4	5,515,034,756	1,780,402,694	196,236,000	0	11,290,051,065	18,781,724,515
R-400-2	17,717,695,598	3,852,946,060	526,987,200	0	11,290,051,065	33,387,679,923
R-400-3	19,516,267,967	4,442,002,912	562,416,000	0	11,290,051,065	35,810,737,945
R-400-4	21,523,483,028	5,158,187,245	638,700,000	0	11,290,051,065	38,610,421,339
R-1000-4	29,417,016,719	5,164,843,592	814,560,000	0	11,290,051,065	46,686,471,376
WBI-100-1	558,079,147	100,454,247	0	0	11,290,051,065	11,948,584,459
WBI-400-1	16,005,508,602	3,272,297,563	442,464,000	0	11,290,051,065	31,010,321,230
C-G-100-1	6,080,751,483	1,040,725,735	116,315,116	2,142,418,805	11,290,051,065	20,670,262,205
C-G-100-4	10,020,468,854	2,438,283,154	268,943,346	1,795,574,148	11,290,051,065	25,813,320,568
C-G-400-4	28,117,494,389	5,640,029,388	891,803,099	1,607,311,035	11,290,051,065	47,546,688,976
C-G-1000-4	31,865,733,996	6,992,208,363	1,134,996,570	2,090,044,979	11,290,051,065	53,373,034,972
C-R-100-2	2,113,627,695	523,680,206	84,540,000	2,364,045,973	11,290,051,065	16,375,944,939
C-R-100-3	3,670,147,652	1,093,042,318	119,220,000	2,116,041,838	11,290,051,065	18,288,502,874
C-R-100-4	5,515,034,756	1,780,402,694	196,236,000	1,991,495,222	11,290,051,065	20,773,219,737
C-R-400-2	17,717,695,598	3,852,946,060	526,987,200	1,856,204,913	11,290,051,065	35,243,884,836
C-R-400-3	19,516,267,967	4,442,002,912	562,416,000	1,752,368,134	11,290,051,065	37,563,106,079
C-R-400-4	21,523,483,028	5,158,187,245	638,700,000	1,605,444,613	11,290,051,065	40,215,865,952
C-R-1000-4	29,417,016,719	5,164,843,592	814,560,000	1,963,085,071	11,290,051,065	48,649,556,447
C-WBI-100-1	558,079,147	100,454,247	0	2,959,561,863	11,290,051,065	14,908,146,322
C-WBI-400-1	16,005,508,602	3,272,297,563	442,464,000	2,437,692,699	11,290,051,065	33,448,013,929

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	9,637,580,128	9,637,580,128
NS-100	0	0	0	4,528,178,444	9,637,580,128	14,165,758,572
NS-400	0	0	0	16,540,266,776	9,637,580,128	26,177,846,904
NS-1000	0	0	0	26,978,007,723	9,637,580,128	36,615,587,851
HL-a-100-2	15,424,225,958	3,554,039,980	498,840,000	0	9,637,580,128	29,114,686,066
HL-a-100-3	13,127,315,431	2,682,107,320	434,280,000	0	9,637,580,128	25,881,282,879
HL-b-400-2	45,172,556,114	8,285,298,983	720,480,000	0	9,637,580,128	63,815,915,224
HL-b-400-3	41,595,134,753	7,087,199,563	655,800,000	0	9,637,580,128	58,975,714,443
LP-a-100-1	5,179,554,587	1,590,049,526	117,600,000	0	9,637,580,128	16,524,784,241
LP-a-100-2	15,397,357,222	4,667,040,399	496,440,000	0	9,637,580,128	30,198,417,749
LP-a-100-3	14,651,716,985	4,878,897,794	438,840,000	0	9,637,580,128	29,607,034,907
LP-b-400-1	20,675,578,328	4,782,852,651	508,560,000	0	9,637,580,128	35,604,571,107
LP-b-400-3	35,941,874,436	8,629,126,019	902,880,000	0	9,637,580,128	55,111,460,583
LP-b-1000-1	29,842,715,735	6,076,106,784	612,000,000	0	9,637,580,128	46,168,402,646
LP-b-1000-2	50,073,324,474	11,154,040,058	1,092,000,000	0	9,637,580,128	71,956,944,660
C-HL-a-100-2	15,424,225,958	3,554,039,980	498,840,000	2,032,064,365	9,637,580,128	31,146,750,431
C-HL-a-100-3	13,127,315,431	2,682,107,320	434,280,000	2,176,427,081	9,637,580,128	28,057,709,960
C-HL-b-400-2	45,172,556,114	8,285,298,983	720,480,000	2,226,391,741	9,637,580,128	66,042,306,965
C-HL-b-400-3	41,595,134,753	7,087,199,563	655,800,000	2,385,407,606	9,637,580,128	61,361,122,049
C-LP-a-100-1	5,179,554,587	1,590,049,526	117,600,000	2,715,056,941	9,637,580,128	19,239,841,182
C-LP-a-100-2	15,397,357,222	4,667,040,399	496,440,000	1,978,506,595	9,637,580,128	32,176,924,344
C-LP-a-100-3	14,651,716,985	4,878,897,794	438,840,000	2,088,918,473	9,637,580,128	31,695,953,380
C-LP-b-400-1	20,675,578,328	4,782,852,651	508,560,000	4,071,547,228	9,637,580,128	39,676,118,335
C-LP-b-400-3	35,941,874,436	8,629,126,019	902,880,000	2,219,853,100	9,637,580,128	57,331,313,684
C-LP-b-1000-1	29,842,715,735	6,076,106,784	612,000,000	4,478,468,683	9,637,580,128	50,646,871,330
C-LP-b-1000-2	50,073,324,474	11,154,040,058	1,092,000,000	2,412,785,037	9,637,580,128	74,369,729,697

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0		0
NS-100	0	0	0	2,991,213,525	11,312,631,167	14,303,844,693
NS-400	0	0	0	10,717,863,605	11,312,631,167	22,030,494,773
NS-1000	0	0	0	20,231,577,299	11,312,631,167	31,544,208,466
G-100-1	6,080,751,483	1,332,810,890	116,315,116	0	11,312,631,167	18,842,508,657
G-100-4	10,020,468,854	2,802,037,920	268,943,346	0	11,312,631,167	24,404,081,288
G-400-4	28,117,494,389	5,914,689,535	891,803,099	0	11,312,631,167	46,236,618,190
G-1000-4	31,865,733,996	7,242,027,428	1,134,996,570	0	11,312,631,167	51,555,389,161
R-100-2	2,113,627,695	586,214,541	84,540,000	0	11,312,631,167	14,097,013,403
R-100-3	3,670,147,652	1,184,774,710	119,220,000	0	11,312,631,167	16,286,773,530
R-100-4	5,515,034,756	1,907,384,336	196,236,000	0	11,312,631,167	18,931,286,259
R-400-2	17,717,695,598	4,050,607,170	526,987,200	0	11,312,631,167	33,607,921,135
R-400-3	19,516,267,967	4,669,872,066	562,416,000	0	11,312,631,167	36,061,187,200
R-400-4	21,523,483,028	5,422,783,801	638,700,000	0	11,312,631,167	38,897,597,997
R-1000-4	29,417,016,719	6,367,984,244	814,560,000	0	11,312,631,167	47,912,192,131
WBI-100-1	558,079,147	150,681,370	0	0	11,312,631,167	12,021,391,685
WBI-400-1	16,005,508,602	3,440,181,827	442,464,000	0	11,312,631,167	31,200,785,597
C-G-100-1	6,080,751,483	1,332,810,890	116,315,116	2,142,418,805	11,312,631,167	20,984,927,462
C-G-100-4	10,020,468,854	2,802,037,920	268,943,346	1,795,574,148	11,312,631,167	26,199,655,436
C-G-400-4	28,117,494,389	5,914,689,535	891,803,099	1,607,311,035	11,312,631,167	47,843,929,224
C-G-1000-4	31,865,733,996	7,242,027,428	1,134,996,570	2,090,044,979	11,312,631,167	53,645,434,140
C-R-100-2	2,113,627,695	586,214,541	84,540,000	2,364,045,973	11,312,631,167	16,461,059,375
C-R-100-3	3,670,147,652	1,184,774,710	119,220,000	2,116,041,838	11,312,631,167	18,402,815,368
C-R-100-4	5,515,034,756	1,907,384,336	196,236,000	1,991,495,222	11,312,631,167	20,922,781,481
C-R-400-2	17,717,695,598	4,050,607,170	526,987,200	1,856,204,913	11,312,631,167	35,464,126,048
C-R-400-3	19,516,267,967	4,669,872,066	562,416,000	1,752,368,134	11,312,631,167	37,813,555,335
C-R-400-4	21,523,483,028	5,422,783,801	638,700,000	1,605,444,613	11,312,631,167	40,503,042,610
C-R-1000-4	29,417,016,719	6,367,984,244	814,560,000	1,963,085,071	11,312,631,167	49,875,277,202
C-WBI-100-1	558,079,147	150,681,370	0	2,959,561,863	11,312,631,167	14,980,953,548
C-WBI-400-1	16,005,508,602	3,440,181,827	442,464,000	2,437,692,699	11,312,631,167	33,638,478,296

Color Code

No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	9,448,607,969	9,448,607,969
NS-100	0	0	0	4,258,734,736	9,448,607,969	13,707,342,705
NS-400	0	0	0	19,409,614,275	9,448,607,969	28,858,222,244
NS-1000	0	0	0	28,240,698,887	9,448,607,969	37,689,306,856
HL-a-100-2	15,424,225,958	3,437,769,526	498,840,000	0	9,448,607,969	28,809,443,453
HL-a-100-3	13,127,315,431	2,611,728,059	434,280,000	0	9,448,607,969	25,621,931,458
HL-b-400-2	45,172,556,114	7,798,380,255	720,480,000	0	9,448,607,969	63,140,024,338
HL-b-400-3	41,595,134,753	6,663,338,700	655,800,000	0	9,448,607,969	58,362,881,421
LP-a-100-1	5,179,554,587	1,369,386,540	117,600,000	0	9,448,607,969	16,115,149,095
LP-a-100-2	15,397,357,222	4,384,071,019	496,440,000	0	9,448,607,969	29,726,476,210
LP-a-100-3	14,651,716,985	4,498,121,995	438,840,000	0	9,448,607,969	29,037,286,948
LP-b-400-1	20,675,578,328	4,615,035,804	508,560,000	0	9,448,607,969	35,247,782,100
LP-b-400-3	35,941,874,436	8,309,389,865	902,880,000	0	9,448,607,969	54,602,752,270
LP-b-1000-1	29,842,715,735	5,622,186,542	612,000,000	0	9,448,607,969	45,525,510,246
LP-b-1000-2	50,073,324,474	10,731,555,892	1,092,000,000	0	9,448,607,969	71,345,488,335
C-HL-a-100-2	15,424,225,958	3,437,769,526	498,840,000	1,581,952,286	9,448,607,969	30,391,395,739
C-HL-a-100-3	13,127,315,431	2,611,728,059	434,280,000	1,742,427,542	9,448,607,969	27,364,359,000
C-HL-b-400-2	45,172,556,114	7,798,380,255	720,480,000	1,756,733,800	9,448,607,969	64,896,758,138
C-HL-b-400-3	41,595,134,753	6,663,338,700	655,800,000	2,052,801,484	9,448,607,969	60,415,682,905
C-LP-a-100-1	5,179,554,587	1,369,386,540	117,600,000	2,309,375,337	9,448,607,969	18,424,524,432
C-LP-a-100-2	15,397,357,222	4,384,071,019	496,440,000	1,482,382,332	9,448,607,969	31,208,858,542
C-LP-a-100-3	14,651,716,985	4,498,121,995	438,840,000	1,605,113,419	9,448,607,969	30,642,400,367
C-LP-b-400-1	20,675,578,328	4,615,035,804	508,560,000	4,517,615,291	9,448,607,969	39,765,397,390
C-LP-b-400-3	35,941,874,436	8,309,389,865	902,880,000	1,767,505,945	9,448,607,969	56,370,258,215
C-LP-b-1000-1	29,842,715,735	5,622,186,542	612,000,000	5,760,652,936	9,448,607,969	51,286,163,182
C-LP-b-1000-2	50,073,324,474	10,731,555,892	1,092,000,000	1,699,495,398	9,448,607,969	73,044,983,733

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	11,290,051,065	11,290,051,065
NS-100	0	0	0	3,081,075,201	11,290,051,065	14,371,126,266
NS-400	0	0	0	19,409,614,275	11,290,051,065	30,699,665,341
NS-1000	0	0	0	28,240,698,887	11,290,051,065	39,530,749,953
G-100-1	6,080,751,483	1,040,725,735	116,315,116	0	11,290,051,065	18,527,843,400
G-100-4	10,020,468,854	2,438,283,154	268,943,346	0	11,290,051,065	24,017,746,420
G-400-4	28,117,494,389	5,640,029,388	891,803,099	0	11,290,051,065	45,939,377,941
G-1000-4	31,865,733,996	6,992,208,363	1,134,996,570	0	11,290,051,065	51,282,989,993
R-100-2	2,113,627,695	523,680,206	84,540,000	0	11,290,051,065	14,011,898,966
R-100-3	3,670,147,652	1,093,042,318	119,220,000	0	11,290,051,065	16,172,461,036
R-100-4	5,515,034,756	1,780,402,694	196,236,000	0	11,290,051,065	18,781,724,515
R-400-2	17,717,695,598	3,852,946,060	526,987,200	0	11,290,051,065	33,387,679,923
R-400-3	19,516,267,967	4,442,002,912	562,416,000	0	11,290,051,065	35,810,737,945
R-400-4	21,523,483,028	5,158,187,245	638,700,000	0	11,290,051,065	38,610,421,339
R-1000-4	29,417,016,719	5,164,843,592	814,560,000	0	11,290,051,065	46,686,471,376
WBI-100-1	558,079,147	100,454,247	0	0	11,290,051,065	11,948,584,459
WBI-400-1	16,005,508,602	3,272,297,563	442,464,000	0	11,290,051,065	31,010,321,230
C-G-100-1	6,080,751,483	1,040,725,735	116,315,116	2,194,965,309	11,290,051,065	20,722,808,709
C-G-100-4	10,020,468,854	2,438,283,154	268,943,346	1,823,625,898	11,290,051,065	25,841,372,318
C-G-400-4	28,117,494,389	5,640,029,388	891,803,099	2,094,957,764	11,290,051,065	48,034,335,706
C-G-1000-4	31,865,733,996	6,992,208,363	1,134,996,570	2,449,946,391	11,290,051,065	53,732,936,384
C-R-100-2	2,113,627,695	523,680,206	84,540,000	2,386,992,423	11,290,051,065	16,398,891,388
C-R-100-3	3,670,147,652	1,093,042,318	119,220,000	2,110,551,526	11,290,051,065	18,283,012,562
C-R-100-4	5,515,034,756	1,780,402,694	196,236,000	2,011,195,484	11,290,051,065	20,792,919,999
C-R-400-2	17,717,695,598	3,852,946,060	526,987,200	2,823,354,187	11,290,051,065	36,211,034,110
C-R-400-3	19,516,267,967	4,442,002,912	562,416,000	2,508,167,425	11,290,051,065	38,318,905,370
C-R-400-4	21,523,483,028	5,158,187,245	638,700,000	2,294,124,391	11,290,051,065	40,904,545,730
C-R-1000-4	29,417,016,719	5,164,843,592	814,560,000	2,408,216,218	11,290,051,065	49,094,687,594
C-WBI-100-1	558,079,147	100,454,247	0	3,050,872,364	11,290,051,065	14,999,456,823
C-WBI-400-1	16,005,508,602	3,272,297,563	442,464,000	3,617,595,484	11,290,051,065	34,627,916,714

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	9,637,580,128	9,637,580,128
NS-100	0	0	0	4,258,734,736	9,637,580,128	13,896,314,864
NS-400	0	0	0	19,409,614,275	9,637,580,128	29,047,194,403
NS-1000	0	0	0	28,240,698,887	9,637,580,128	37,878,279,015
HL-a-100-2	15,424,225,958	3,554,039,980	498,840,000	0	9,637,580,128	29,114,686,066
HL-a-100-3	13,127,315,431	2,682,107,320	434,280,000	0	9,637,580,128	25,881,282,879
HL-b-400-2	45,172,556,114	8,285,298,983	720,480,000	0	9,637,580,128	63,815,915,224
HL-b-400-3	41,595,134,753	7,087,199,563	655,800,000	0	9,637,580,128	58,975,714,443
LP-a-100-1	5,179,554,587	1,590,049,526	117,600,000	0	9,637,580,128	16,524,784,241
LP-a-100-2	15,397,357,222	4,667,040,399	496,440,000	0	9,637,580,128	30,198,417,749
LP-a-100-3	14,651,716,985	4,878,897,794	438,840,000	0	9,637,580,128	29,607,034,907
LP-b-400-1	20,675,578,328	4,782,852,651	508,560,000	0	9,637,580,128	35,604,571,107
LP-b-400-3	35,941,874,436	8,629,126,019	902,880,000	0	9,637,580,128	55,111,460,583
LP-b-1000-1	29,842,715,735	6,076,106,784	612,000,000	0	9,637,580,128	46,168,402,646
LP-b-1000-2	50,073,324,474	11,154,040,058	1,092,000,000	0	9,637,580,128	71,956,944,660
C-HL-a-100-2	15,424,225,958	3,554,039,980	498,840,000	1,581,952,286	9,637,580,128	30,696,638,352
C-HL-a-100-3	13,127,315,431	2,682,107,320	434,280,000	1,742,427,542	9,637,580,128	27,623,710,421
C-HL-b-400-2	45,172,556,114	8,285,298,983	720,480,000	1,756,733,800	9,637,580,128	65,572,649,024
C-HL-b-400-3	41,595,134,753	7,087,199,563	655,800,000	2,052,801,484	9,637,580,128	61,028,515,928
C-LP-a-100-1	5,179,554,587	1,590,049,526	117,600,000	2,309,375,337	9,637,580,128	18,834,159,578
C-LP-a-100-2	15,397,357,222	4,667,040,399	496,440,000	1,482,382,332	9,637,580,128	31,680,800,081
C-LP-a-100-3	14,651,716,985	4,878,897,794	438,840,000	1,605,113,419	9,637,580,128	31,212,148,326
C-LP-b-400-1	20,675,578,328	4,782,852,651	508,560,000	4,517,615,291	9,637,580,128	40,122,186,398
C-LP-b-400-3	35,941,874,436	8,629,126,019	902,880,000	1,767,505,945	9,637,580,128	56,878,966,529
C-LP-b-1000-1	29,842,715,735	6,076,106,784	612,000,000	5,760,652,936	9,637,580,128	51,929,055,582
C-LP-b-1000-2	50,073,324,474	11,154,040,058	1,092,000,000	1,699,495,398	9,637,580,128	73,656,440,058

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 2 (PU2-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**NS Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	11,312,631,167	11,312,631,167
NS-100	0	0	0	3,081,075,201	11,312,631,167	14,393,706,368
NS-400	0	0	0	19,409,614,275	11,312,631,167	30,722,245,443
NS-1000	0	0	0	28,240,698,887	11,312,631,167	39,553,330,055
G-100-1	6,080,751,483	1,332,810,890	116,315,116	0	11,312,631,167	18,842,508,657
G-100-4	10,020,468,854	2,802,037,920	268,943,346	0	11,312,631,167	24,404,081,288
G-400-4	28,117,494,389	5,914,689,535	891,803,099	0	11,312,631,167	46,236,618,190
G-1000-4	31,865,733,996	7,242,027,428	1,134,996,570	0	11,312,631,167	51,555,389,161
R-100-2	2,113,627,695	586,214,541	84,540,000	0	11,312,631,167	14,097,013,403
R-100-3	3,670,147,652	1,184,774,710	119,220,000	0	11,312,631,167	16,286,773,530
R-100-4	5,515,034,756	1,907,384,336	196,236,000	0	11,312,631,167	18,931,286,259
R-400-2	17,717,695,598	4,050,607,170	526,987,200	0	11,312,631,167	33,607,921,135
R-400-3	19,516,267,967	4,669,872,066	562,416,000	0	11,312,631,167	36,061,187,200
R-400-4	21,523,483,028	5,422,783,801	638,700,000	0	11,312,631,167	38,897,597,997
R-1000-4	29,417,016,719	6,367,984,244	814,560,000	0	11,312,631,167	47,912,192,131
WBI-100-1	558,079,147	150,681,370	0	0	11,312,631,167	12,021,391,685
WBI-400-1	16,005,508,602	3,440,181,827	442,464,000	0	11,312,631,167	31,200,785,597
C-G-100-1	6,080,751,483	1,332,810,890	116,315,116	2,194,965,309	11,312,631,167	21,037,473,966
C-G-100-4	10,020,468,854	2,802,037,920	268,943,346	1,823,625,898	11,312,631,167	26,227,707,186
C-G-400-4	28,117,494,389	5,914,689,535	891,803,099	2,094,957,764	11,312,631,167	48,331,575,954
C-G-1000-4	31,865,733,996	7,242,027,428	1,134,996,570	2,449,946,391	11,312,631,167	54,005,335,552
C-R-100-2	2,113,627,695	586,214,541	84,540,000	2,386,992,423	11,312,631,167	16,484,005,825
C-R-100-3	3,670,147,652	1,184,774,710	119,220,000	2,110,551,526	11,312,631,167	18,397,325,056
C-R-100-4	5,515,034,756	1,907,384,336	196,236,000	2,011,195,484	11,312,631,167	20,942,481,743
C-R-400-2	17,717,695,598	4,050,607,170	526,987,200	2,823,354,187	11,312,631,167	36,431,275,322
C-R-400-3	19,516,267,967	4,669,872,066	562,416,000	2,508,167,425	11,312,631,167	38,569,354,626
C-R-400-4	21,523,483,028	5,422,783,801	638,700,000	2,294,124,391	11,312,631,167	41,191,722,388
C-R-1000-4	29,417,016,719	6,367,984,244	814,560,000	2,408,216,218	11,312,631,167	50,320,408,348
C-WBI-100-1	558,079,147	150,681,370	0	3,050,872,364	11,312,631,167	15,072,264,049
C-WBI-400-1	16,005,508,602	3,440,181,827	442,464,000	3,617,595,484	11,312,631,167	34,818,381,080

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	19,431,425,544	19,431,425,544
NS-100	0	0	0	5,491,870,436	19,431,425,544	24,923,295,980
NS-400	0	0	0	7,474,735,521	19,431,425,544	26,906,161,065
NS-1000	0	0	0	8,192,901,293	19,431,425,544	27,624,326,837
M-100-1	16,434,372,132	1,736,750,667	585,720,000	0	19,431,425,544	38,188,268,343
M-100-2 (was R-100-1)	14,764,456,589	1,769,898,087	504,120,000	0	19,431,425,544	36,469,900,220
G-400-2	19,303,922,225	2,510,303,624	631,320,000	0	19,431,425,544	41,876,971,393
G-1000-2	21,035,285,669	2,729,355,082	797,040,000	0	19,431,425,544	43,993,106,295
C-M-100-1	16,434,372,132	1,736,750,667	585,720,000	442,655,813	19,431,425,544	38,630,924,156
C-M-100-2	14,764,456,589	1,769,898,087	504,120,000	487,883,084	19,431,425,544	36,957,783,303
C-G-400-2	19,303,922,225	2,510,303,624	631,320,000	1,060,167,530	19,431,425,544	42,937,138,923
C-G-1000-2	21,035,285,669	2,729,355,082	797,040,000	1,739,980,750	19,431,425,544	45,733,087,045

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 3b (PU3b-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	4,364,994,612	4,364,994,612
NS-100	0	0	0	1,843,806,485	4,364,994,612	6,208,801,097
NS-400	0	0	0	3,186,105,365	4,364,994,612	7,551,099,977
NS-1000	0	0	0	3,974,270,990	4,364,994,612	8,339,265,602
G-100-1	11,125,894,560	2,727,160,513	275,520,000	0	4,364,994,612	18,493,569,685
F-100-1	10,317,552,457	2,707,345,670	295,920,000	0	4,364,994,612	17,685,812,738
F-400-1	19,351,655,687	2,802,312,099	465,360,000	0	4,364,994,612	26,984,322,398
F-1000-1	26,644,173,031	3,654,940,201	622,560,000	0	4,364,994,612	35,286,667,844
RL-100-1	8,671,820,687	2,334,894,790	112,800,000	0	4,364,994,612	15,484,510,089
RL-400-1	14,988,769,036	2,098,139,483	204,240,000	0	4,364,994,612	21,656,143,131
C-G-100-1	11,125,894,560	2,727,160,513	275,520,000	171,091,102	4,364,994,612	18,664,660,787
C-F-100-1	10,317,552,457	2,707,345,670	295,920,000	256,312,147	4,364,994,612	17,942,124,885
C-F-400-1	19,351,655,687	2,802,312,099	465,360,000	205,281,980	4,364,994,612	27,189,604,379
C-F-1000-1	26,644,173,031	3,654,940,201	622,560,000	605,212,664	4,364,994,612	35,891,880,509
C-RL-100-1	8,671,820,687	2,334,894,790	112,800,000	605,212,664	4,364,994,612	16,089,722,754
C-RL-400-1	14,988,769,036	2,098,139,483	204,240,000	695,798,972	4,364,994,612	22,351,942,103

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	10,295,953,284	10,295,953,284
NS-100	0	0	0	1,503,157,724	10,295,953,284	11,799,111,008
NS-400	0	0	0	2,416,672,397	10,295,953,284	12,712,625,681
NS-1000	0	0	0	3,353,405,565	10,295,953,284	13,649,358,849
G-100-1	8,333,680,532	2,205,061,596	266,520,000	0	10,295,953,284	21,101,215,412
G-100-2	8,387,245,367	2,136,572,912	211,560,000	0	10,295,953,284	21,031,331,562
G-400-3	8,118,918,760	2,118,830,878	297,960,000	0	10,295,953,284	20,831,662,921
G-1000-3	8,465,662,575	2,213,201,037	298,200,000	0	10,295,953,284	21,273,016,896
RL-100-1	1,612,334,989	668,122,326	10,560,000	0	10,295,953,284	12,586,970,598
RL-400-1	2,292,524,528	843,956,072	11,400,000	0	10,295,953,284	13,443,833,884
RL-1000-1	2,633,222,019	931,596,787	11,880,000	0	10,295,953,284	13,872,652,090
C-G-100-1	8,333,680,532	2,205,061,596	266,520,000	1,337,343,944	10,295,953,284	22,438,559,356
C-G-100-2	8,387,245,367	2,136,572,912	211,560,000	1,166,677,999	10,295,953,284	22,198,009,561
C-G-400-3	8,118,918,760	2,118,830,878	297,960,000	2,449,763,253	10,295,953,284	23,281,426,175
C-G-1000-3	8,465,662,575	2,213,201,037	298,200,000	1,018,326,175	10,295,953,284	22,291,343,071
C-RL-100-1	1,612,334,989	668,122,326	10,560,000	1,019,265,296	10,295,953,284	13,606,235,895
C-RL-400-1	2,292,524,528	843,956,072	11,400,000	1,041,121,803	10,295,953,284	14,484,955,687
C-RL-1000-1	2,633,222,019	931,596,787	11,880,000	2,501,242,463	10,295,953,284	16,373,894,553

Color Code

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	19,625,739,799	19,625,739,799
NS-100	0	0	0	5,491,870,436	19,625,739,799	25,117,610,236
NS-400	0	0	0	7,474,735,521	19,625,739,799	27,100,475,320
NS-1000	0	0	0	8,192,901,293	19,625,739,799	27,818,641,092
M-100-1	16,434,372,132	2,787,977,661	585,720,000	0	19,625,739,799	39,433,809,593
M-100-2 (was R-100-1)	14,764,456,589	2,004,661,651	504,120,000	0	19,625,739,799	36,898,978,039
G-400-2	19,303,922,225	2,657,465,063	631,320,000	0	19,625,739,799	42,218,447,087
G-1000-2	21,035,285,669	2,887,127,039	797,040,000	0	19,625,739,799	44,345,192,507
C-M-100-1	16,434,372,132	2,787,977,661	585,720,000	442,655,813	19,625,739,799	39,876,465,405
C-M-100-2	14,764,456,589	2,004,661,651	504,120,000	487,883,084	19,625,739,799	37,386,861,123
C-G-400-2	19,303,922,225	2,657,465,063	631,320,000	1,060,167,530	19,625,739,799	43,278,614,617
C-G-1000-2	21,035,285,669	2,887,127,039	797,040,000	1,739,980,750	19,625,739,799	46,085,173,257

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 3b (PU3b-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	4,408,644,558	4,408,644,558
NS-100	0	0	0	1,843,806,485	4,408,644,558	6,252,451,043
NS-400	0	0	0	3,186,105,365	4,408,644,558	7,594,749,924
NS-1000	0	0	0	3,974,270,990	4,408,644,558	8,382,915,548
G-100-1	11,125,894,560	2,776,494,028	275,520,000	0	4,408,644,558	18,586,553,146
F-100-1	10,317,552,457	2,781,487,033	295,920,000	0	4,408,644,558	17,803,604,048
F-400-1	19,351,655,687	3,144,298,977	465,360,000	0	4,408,644,558	27,369,959,222
F-1000-1	26,644,173,031	3,682,488,092	622,560,000	0	4,408,644,558	35,357,865,681
RL-100-1	8,671,820,687	2,401,488,601	112,800,000	0	4,408,644,558	15,594,753,846
RL-400-1	14,988,769,036	2,154,845,955	204,240,000	0	4,408,644,558	21,756,499,550
C-G-100-1	11,125,894,560	2,776,494,028	275,520,000	171,091,102	4,408,644,558	18,757,644,248
C-F-100-1	10,317,552,457	2,781,487,033	295,920,000	256,312,147	4,408,644,558	18,059,916,195
C-F-400-1	19,351,655,687	3,144,298,977	465,360,000	205,281,980	4,408,644,558	27,575,241,203
C-F-1000-1	26,644,173,031	3,682,488,092	622,560,000	320,696,539	4,408,644,558	35,678,562,221
C-RL-100-1	8,671,820,687	2,401,488,601	112,800,000	605,212,664	4,408,644,558	16,199,966,511
C-RL-400-1	14,988,769,036	2,154,845,955	204,240,000	695,798,972	4,408,644,558	22,452,298,522

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	10,501,872,350	10,501,872,350
NS-100	0	0	0	1,503,157,724	10,501,872,350	12,005,030,074
NS-400	0	0	0	2,416,672,397	10,501,872,350	12,918,544,746
NS-1000	0	0	0	3,353,405,565	10,501,872,350	13,855,277,914
G-100-1	8,333,680,532	2,780,783,620	266,520,000	0	10,501,872,350	21,882,856,502
G-100-2	8,387,245,367	2,708,490,008	211,560,000	0	10,501,872,350	21,809,167,725
G-400-3	8,118,918,760	2,689,762,306	297,960,000	0	10,501,872,350	21,608,513,415
G-1000-3	8,465,662,575	2,789,375,252	298,200,000	0	10,501,872,350	22,055,110,177
RL-100-1	1,612,334,989	705,240,233	10,560,000	0	10,501,872,350	12,830,007,571
RL-400-1	2,292,524,528	890,842,521	11,400,000	0	10,501,872,350	13,696,639,399
RL-1000-1	2,633,222,019	983,352,164	11,880,000	0	10,501,872,350	14,130,326,533
C-G-100-1	8,333,680,532	2,780,783,620	266,520,000	1,337,343,944	10,501,872,350	23,220,200,446
C-G-100-2	8,387,245,367	2,708,490,008	211,560,000	1,166,677,999	10,501,872,350	22,975,845,724
C-G-400-3	8,118,918,760	2,689,762,306	297,960,000	2,449,763,253	10,501,872,350	24,058,276,669
C-G-1000-3	8,465,662,575	2,789,375,252	298,200,000	1,018,326,175	10,501,872,350	23,073,436,351
C-RL-100-1	1,612,334,989	705,240,233	10,560,000	1,019,265,296	10,501,872,350	13,849,272,867
C-RL-400-1	2,292,524,528	890,842,521	11,400,000	1,041,121,803	10,501,872,350	14,737,761,201
C-RL-1000-1	2,633,222,019	983,352,164	11,880,000	2,501,242,463	10,501,872,350	16,631,568,995

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	19,431,425,544	19,431,425,544
NS-100	0	0	0	5,480,711,485	19,431,425,544	24,912,137,029
NS-400	0	0	0	7,369,688,257	19,431,425,544	26,801,113,801
NS-1000	0	0	0	8,373,166,632	19,431,425,544	27,804,592,176
M-100-1	16,434,372,132	1,736,750,667	585,720,000	0	19,431,425,544	38,188,268,343
M-100-2 (was R-100-1)	14,764,456,589	1,769,898,087	504,120,000	0	19,431,425,544	36,469,900,220
G-400-2	19,303,922,225	2,510,303,624	631,320,000	0	19,431,425,544	41,876,971,393
G-1000-2	21,035,285,669	2,729,355,082	797,040,000	0	19,431,425,544	43,993,106,295
C-M-100-1	16,434,372,132	1,736,750,667	585,720,000	436,881,756	19,431,425,544	38,625,150,100
C-M-100-2	14,764,456,589	1,769,898,087	504,120,000	483,576,961	19,431,425,544	36,953,477,181
C-G-400-2	19,303,922,225	2,510,303,624	631,320,000	1,282,255,156	19,431,425,544	43,159,226,549
C-G-1000-2	21,035,285,669	2,729,355,082	797,040,000	1,919,416,621	19,431,425,544	45,912,522,916

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 3b (PU3b-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	4,364,994,612	4,364,994,612
NS-100	0	0	0	1,893,104,451	4,364,994,612	6,258,099,063
NS-400	0	0	0	3,276,057,346	4,364,994,612	7,641,051,958
NS-1000	0	0	0	4,434,303,424	4,364,994,612	8,799,298,036
G-100-1	11,125,894,560	2,727,160,513	275,520,000	0	4,364,994,612	18,493,569,685
F-100-1	10,317,552,457	2,707,345,670	295,920,000	0	4,364,994,612	17,685,812,738
F-400-1	19,351,655,687	2,802,312,099	465,360,000	0	4,364,994,612	26,984,322,398
F-1000-1	26,644,173,031	3,654,940,201	622,560,000	0	4,364,994,612	35,286,667,844
RL-100-1	8,671,820,687	2,334,894,790	112,800,000	0	4,364,994,612	15,484,510,089
RL-400-1	14,988,769,036	2,098,139,483	204,240,000	0	4,364,994,612	21,656,143,131
C-G-100-1	11,125,894,560	2,727,160,513	275,520,000	179,145,080	4,364,994,612	18,672,714,765
C-F-100-1	10,317,552,457	2,707,345,670	295,920,000	266,253,600	4,364,994,612	17,952,066,339
C-F-400-1	19,351,655,687	2,802,312,099	465,360,000	316,602,205	4,364,994,612	27,300,924,604
C-F-1000-1	26,644,173,031	3,654,940,201	622,560,000	343,940,192	4,364,994,612	35,630,608,036
C-RL-100-1	8,671,820,687	2,334,894,790	112,800,000	636,446,508	4,364,994,612	16,120,956,597
C-RL-400-1	14,988,769,036	2,098,139,483	204,240,000	1,246,495,282	4,364,994,612	22,902,638,413

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 4 (PU4-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	10,295,953,284	10,295,953,284
NS-100	0	0	0	1,504,805,790	10,295,953,284	11,800,759,074
NS-400	0	0	0	2,374,671,167	10,295,953,284	12,670,624,451
NS-1000	0	0	0	3,462,593,524	10,295,953,284	13,758,546,808
G-100-1	8,333,680,532	2,205,061,596	266,520,000	0	10,295,953,284	21,101,215,412
G-100-2	8,387,245,367	2,136,572,912	211,560,000	0	10,295,953,284	21,031,331,562
G-400-3	8,118,918,760	2,118,830,878	297,960,000	0	10,295,953,284	20,831,662,921
G-1000-3	8,465,662,575	2,213,201,037	298,200,000	0	10,295,953,284	21,273,016,896
RL-100-1	1,612,334,989	668,122,326	10,560,000	0	10,295,953,284	12,586,970,598
RL-400-1	2,292,524,528	843,956,072	11,400,000	0	10,295,953,284	13,443,833,884
RL-1000-1	2,633,222,019	931,596,787	11,880,000	0	10,295,953,284	13,872,652,090
C-G-100-1	8,333,680,532	2,205,061,596	266,520,000	1,343,742,214	10,295,953,284	22,444,957,627
C-G-100-2	8,387,245,367	2,136,572,912	211,560,000	1,887,723,808	10,295,953,284	22,919,055,370
C-G-400-3	8,118,918,760	2,118,830,878	297,960,000	2,552,818,056	10,295,953,284	23,384,480,977
C-G-1000-3	8,465,662,575	2,213,201,037	298,200,000	1,029,220,294	10,295,953,284	22,302,237,190
C-RL-100-1	1,612,334,989	668,122,326	10,560,000	1,030,010,452	10,295,953,284	13,616,981,050
C-RL-400-1	2,292,524,528	843,956,072	11,400,000	1,531,934,723	10,295,953,284	14,975,768,607
C-RL-1000-1	2,633,222,019	931,596,787	11,880,000	2,530,878,036	10,295,953,284	16,403,530,126

Color Code

No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	19,625,739,799	19,625,739,799
NS-100	0	0	0	5,480,711,485	19,625,739,799	25,106,451,285
NS-400	0	0	0	7,369,688,257	19,625,739,799	26,995,428,056
NS-1000	0	0	0	8,373,166,632	19,625,739,799	27,998,906,431
M-100-1	16,434,372,132	2,787,977,661	585,720,000	0	19,625,739,799	39,433,809,593
M-100-2 (was R-100-1)	14,764,456,589	2,004,661,651	504,120,000	0	19,625,739,799	36,898,978,039
G-400-2	19,303,922,225	2,657,465,063	631,320,000	0	19,625,739,799	42,218,447,087
G-1000-2	21,035,285,669	2,887,127,039	797,040,000	0	19,625,739,799	44,345,192,507
C-M-100-1	16,434,372,132	2,787,977,661	585,720,000	436,881,756	19,625,739,799	39,870,691,349
C-M-100-2	14,764,456,589	2,004,661,651	504,120,000	483,576,961	19,625,739,799	37,382,555,001
C-G-400-2	19,303,922,225	2,657,465,063	631,320,000	1,282,255,156	19,625,739,799	43,500,702,243
C-G-1000-2	21,035,285,669	2,887,127,039	797,040,000	1,919,416,621	19,625,739,799	46,264,609,128

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 3b (PU3b-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	4,408,644,558	4,408,644,558
NS-100	0	0	0	1,893,104,451	4,408,644,558	6,301,749,010
NS-400	0	0	0	3,276,057,346	4,408,644,558	7,684,701,904
NS-1000	0	0	0	4,434,303,424	4,408,644,558	8,842,947,983
G-100-1	11,125,894,560	2,776,494,028	275,520,000	0	4,408,644,558	18,586,553,146
F-100-1	10,317,552,457	2,781,487,033	295,920,000	0	4,408,644,558	17,803,604,048
F-400-1	19,351,655,687	3,144,298,977	465,360,000	0	4,408,644,558	27,369,959,222
F-1000-1	26,644,173,031	3,682,488,092	622,560,000	0	4,408,644,558	35,357,865,681
RL-100-1	8,671,820,687	2,401,488,601	112,800,000	0	4,408,644,558	15,594,753,846
RL-400-1	14,988,769,036	2,154,845,955	204,240,000	0	4,408,644,558	21,756,499,550
C-G-100-1	11,125,894,560	2,776,494,028	275,520,000	179,145,080	4,408,644,558	18,765,698,226
C-F-100-1	10,317,552,457	2,781,487,033	295,920,000	266,253,600	4,408,644,558	18,069,857,648
C-F-400-1	19,351,655,687	3,144,298,977	465,360,000	316,602,205	4,408,644,558	27,686,561,427
C-F-1000-1	26,644,173,031	3,682,488,092	622,560,000	343,940,192	4,408,644,558	35,701,805,873
C-RL-100-1	8,671,820,687	2,401,488,601	112,800,000	636,446,508	4,408,644,558	16,231,200,354
C-RL-400-1	14,988,769,036	2,154,845,955	204,240,000	1,246,495,282	4,408,644,558	23,002,994,831

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R1 (Coastal)	0	0	0	0	10,501,872,350	10,501,872,350
NS-100	0	0	0	1,504,805,790	10,501,872,350	12,006,678,139
NS-400	0	0	0	2,374,671,167	10,501,872,350	12,876,543,516
NS-1000	0	0	0	3,462,593,524	10,501,872,350	13,964,465,874
G-100-1	8,333,680,532	2,780,783,620	266,520,000	0	10,501,872,350	21,882,856,502
G-100-2	8,387,245,367	2,708,490,008	211,560,000	0	10,501,872,350	21,809,167,725
G-400-3	8,118,918,760	2,689,762,306	297,960,000	0	10,501,872,350	21,608,513,415
G-1000-3	8,465,662,575	2,789,375,252	298,200,000	0	10,501,872,350	22,055,110,177
RL-100-1	1,612,334,989	705,240,233	10,560,000	0	10,501,872,350	12,830,007,571
RL-400-1	2,292,524,528	890,842,521	11,400,000	0	10,501,872,350	13,696,639,399
RL-1000-1	2,633,222,019	983,352,164	11,880,000	0	10,501,872,350	14,130,326,533
C-G-100-1	8,333,680,532	2,780,783,620	266,520,000	1,343,742,214	10,501,872,350	23,226,598,716
C-G-100-2	8,387,245,367	2,708,490,008	211,560,000	1,887,723,808	10,501,872,350	23,696,891,533
C-G-400-3	8,118,918,760	2,689,762,306	297,960,000	2,552,818,056	10,501,872,350	24,161,331,471
C-G-1000-3	8,465,662,575	2,789,375,252	298,200,000	1,029,220,294	10,501,872,350	23,084,330,471
C-RL-100-1	1,612,334,989	705,240,233	10,560,000	1,030,010,452	10,501,872,350	13,860,018,023
C-RL-400-1	2,292,524,528	890,842,521	11,400,000	1,531,934,723	10,501,872,350	15,228,574,121
C-RL-1000-1	2,633,222,019	983,352,164	11,880,000	2,530,878,036	10,501,872,350	16,661,204,569

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	36,217,385,412	36,217,385,412
NS-100	0	0	0	5,433,814,133	36,217,385,412	41,651,199,544
NS-400	0	0	0	19,848,320,132	36,217,385,412	56,065,705,544
NS-1000	0	0	0	32,373,609,268	36,217,385,412	68,590,994,680
LP-a-100-1	6,215,465,504	1,643,263,848	141,120,000	0	36,217,385,412	44,217,234,764
C-LP-a-100-1	6,215,465,504	1,643,263,848	141,120,000	3,258,068,329	36,217,385,412	47,475,303,093

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	12,861,436,326	10,058,418,401	22,919,854,728
WBI-100-1	669,694,977	120,545,096	0	0	10,058,418,401	10,848,658,474
C-G-100-1	7,296,901,780	1,248,870,882	139,578,140	2,570,902,566	10,058,418,401	21,314,671,769
C-WBI-100-1	669,694,977	120,545,096	0	3,551,474,236	10,058,418,401	14,400,132,710
C-R-100-2	2,536,353,234	628,416,247	101,448,000	2,836,855,167	10,058,418,401	16,161,491,049

Color Code

No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	36,941,733,120	36,941,733,120
NS-100	0	0	0	5,433,814,133	36,941,733,120	42,375,547,253
NS-400	0	0	0	19,848,320,132	36,941,733,120	56,790,053,252
NS-1000	0	0	0	32,373,609,268	36,941,733,120	69,315,342,388
LP-a-100-1	6,215,465,504	1,908,059,432	141,120,000	0	36,941,733,120	45,206,378,056
C-LP-a-100-1	6,215,465,504	1,908,059,432	141,120,000	3,258,068,329	36,941,733,120	48,464,446,386

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	12,861,436,326	10,159,002,585	23,020,438,912
WBI-100-1	669,694,977	180,817,644	0	0	10,159,002,585	11,009,515,206
C-G-100-1	7,296,901,780	1,599,373,068	139,578,140	2,570,902,566	10,159,002,585	21,765,758,138
C-WBI-100-1	669,694,977	180,817,644	0	3,551,474,236	10,159,002,585	14,560,989,442
C-R-100-2	2,536,353,234	703,457,449	101,448,000	2,836,855,167	10,159,002,585	16,337,116,435

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	36,217,385,412	36,217,385,412
NS-100	0	0	0	5,110,481,684	36,217,385,412	41,327,867,096
NS-400	0	0	0	23,291,537,130	36,217,385,412	59,508,922,542
NS-1000	0	0	0	33,888,838,665	36,217,385,412	70,106,224,077
LP-a-100-1	6,215,465,504	1,643,263,848	141,120,000	0	36,217,385,412	44,217,234,764
C-LP-a-100-1	6,215,465,504	1,643,263,848	141,120,000	2,771,250,405	36,217,385,412	46,988,485,168

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	23,082,585,313	10,058,418,401	33,141,003,714
WBI-100-1	669,694,977	120,545,096	0	0	10,058,418,401	10,848,658,474
C-G-100-1	7,296,901,780	1,248,870,882	139,578,140	2,633,958,371	10,058,418,401	21,377,727,574
C-WBI-100-1	669,694,977	120,545,096	0	3,661,046,837	10,058,418,401	14,509,705,311
C-R-100-2	2,536,353,234	628,416,247	101,448,000	2,864,390,907	10,058,418,401	16,189,026,789

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 1 Alternatives
(First Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 1 (PU1-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**NS Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	36,941,733,120	36,941,733,120
NS-100	0	0	0	5,110,481,684	36,941,733,120	42,052,214,804
NS-400	0	0	0	23,291,537,130	36,941,733,120	60,233,270,250
NS-1000	0	0	0	33,888,838,665	36,941,733,120	70,830,571,785
LP-a-100-1	6,215,465,504	1,908,059,432	141,120,000	0	36,941,733,120	45,206,378,056
C-LP-a-100-1	6,215,465,504	1,908,059,432	141,120,000	2,771,250,405	36,941,733,120	47,977,628,461

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 2 Alternatives
(First Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	23,082,585,313	10,159,002,585	33,241,587,898
WBI-100-1	669,694,977	180,817,644	0	0	10,159,002,585	11,009,515,206
C-G-100-1	7,296,901,780	1,599,373,068	139,578,140	2,633,958,371	10,159,002,585	21,828,813,943
C-WBI-100-1	669,694,977	180,817,644	0	3,661,046,837	10,159,002,585	14,670,562,043
C-R-100-2	2,536,353,234	703,457,449	101,448,000	2,864,390,907	10,159,002,585	16,364,652,175

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	6,590,244,523	0	6,590,244,523
NS-400	0	0	0	8,969,682,625	0	8,969,682,625
NS-1000	0	0	0	9,831,481,551	0	9,831,481,551
C-M-100-1	19,721,246,559	2,084,100,800	702,864,000	531,186,975	0	23,039,398,334
C-M-100-2	17,717,347,907	2,123,877,704	604,944,000	585,459,701	0	21,031,629,311

Color Code
No Action
Nonstructural
Comprehensive (Struct + NS)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives carried into MCDA)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 3b (PU3b-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-400	0	0	0	3,823,326,439	0	3,823,326,439
NS-1000	0	0	0	4,769,125,188	0	4,769,125,188
C-G-100-1	13,351,073,472	3,272,592,616	330,624,000	205,309,322	0	17,159,599,410
C-F-100-1	12,381,062,948	3,248,814,804	355,104,000	307,574,576	0	16,292,556,328
C-RL-100-1	10,406,184,824	2,801,873,748	135,360,000	726,255,197	0	14,069,673,770

Color Code
No Action
Nonstructural
Comprehensive (Struct + NS)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	1,803,789,269	0	1,803,789,269
NS-400	0	0	0	2,900,006,876	0	2,900,006,876
NS-1000	0	0	0	4,024,086,678	0	4,024,086,678
C-RL-100-1	1,934,801,987	801,746,791	12,672,000	1,604,812,733	0	4,354,033,510
C-RL-400-1	2,751,029,434	1,012,747,287	13,680,000	1,400,013,598	0	5,177,470,319
C-RL-1000-1	3,159,866,423	1,117,916,144	14,256,000	2,939,715,904	0	7,231,754,471

Color Code

- No Action
- Nonstructural
- Comprehensive (Struct + NS)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	6,590,244,523	0	6,590,244,523
NS-400	0	0	0	8,969,682,625	0	8,969,682,625
NS-1000	0	0	0	9,831,481,551	0	9,831,481,551
C-M-100-1	19,721,246,559	3,345,573,193	702,864,000	531,186,975	0	24,300,870,727
C-M-100-2	17,717,347,907	2,405,593,981	604,944,000	585,459,701	0	21,313,345,588

Color Code

- No Action
- Nonstructural / Coastal
- Comprehensive (Struct + NS)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 3b (PU3b-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	3,823,326,439	0	3,823,326,439
NS-1000	0	0	0	4,769,125,188	0	4,769,125,188
C-G-100-1	13,351,073,472	3,331,792,833	330,624,000	205,309,322	0	17,218,799,628
C-F-100-1	12,381,062,948	3,337,784,440	355,104,000	307,574,576	0	16,381,525,964
C-RL-100-1	10,406,184,824	2,881,786,322	135,360,000	726,255,197	0	14,149,586,343

Color Code

No Action
Nonstructural / Coastal
Comprehensive (Struct + NS)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	1,803,789,269	0	1,803,789,269
NS-400	0	0	0	2,900,006,876	0	2,900,006,876
NS-1000	0	0	0	4,024,086,678	0	4,024,086,678
C-RL-100-1	1,934,801,987	846,288,279	12,672,000	1,604,812,733	0	4,398,574,999
C-RL-400-1	2,751,029,434	1,069,011,025	13,680,000	1,400,013,598	0	5,233,734,057
C-RL-1000-1	3,159,866,423	1,180,022,597	14,256,000	2,939,715,904	0	7,293,860,924

Color Code

No Action
Nonstructural / Coastal
Comprehensive (Struct + NS)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	6,576,853,782	0	6,576,853,782
NS-400	0	0	0	8,843,625,908	0	8,843,625,908
NS-1000	0	0	0	10,047,799,958	0	10,047,799,958
C-M-100-1	19,721,246,559	2,084,100,800	702,864,000	524,258,108	0	23,032,469,467
C-M-100-2	17,717,347,907	2,123,877,704	604,944,000	580,292,354	0	21,026,461,965

Color Code

- No Action
- Nonstructural / Coastal
- Comprehensive (Struct + NS)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 3b (PU3b-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-400	0	0	0	3,931,268,816	0	3,931,268,816
NS-1000	0	0	0	5,321,164,109	0	5,321,164,109
C-G-100-1	13,351,073,472	3,272,592,616	330,624,000	214,974,095	0	17,169,264,183
C-F-100-1	12,381,062,948	3,248,814,804	355,104,000	319,504,320	0	16,304,486,072
C-RL-100-1	10,406,184,824	2,801,873,748	135,360,000	763,735,810	0	14,107,154,383
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 4 (PU4-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-100	0	0	0	1,805,766,948	0	1,805,766,948
NS-400	0	0	0	2,849,605,400	0	2,849,605,400
NS-1000	0	0	0	4,155,112,229	0	4,155,112,229
C-RL-100-1	1,934,801,987	801,746,791	12,672,000	1,612,490,657	0	4,361,711,435
C-RL-400-1	2,751,029,434	1,012,747,287	13,680,000	2,265,268,570	0	6,042,725,290
C-RL-1000-1	3,159,866,423	1,117,916,144	14,256,000	3,063,381,667	0	7,355,420,234
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3a Alternatives
(First Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	6,576,853,782	0	6,576,853,782
NS-400	0	0	0	8,843,625,908	0	8,843,625,908
NS-1000	0	0	0	10,047,799,958	0	10,047,799,958
C-M-100-1	19,721,246,559	3,345,573,193	702,864,000	524,258,108	0	24,293,941,860
C-M-100-2	17,717,347,907	2,405,593,981	604,944,000	580,292,354	0	21,308,178,242
Color Code						
No Action						
Coastal Only						
Nonstructural / Coastal						
Structural / Coastal						

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 3b Alternatives
(First Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 3b (PU3b-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	3,931,268,816	0	3,931,268,816
NS-1000	0	0	0	5,321,164,109	0	5,321,164,109
C-G-100-1	13,351,073,472	3,331,792,833	330,624,000	214,974,095	0	17,228,464,401
C-F-100-1	12,381,062,948	3,337,784,440	355,104,000	319,504,320	0	16,393,455,708
C-RL-100-1	10,406,184,824	2,881,786,322	135,360,000	763,735,810	0	14,187,066,956

Color Code
No Action
Nonstructural / Coastal
Comprehensive (Struct + NS)

Louisiana Coastal Protection and Restoration (LACPR)

First Cost - Planning Unit 4 Alternatives
(First Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	1,805,766,948	0	1,805,766,948
NS-400	0	0	0	2,849,605,400	0	2,849,605,400
NS-1000	0	0	0	4,155,112,229	0	4,155,112,229
C-RL-100-1	1,934,801,987	846,288,279	12,672,000	1,612,490,657	0	4,406,252,923
C-RL-400-1	2,751,029,434	1,069,011,025	13,680,000	2,265,268,570	0	6,098,989,028
C-RL-1000-1	3,159,866,423	1,180,022,597	14,256,000	3,063,381,667	0	7,417,526,687

Color Code
No Action
Nonstructural / Coastal
Comprehensive (Struct + NS)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 1 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 1 (PU1-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**NS Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	64,072,239,679	64,072,239,679
NS-100	0	0	0	6,730,544,358	64,072,239,679	70,802,784,036
NS-400	0	0	0	24,584,940,856	64,072,239,679	88,657,180,535
NS-1000	0	0	0	40,099,276,103	64,072,239,679	104,171,515,781
LP-a-100-1	8,504,796,625	3,209,674,338	174,797,002	0	64,072,239,679	75,961,507,644
C-LP-a-100-1	8,504,796,625	3,209,674,338	174,797,002	4,035,576,646	64,072,239,679	79,997,084,290

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 2 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	15,930,700,901	14,311,350,500	30,242,051,401
WBI-100-1	829,511,580	235,452,451	0	0	14,311,350,500	15,376,314,532
C-G-100-1	10,468,365,066	2,439,333,665	172,887,191	3,184,425,035	14,311,350,500	30,576,361,457
C-WBI-100-1	829,511,580	235,452,451	0	4,399,001,198	14,311,350,500	19,775,315,730
C-R-100-2	3,195,753,014	1,227,442,267	125,657,641	3,513,844,801	14,311,350,500	22,374,048,223

Color Code
- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 1 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	65,353,684,472	65,353,684,472
NS-100	0	0	0	6,730,544,358	65,353,684,472	72,084,228,830
NS-400	0	0	0	24,584,940,856	65,353,684,472	89,938,625,328
NS-1000	0	0	0	40,099,276,103	65,353,684,472	105,452,960,575
LP-a-100-1	8,504,796,625	3,726,881,354	174,797,002	0	65,353,684,472	77,760,159,454
C-LP-a-100-1	8,504,796,625	3,726,881,354	174,797,002	4,035,576,646	65,353,684,472	81,795,736,099

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 2 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 2 (PU2-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**NS Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-400	0	0	0	15,930,700,901	14,454,464,005	30,385,164,906
WBI-100-1	829,511,580	353,178,677	0	0	14,454,464,005	15,637,154,262
C-G-100-1	10,468,365,066	3,123,945,494	172,887,191	3,184,425,035	14,454,464,005	31,404,086,791
C-WBI-100-1	829,511,580	353,178,677	0	4,399,001,198	14,454,464,005	20,036,155,460
C-R-100-2	3,195,753,014	1,374,015,089	125,657,641	3,513,844,801	14,454,464,005	22,663,734,550

Color Code

No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 1 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	64,072,239,679	64,072,239,679
NS-100	0	0	0	6,330,051,566	64,072,239,679	70,402,291,245
NS-400	0	0	0	28,849,850,213	64,072,239,679	92,922,089,892
NS-1000	0	0	0	41,976,101,187	64,072,239,679	106,048,340,866
LP-a-100-1	8,504,796,625	3,209,674,338	174,797,002	0	64,072,239,679	75,961,507,644
C-LP-a-100-1	8,504,796,625	3,209,674,338	174,797,002	3,432,584,060	64,072,239,679	79,394,091,704

Color Code

- No Action
- Coastal Only
- Nonstructural / Coastal
- Structural / Coastal
- Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 2 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	28,591,033,949	14,311,350,500	42,902,384,450
WBI-100-1	829,511,580	235,452,451	0	0	14,311,350,500	15,376,314,532
C-G-100-1	10,468,365,066	2,439,333,665	172,887,191	3,262,528,533	14,311,350,500	30,654,464,955
C-WBI-100-1	829,511,580	235,452,451	0	4,534,722,302	14,311,350,500	19,911,036,833
C-R-100-2	3,195,753,014	1,227,442,267	125,657,641	3,547,951,694	14,311,350,500	22,408,155,116

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 1 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 1 (PU1-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
R2 (Coastal)	0	0	0	0	65,353,684,472	65,353,684,472
NS-100	0	0	0	6,330,051,566	65,353,684,472	71,683,736,039
NS-400	0	0	0	28,849,850,213	65,353,684,472	94,203,534,686
NS-1000	0	0	0	41,976,101,187	65,353,684,472	107,329,785,660
LP-a-100-1	8,504,796,625	3,726,881,354	174,797,002	0	65,353,684,472	77,760,159,454
C-LP-a-100-1	8,504,796,625	3,726,881,354	174,797,002	3,432,584,060	65,353,684,472	81,192,743,513

Color Code
No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 2 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 2 (PU2-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	NS Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-400	0	0	0	28,591,033,949	14,454,464,005	43,045,497,955
WBI-100-1	829,511,580	353,178,677	0	0	14,454,464,005	15,637,154,262
C-G-100-1	10,468,365,066	3,123,945,494	172,887,191	3,262,528,533	14,454,464,005	31,482,190,289
C-WBI-100-1	829,511,580	353,178,677	0	4,534,722,302	14,454,464,005	20,171,876,564
C-R-100-2	3,195,753,014	1,374,015,089	125,657,641	3,547,951,694	14,454,464,005	22,697,841,443

Color Code

No Action
Coastal Only
Nonstructural / Coastal
Structural / Coastal
Comprehensive (Struct + NS + Coastal)

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 3a Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 3a (PU3a-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-100	0	0	0	8,162,946,323	0	8,162,946,323
NS-400	0	0	0	11,110,215,643	0	11,110,215,643
NS-1000	0	0	0	12,177,675,030	0	12,177,675,030
C-M-100-1	29,265,349,174	4,070,730,861	870,596,088	657,949,906	0	34,864,626,030
C-M-100-2	26,652,831,028	4,148,424,353	749,308,373	725,174,323	0	32,275,738,077
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 3b Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 3b (PU3b-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-400	0	0	0	4,735,728,452	0	4,735,728,452
NS-1000	0	0	0	5,907,233,454	0	5,907,233,454
C-G-100-1	19,942,834,072	6,392,130,244	409,524,405	254,304,521	0	26,998,793,242
C-F-100-1	18,243,772,858	6,345,686,678	439,846,334	380,974,446	0	25,410,280,316
C-RL-100-1	15,233,606,634	5,472,707,431	167,662,430	899,569,382	0	21,773,545,878
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 4 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 1 (Low RSLR and Dispersed Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	2,234,247,141	0	2,234,247,141
NS-400	0	0	0	3,592,067,090	0	3,592,067,090
NS-1000	0	0	0	4,984,398,292	0	4,984,398,292
C-RL-100-1	2,499,996,449	1,565,996,906	15,696,057	1,987,786,667	0	6,069,476,080
C-RL-400-1	3,704,826,507	1,978,129,673	16,944,607	1,734,114,086	0	7,434,014,874
C-RL-1000-1	4,308,896,694	2,183,548,775	17,658,064	3,641,252,315	0	10,151,355,849
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						
Structural / Coastal						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 3a Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	8,162,946,323	0	8,162,946,323
NS-400	0	0	0	11,110,215,643	0	11,110,215,643
NS-1000	0	0	0	12,177,675,030	0	12,177,675,030
C-M-100-1	29,265,349,174	6,534,678,190	870,596,088	657,949,906	0	37,328,573,359
C-M-100-2	26,652,831,028	4,698,681,396	749,308,373	725,174,323	0	32,825,995,120
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 3b Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 3b (PU3b-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-400	0	0	0	4,735,728,452	0	4,735,728,452
NS-1000	0	0	0	5,907,233,454	0	5,907,233,454
C-G-100-1	19,942,834,072	6,507,761,960	409,524,405	254,304,521	0	27,114,424,958
C-F-100-1	18,243,772,858	6,519,464,953	439,846,334	380,974,446	0	25,584,058,591
C-RL-100-1	15,233,606,634	5,628,795,168	167,662,430	899,569,382	0	21,929,633,615
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 4 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 2 (High RSLR and Dispersed Population)

Planning Unit 4 (PU4-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-100	0	0	0	2,234,247,141	0	2,234,247,141
NS-400	0	0	0	3,592,067,090	0	3,592,067,090
NS-1000	0	0	0	4,984,398,292	0	4,984,398,292
C-RL-100-1	2,499,996,449	1,652,996,734	15,696,057	1,987,786,667	0	6,156,475,908
C-RL-400-1	3,704,826,507	2,088,025,766	16,944,607	1,734,114,086	0	7,543,910,966
C-RL-1000-1	4,308,896,694	2,304,857,040	17,658,064	3,641,252,315	0	10,272,664,114
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Fully Funded Cost - Planning Unit 3a Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	8,146,360,003	0	8,146,360,003
NS-400	0	0	0	10,954,076,640	0	10,954,076,640
NS-1000	0	0	0	12,445,615,854	0	12,445,615,854
C-M-100-1	29,265,349,174	4,070,730,861	870,596,088	649,367,527	0	34,856,043,651
C-M-100-2	26,652,831,028	4,148,424,353	749,308,373	718,773,836	0	32,269,337,590

Color Code

- No Action
- Nonstructural / Coastal
- Comprehensive (Struct + NS)

Fully Funded Cost - Planning Unit 3b Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 3b (PU3b-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-400	0	0	0	4,869,430,293	0	4,869,430,293
NS-1000	0	0	0	6,591,011,433	0	6,591,011,433
C-G-100-1	19,942,834,072	6,392,130,244	409,524,405	266,275,704	0	27,010,764,425
C-F-100-1	18,243,772,858	6,345,686,678	439,846,334	395,751,115	0	25,425,056,985
C-RL-100-1	15,233,606,634	5,472,707,431	167,662,430	945,994,401	0	21,819,970,897
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Fully Funded Cost - Planning Unit 4 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 3 (Low RSLR and Compact Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	2,236,696,774	0	2,236,696,774
NS-400	0	0	0	3,529,637,761	0	3,529,637,761
NS-1000	0	0	0	5,146,691,898	0	5,146,691,898
C-RL-100-1	2,499,996,449	1,565,996,906	15,696,057	1,997,296,858	0	6,078,986,270
C-RL-400-1	3,704,826,507	1,978,129,673	16,944,607	2,805,854,271	0	8,505,755,059
C-RL-1000-1	4,308,896,694	2,183,548,775	17,658,064	3,794,429,786	0	10,304,533,319
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 3a Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 3a (PU3a-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	8,146,360,003	0	8,146,360,003
NS-400	0	0	0	10,954,076,640	0	10,954,076,640
NS-1000	0	0	0	12,445,615,854	0	12,445,615,854
C-M-100-1	29,265,349,174	6,534,678,190	870,596,088	649,367,527	0	37,319,990,980
C-M-100-2	26,652,831,028	4,698,681,396	749,308,373	718,773,836	0	32,819,594,633
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 3b Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 3b (PU3b-)	**Structural Cost**	**Future Lift Cost** (Structural Measures)	**Mitigation Cost**	**Nonstructural Cost**	**Coastal Features Cost**	**Total Cost**
No Action	0	0	0	0	0	0
NS-400	0	0	0	4,869,430,293	0	4,869,430,293
NS-1000	0	0	0	6,591,011,433	0	6,591,011,433
C-G-100-1	19,942,834,072	6,507,761,960	409,524,405	266,275,704	0	27,126,396,141
C-F-100-1	18,243,772,858	6,519,464,953	439,846,334	395,751,115	0	25,598,835,260
C-RL-100-1	15,233,606,634	5,628,795,168	167,662,430	945,994,401	0	21,976,058,634
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						

Louisiana Coastal Protection and Restoration (LACPR)

Fully Funded Cost - Planning Unit 4 Alternatives
(Fully Funded Cost of all alternatives in final array)
Scenario 4 (High RSLR and Compact Population)

Planning Unit 4 (PU4-)	Structural Cost	Future Lift Cost (Structural Measures)	Mitigation Cost	Nonstructural Cost	Coastal Features Cost	Total Cost
No Action	0	0	0	0	0	0
NS-100	0	0	0	2,236,696,774	0	2,236,696,774
NS-400	0	0	0	3,529,637,761	0	3,529,637,761
NS-1000	0	0	0	5,146,691,898	0	5,146,691,898
C-RL-100-1	2,499,996,449	1,652,996,734	15,696,057	1,997,296,858	0	6,165,986,098
C-RL-400-1	3,704,826,507	2,088,025,766	16,944,607	2,805,854,271	0	8,615,651,152
C-RL-1000-1	4,308,896,694	2,304,857,040	17,658,064	3,794,429,786	0	10,425,841,584
Color Code						
No Action						
Nonstructural / Coastal						
Comprehensive (Struct + NS)						