Mississippi Valley Division, Regional Planning and Environment Division South

Reach A, Hurricane and Storm Damage Risk Reduction Project Morganza to the Gulf of Mexico, Terrebonne Parish, Louisiana

Draft
Appendix A –
Project Description

February 2024

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SECTION 1 INTRODUCTION

Reach A begins in southwest Houma approximately 0.5 miles southwest of the intersection of Highway 182 and Sportsman's Ct (Figure 1). It continues south to intersect with the Gulf Intercoastal Waterway (GIWW), and proceeds southeast, parallel with Highway 315. It terminates approximately 1.4 miles northwest of the town of Theriot. Figure 1 provides an overview of the authorized federal alignment. Summary tables for the major features are also provided at the end of this document.

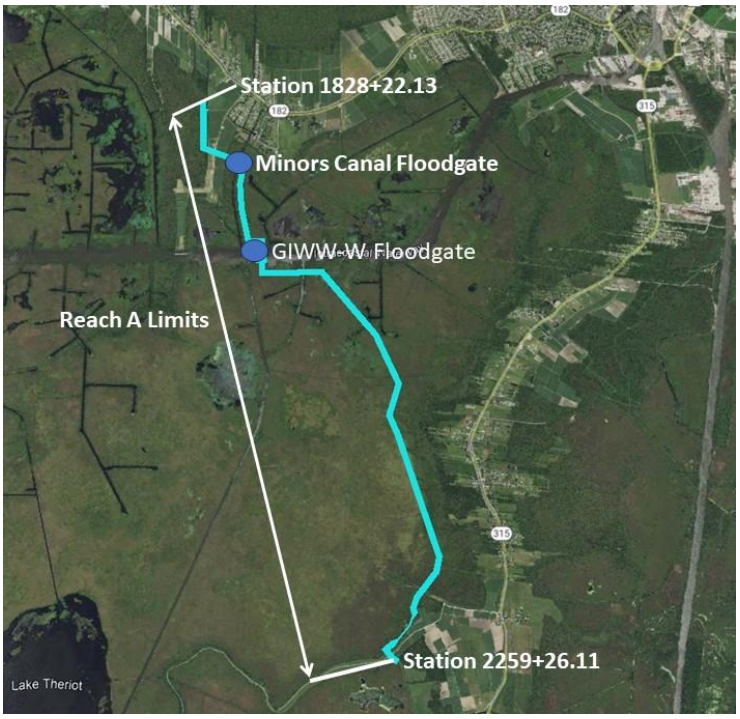


Figure 1. Limits of Reach A and Location of Floodgates

SECTION 2 IMPLEMENTATION SEQUENCE

Project construction is expected to take place in a series of sequential construction contracts, the first of which includes construction of a 6-foot levee embankment (less than the 2035 1% annual exceedance probability design height of elevation +12.5 feet) within the portion of Reach A between Station 3512+00.00 and 3684+00.00. All work included in this first construction contract is described below to a sufficiently detailed level of design to be fully assessed in this EA. This work is referred to herein as "constructible features". The remaining components of the project are considered "programmatic fea-

tures" and are described to a feasibility level of detail, such that additional NEPA analysis will be required prior to their construction. These programmatic features include all work for the entirety of the Reach A levee to the design height to meet the 2085 1% annual exceedance probability (AEP) requirement, including the GIWW-West and Minors Canal Floodgates.

After the construction of the Constructible Features, and completion of additional NEPA analysis, CEMVN anticipates the execution of a series of construction contracts to bring the entirety of Reach A to the 2035 1% annual exceedance probability elevation. This construction is anticipated to begin in 2029 and be complete in 2035. Levee lifts to bring Reach A up to the 2085 1% annual exceedance probability elevation is anticipated to occur around 2050 and 2070.

Construction of the Minors Canal floodgate is anticipated to begin in 2026 and be complete in 2029. Construction of the GIWW-West Floodgate is anticipated to begin in 2027 and be complete in 2031.

SECTION 3 LEVEE

The portion of the reach north of the GIWW includes 2.14 miles (11,318 linear feet) of earthen levee running north to south between Station 1828+22.13 at the beginning of the reach, located approximately 2,740 feet west-southwest of the intersection of Bayou Black Drive (Parish Road 182) and Sportsman's Court, to Station 1941+40.00 immediately north of the proposed West GIWW Gate. The levee would be constructed to a design elevation of 17.0 (which includes 0.5 foot of overbuild), a base width (levee toe to levee toe) of 265 feet, with 4:1 side slopes above the levee berm, and a crown width of 10 feet. Total permanent ROW for this portion of the reach would be 369 feet wide. The levee maintenance road will be located within this ROW beyond the protected side levee toe.

The levee would be constructed in multiple lifts with the first lift being constructed to elevation 6.0, the second lift bring the levee up to the 2035 design elevation of 12.5 (which includes 1.5 of overbuild). Future lifts will bring the levee up to the 2085 design elevation of 17.0 (which includes 0.5 foot of overbuild). During construction of the first lift, the foundation for the full levee section would be constructed. The foundation features a geofabric reinforced clay base.

South of the GIWW, the reach includes approximately 4.8 miles (25,345 linear feet) of earthen levee generally running north to south between Station 1941+40.00 immediately north of the West GIWW flood gate to Station 2259+26.11 located approximately 7,090 feet west-southwest of the intersection of Bayou Dularge Rd. (LA 315) and Seven Oaks Court. The levee would be constructed to a design elevation of 17.0 (which includes 0.5 foot of overbuild), a base width (levee toe to levee toe) of 265 feet, with 4:1 side slopes above the levee berm, and a crown width of 10 feet (Figure 3). Total permanent ROW for this portion of the reach would be 369 feet wide. The levee maintenance road will be located within this ROW beyond the protected side levee toe.

The levee would be constructed in multiple lifts with the first lift being constructed to elevation 6.0, the second lift bring the levee up to the 2035 design elevation of 12.5 (which includes 1.5 of overbuild), future lifts will bring the levee up to the 2085 design elevation of 17.0 (which includes 0.5 foot of overbuild). During construction of the first lift, the foundation for the full levee section would be constructed. The foundation features a geofabric reinforced clay base. This would be constructed in lifts with hauled borrow material then compacted. Geofabric would be installed when a suitable base is established then filled with additional lifts.

Figure 2 and Figure 3 provide a typical cross-section for the 2035 and 2085 design elevations, respectively. Figure 4 shows the dimensions of the levee maintenance road that would be constructed on the protected side of the levee near the toe of the levee berm.

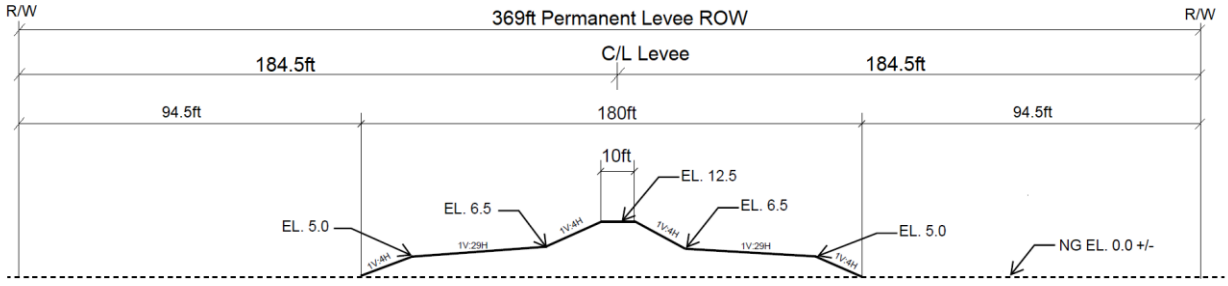


Figure 2. Typical levee section for 2035 design elevation

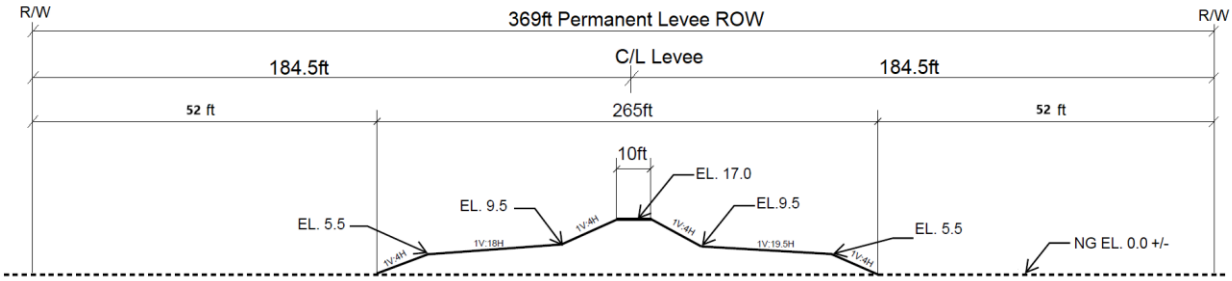


Figure 3. Typical levee section for 2085 design elevation

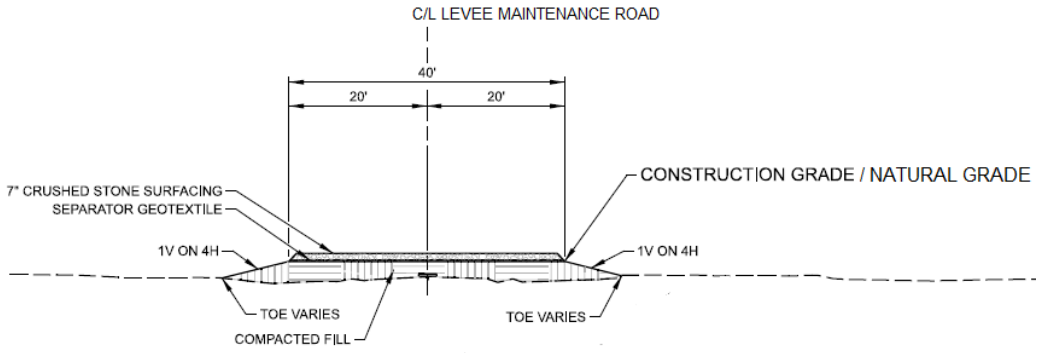


Figure 4. Typical levee maintenance road section

Table 1. Preliminary list of equipment for levee construction and estimated duration of construction

Project Component	Duration (days)	Equipment used
Reach A South of GIWW-2035 Elevation	1095	Dump Trucks
		Bull Dozers
Reach A North of GIWW-2035 Elevation	730	Fill Compactor
		Front End Loader / Back-hoe
Reach A South of GIWW-2085 Elevation	730	
		Fuel Tanks
Reach A North of GIWW-2085 Elevation	730	Construction Trailer
		Portable Chemical Toilets

3.1 CONSTRUCTIBLE FEATURES

Between Stations 3512+00.00 and 3684+00.00, the first lift would be constructed with a foundation for the full 2035 levee lift but would be built to elevation 6.0-ft within the areas outlined in white (with the levee centerline shown in orange) in Figure 5. The levee cross-section is shown in Figure 7. This would be constructed in lifts with hauled borrow material then compacted. Geofabric would be installed when a suitable base is established then filled with additional lifts.

Within the areas outlined in green, yellow, and light blue in Figure 5, no levee would be constructed at this time. Instead, within the green and light blue sections, temporary

roads would be built to allow construction equipment to move between levee construction segments (see Figure 6 for road details). These temporary roads would be 40 feet wide and constructed with compacted fill material placed to elevation 3 feet, topped with geotextile fabric and 7 inches of crushed stone.

Where canals intersect these temporary roads, culverts would be constructed under these temporary roads (locations shown as yellow pins in Figure 8) to allow water flow between the landside and floodside of the levee through existing canals. The northernmost culvert complex (Culvert 1) would be constructed with eight 48-inch diameter culverts. Moving south along the levee ROW, the next two culvert complexes (Culverts 2 and 3) would be constructed with four 48-inch diameter culverts, and the two southernmost culvert complexes (Culverts 4 and 5) would be constructed with three 48-inch diameter culverts.

Culverts would be constructed by excavation of the canal to allow placement of 12 inches of sand fill, geotextile fabric, and 12 inches of bedding material (rock), such that the culverts can be placed to match the invert of the existing ditch. Any material removed from the canal would be placed adjacent to the canal, within the levee ROW, spread to match the top of the embankment elevation, and seeded to prevent erosion. The road over the culverts would be built using compacted fill to meet the top of embankment elevation of 3 feet, geotextile fabric, and 7 inches of crushed stone (Figure 9).

Figure 8 shows also shows locations where existing canal spoil banks would be degraded to adjacent ground elevation within the levee ROW. These areas would be degraded to allow water within the canal to flow over canal banks rather than stack against the levee or culverts. Any material removed from these spoil banks would be spread within the levee ROW to match the constructed embankment elevation and would be seeded.

Figure 5. Limits of constructible Levee features

Within the area outlined in yellow in Figure 5, a timber mat bridge would be used to cross an existing pipeline corridor and allow construction equipment to reach the southernmost portion of the levee to be built (see Figure 10 for details regarding timber mat bridge).

Construction of these features would last approximately 730 days with an assumed work schedule of 7 days a week, from 0600 to 2100 and would utilize the same equipment listed in Table 1.

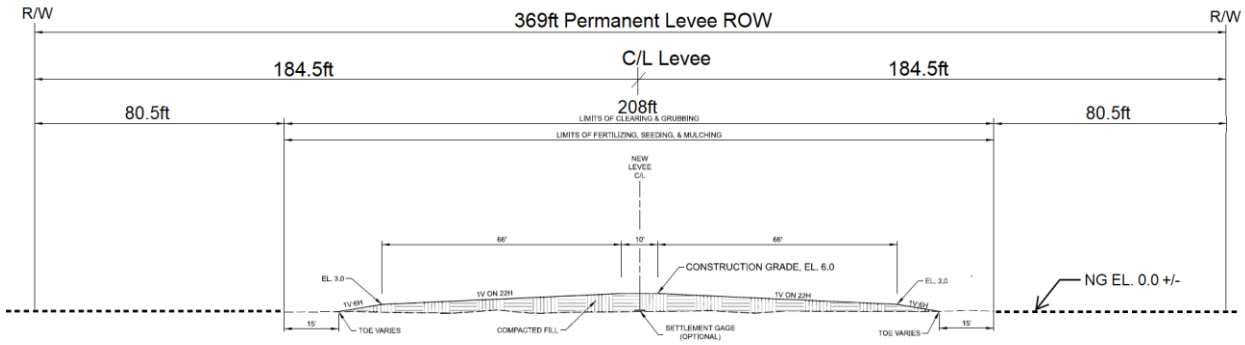


Figure 7. Typical cross-sectional dimensions for levee sections between Stations 3684+00.00 and 3552+00.00

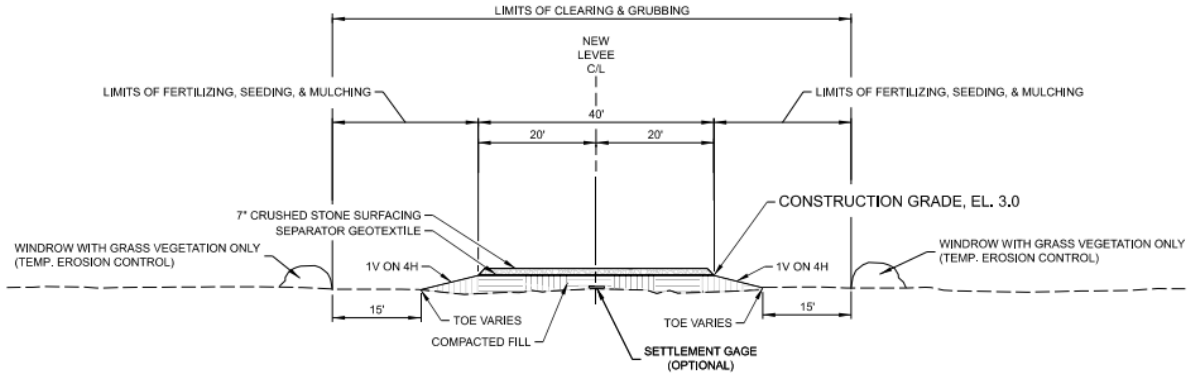


Figure 6. Typical cross-sectional dimensions for temporary roads between levee sections

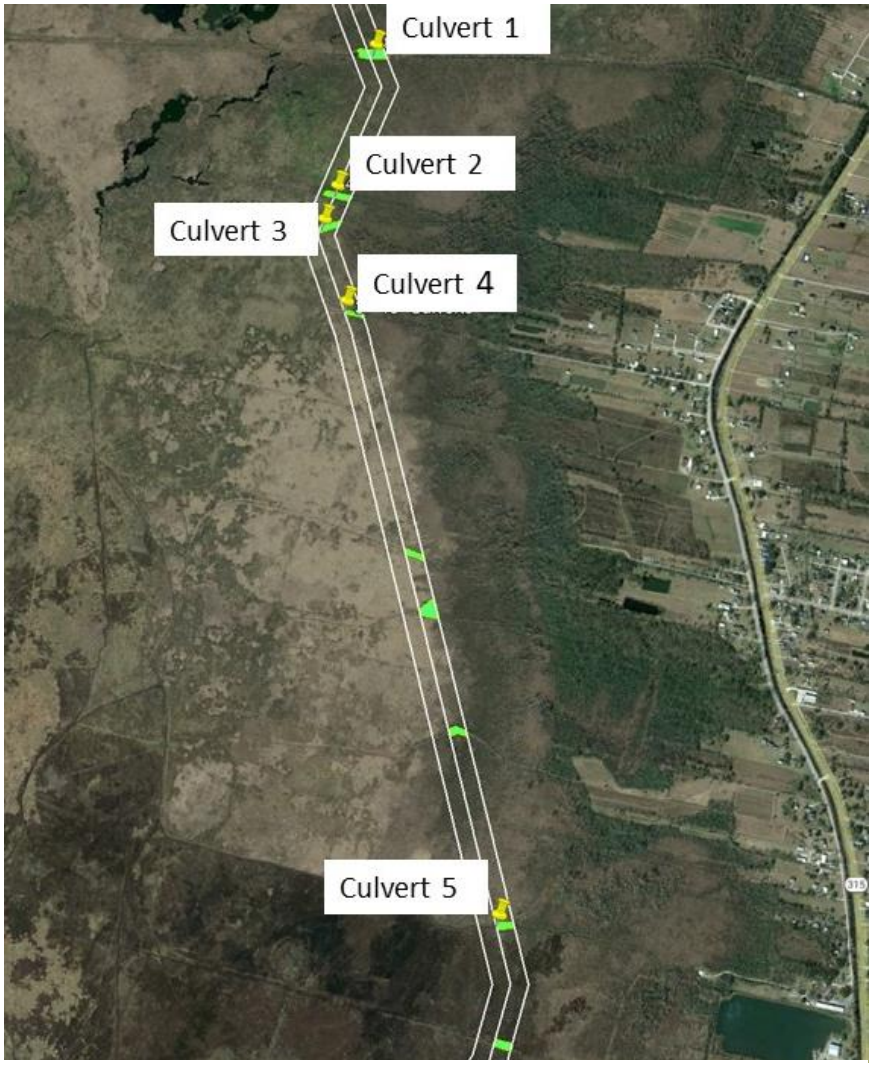


Figure 8. Areas of soil bank degradation (shown in green) and culvert placement (show with yellow pins)

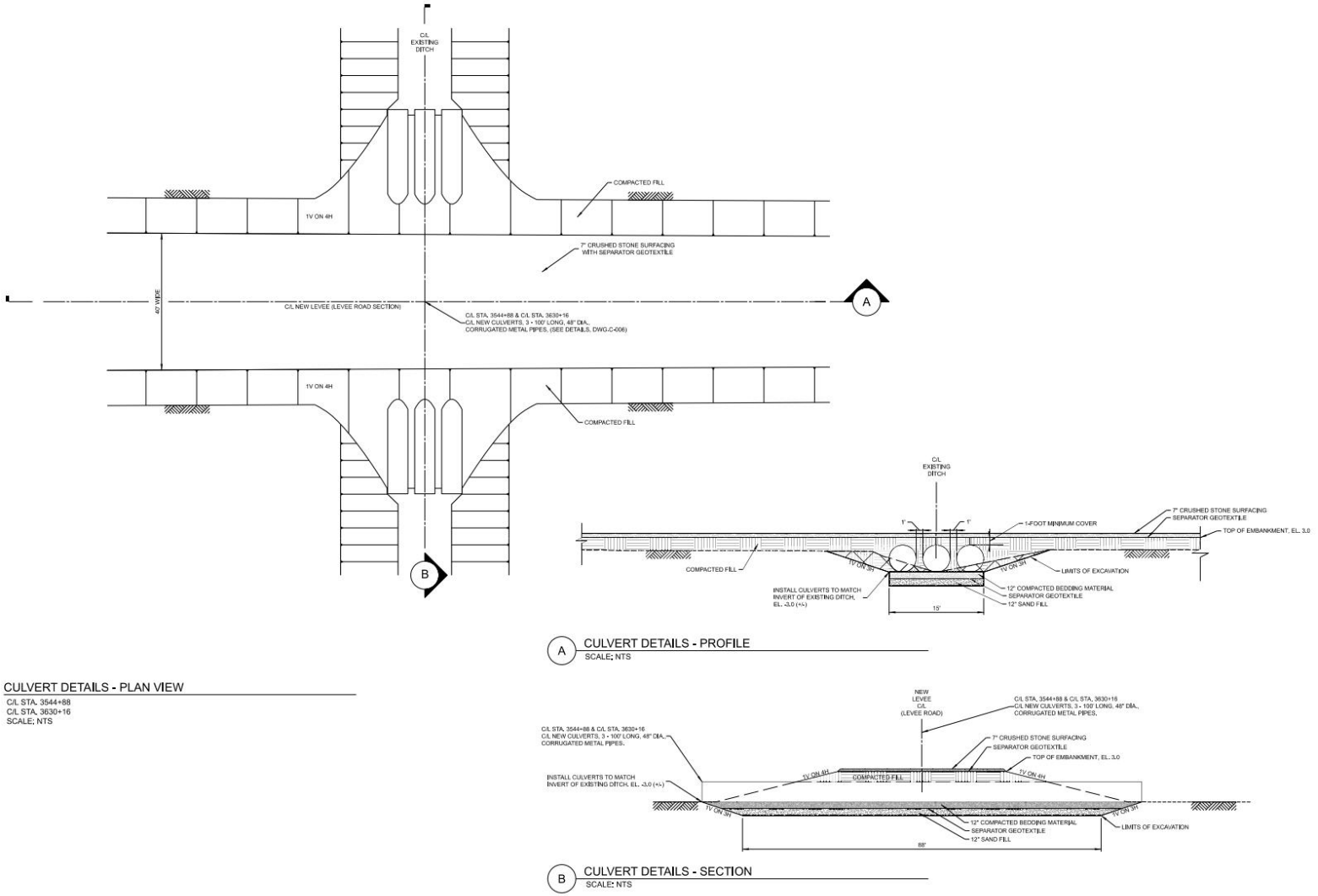
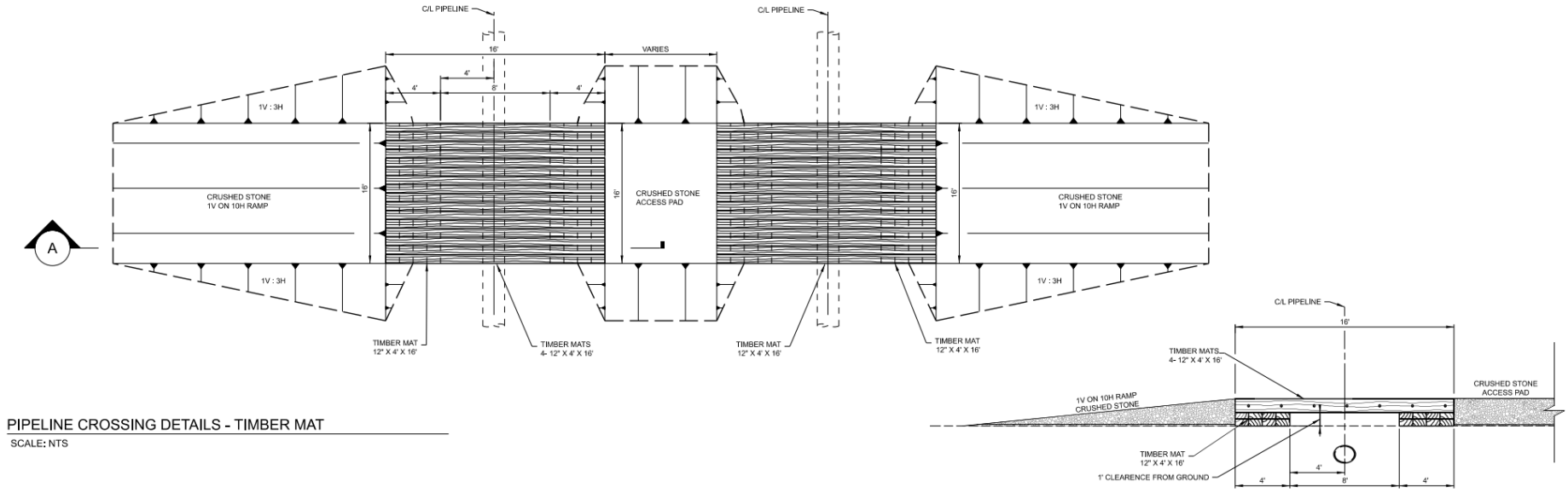


Figure 9. Plan view and cross-section of culverts and temporary roads at canal crossings



PIPELINE CROSSING DETAILS - TIMBER MAT
SCALE: NTS

Figure 10. Plan view and cross-section of timber mat crossing

3.1.1 Disposal of Debris

Material collected from clearing and grubbing of the levee Right of Way may be disposed of by either windrowing, burning, chipping, or removal from the site. Windrowing, burning, and chipping would occur within the Right of Way. Debris resulting from clearing and grubbing the borrow site would be buried in the borrow pit.

Vegetative debris, including grass, organic material, and brush trees, may be placed in windrows on the either the protected side or the flood side of the levee. The windrows would extend from right of way to 15' from levee toe not to exceed the levee height.

Vegetative debris may be collected into piles and burned within the Right of Way. Approximately 140 burns over the duration of the project would be anticipated, with approximately 4000 cubic yards of material per burn.

Cut timber, down timber, dead timber, branches, and brush may be chipped. Chipping operations may be conducted over the duration of the project. The chips would be deposited in windrows. Windrows would extend from the limit of right of way to 15' from the levee toe not to exceed the levee height. At the option of the Contractor, the chips may be either sold or spread over worksite areas as a dust preventive measure or may be used within the project area as a mulch for plantings. However, disposal by spreading shall be acceptable only in areas where the wood chips cannot be washed either into ditches, streams, or off the right-of-way by rainfall runoff.

3.2 BORROW, ACCESS ROADS, AND HAUL ROUTES

Figure 11 and Figure 12 show the location of the borrow pits which would be excavated for use in future construction of programmatic features, along with access routes to the construction ROW. To construct the portion of Reach A north of the GIWW to the 2035 design elevation, approximately 1,150,00 cubic yards of borrow material would be excavated from borrow sites NFS-A1 and A60. Approximately 520,000 cubic yards of borrow would be hauled via dump trucks to the levee site from A60 via the portion of Access Road 2 south of the levee ROW to construct the portion of the levee east of Minors Canal (Figure 11). Access Route No. 2 (36 feet wide requiring 60 feet of permanent ROW) would follow an existing route (Sportsman’s Ct.) for 5,500 feet north of the levee ROW and 3,745 feet south of the levee ROW. Access Route No. 1 would be approximately 20 feet wide (requiring 60 feet of ROW) by 4,560 feet in length and would utilize the northern section of an existing route (Rue De La Manson) and would be used to bring trucks and equipment from US Highway 90 to the levee ROW. The northern portion of Access Route 2 would also be used to bring trucks and equipment from US Highway 90 to the levee ROW. The portion of Access Road 1 which crosses wetland habitat would include installation of culverts under the road to allow unimpeded water flow. These culverts are estimated to be 24 inches in diameter and placed every 250 feet along the portion of road crossing wetland habitat. The size, spacing, and bottom elevation of these culverts would be such that natural pre-project flow conditions within the area would be maintained.

There would be two temporary 1.25-acre staging areas for equipment and construction trailers adjacent to Access Roads 1 and 2. The existing land for these staging areas is agricultural and approximately 6 inches of temporary stone would be placed to provide a dry area as needed within the staging area limits. Once the project is complete, the area would be restored to original conditions.

Borrow site NFS-A1 is located approximately 5.5 miles east of the project alignment parallel to the GIWW where 640,000 cubic yards of borrow would be barged in to construct the portion of the levee between Minors Canal and the GIWW. Borrow material would be hauled from the borrow pit via an internal haul road to an existing bulkhead where it would be loaded onto barges for transport to the levee ROW north of the GIWW and south of Minors Canal. An excavator would be used to unload borrow material from the barges and stockpile it within the project ROW.

To bring the portion of the reach south of the GIWW to the 2035 design elevation, approximately 2,378,000 cubic yards of borrow material would be excavated from borrow pits A82 and NFS-A1. A82 is located less than a mile from the southern end of the south Reach A alignment. Dump trucks would haul approximately 713,400 cubic yards of borrow from A82 to the levee using Access Road 4a (Figure 12). Borrow site NFS-A1 is located approximately 2.25 miles east of the project alignment on the GIWW. Approximately 832,300 cubic yards of borrow material would be delivered via barge to construct the northern section of the South Reach A Levee beginning at the GIWW. Approximately 832,300 cubic yards of borrow material would be hauled via truck from NFS-A1 via an internal haul road to Highway 315 South and Access Road 3 (Figure 12). Access Roads 3 and 4a would also be used to bring trucks and equipment to the levee ROW.

Cross-sections of access roads are shown in Figure 14 and Figure 13. Access Road 3 would include improvement of an existing 550 foot long and 15 ft wide road leading from Bayou Dularge Canal and construction of 3,430 feet of a new 40 ft wide road from the end of the existing road to the levee ROW. Access Road 4a would include improvement of 4,700 feet of an existing 24-foot wide road between Highway 315 and the Levee ROW. Improvement of existing roads would include placement of surfacing material such as 4 inches of crushed stone. Construction of the new access road would include placement of two feet of sand topped with geotextile fabric and 7 inches of crushed stone. Access Road 4b would be approximately 4,250 feet long with a ROW width of 24 feet, providing access to the southern end of the Reach A levee alignment via Access Road 4a and LA 315. The portion of Access Road 3 which crosses wetland habitat would include installation of culverts under the road to allow unimpeded water flow. These culverts are estimated to be 24 inches in diameter and placed every 250 feet along the portion of road crossing wetland habitat. The size, spacing, and bottom elevation of these culverts would be such that natural pre-project flow conditions within the area would be maintained.

There would be one staging area adjacent to Access Route 4a and would be 1.50 acres. The existing land is agricultural and approximately 6 inches of temporary stone would be placed to provide a dry area as needed within the staging area limits. Once the project is complete the area would be restored to original conditions. The staging

area would be used for construction equipment and construction trailers. Latitudes and longitudes for the corners of both staging areas is provided in Table 2.

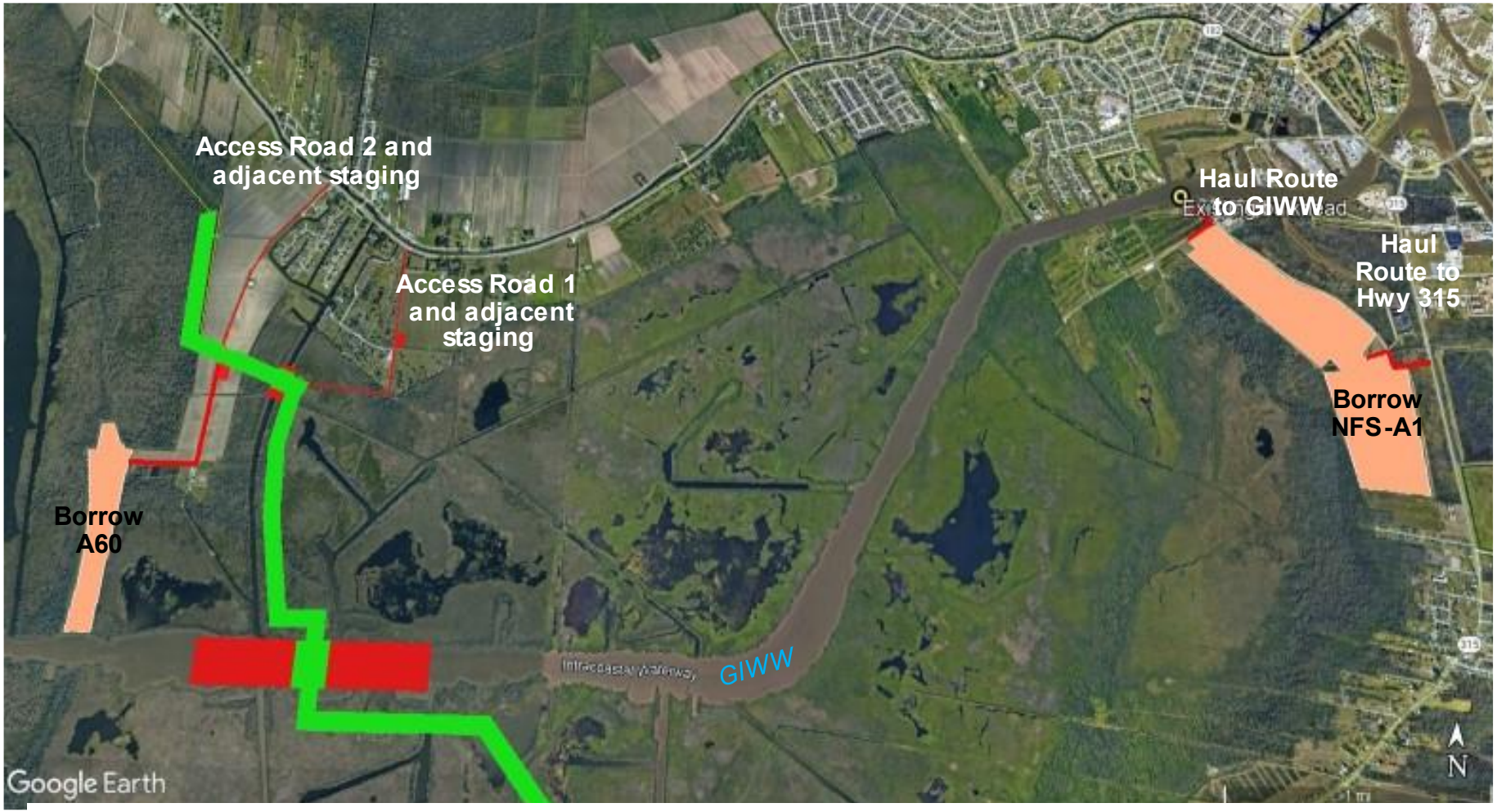


Figure 11. Borrow areas and access for Reach A North

Figure 12. Borrow areas and access for Reach A South. Note that some material would also come from NFS-A100 in Figure 15 via Hwy 315.

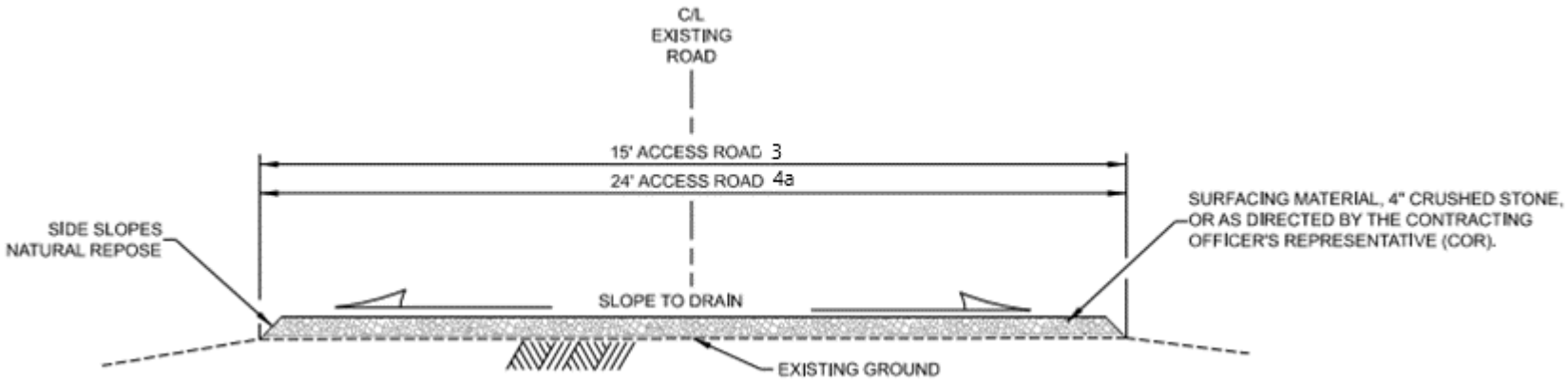


Figure 14. Cross-section of improvement of existing access roads

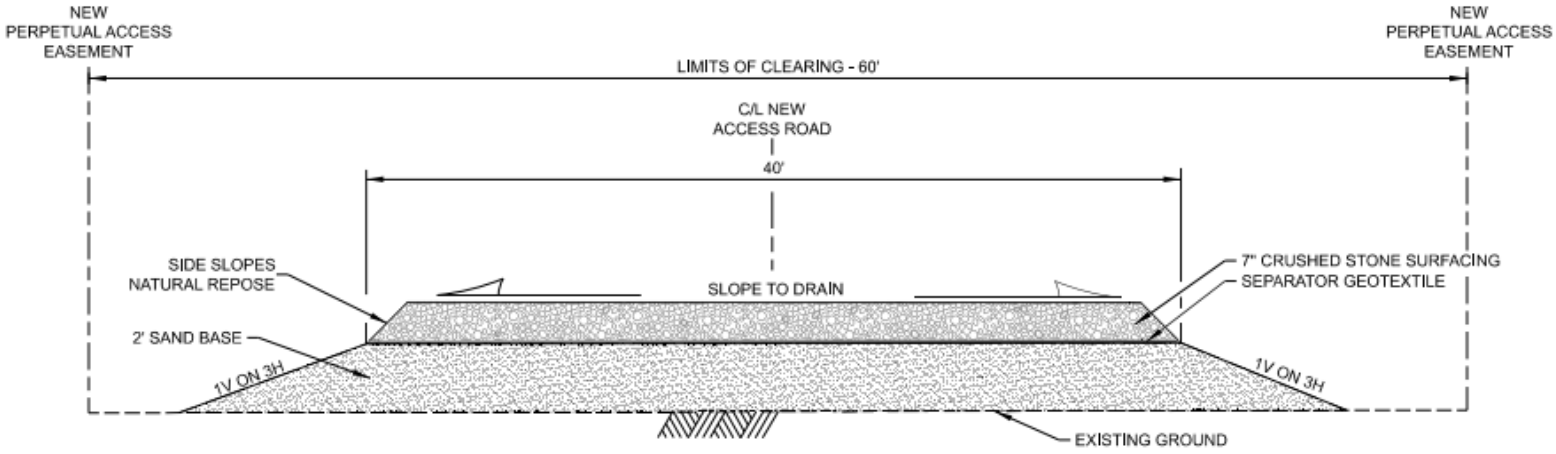


Figure 13. Cross-section of new access road

3.2.1 Constructible Features

Approximately 392,000 cubic yards of borrow material would be excavated from borrow pit NFS-A100 to build the constructible levee features described in Section 3.1. Dump trucks would haul approximately 196,000 cubic yards of borrow material using Access Road 4a (Figure 15), and another 196,000 cubic yards of borrow material using Access Road 4a to Hwy 315 North to Access Road 3. Access Road 4a would be improved as discussed in previous section. Access Road 4c would include improvement of approximately 1,900 feet of an existing 24-foot road by placement of surfacing material such as 4 inches of crushed stone.

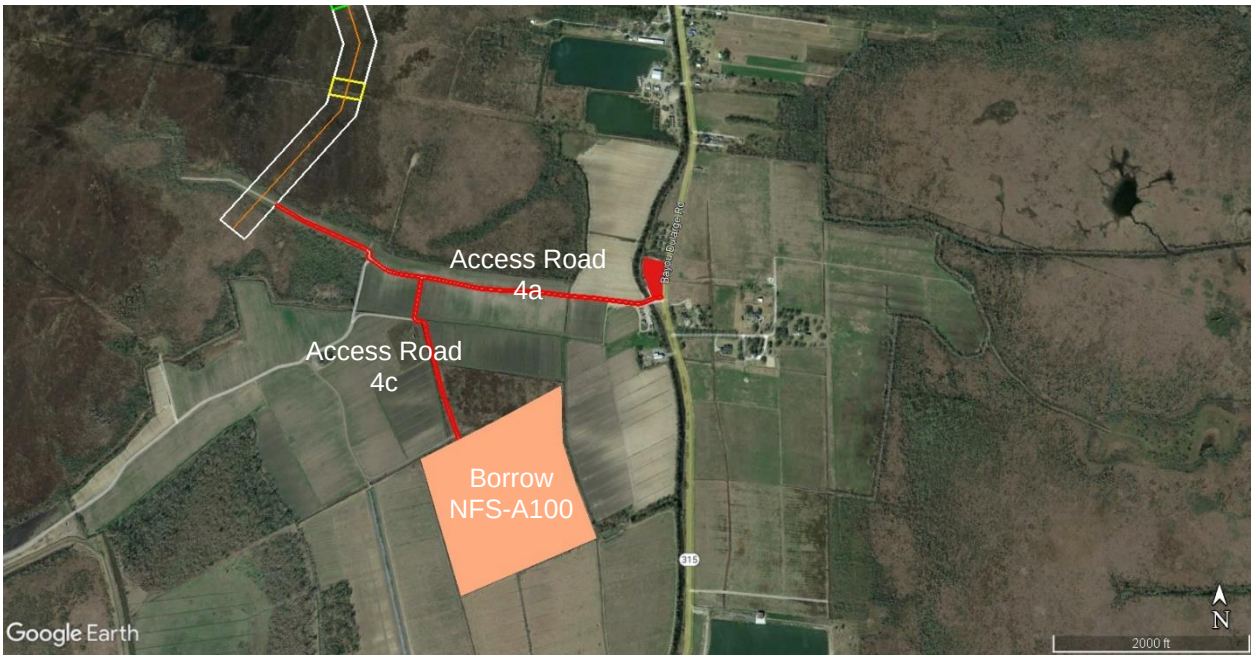


Figure 15. Borrow pit and access road for Constructible Features

Table 2. Latitude and longitude for location of staging areas

Staging Area 1	Staging Area 2	Staging Area 3	Staging Area 4
29°33'07.50"N 90°48'07.74"W	29°13'15.00"N 90°47'24.90"W	29°30'35.79"N 90°45'23.98"W	29°28'45.83"N 90°45'32.30"W
29°33'07.98"N 90°48'05.40"W	29°33'14.96"N 90°47'22.54"W	29°30'34.91"N 90°45'20.45"W	29°28'46.01"N 90°45'31.53"W
29°33'04.38"N 90°48'05.64"W	29°33'12.33"N 90°47'22.51"W	29°30'33.48"N 90°45'21.06"W	29°28'45.06"N 90°45'29.97"W
29°33'04.74"N 90°48'07.98"W	29°33'12.47"N 90°47'24.88"W	29°33'33.55"N 90°45'25.14"W	29°28'44.85"N 90°45'29.37"W

SECTION 4 STRUCTURES (ALL PROGRAMMATIC)

4.1 SOUTHERN END FLOODWALL

Although the majority of Reach A will be constructed using standard levee construction, the southern portion of the alignment contains both environmentally sensitive habitat and potential active petroleum wells. A floodwall will be constructed in this area to fit within the previously stated obstacles. The approximate length of the floodwall will be 1,160 feet. The T-wall will be constructed on pile foundations with concrete base slabs and stems to the 2085 elevation +16.5 feet (Figure 16). It is anticipated that this floodwall will be constructed at grade minimizing the requirement for any significant excavation. It is anticipated any required staging for this floodwall will be within the staging areas already defined for the levee construction. In addition, the access points being used to construct the levee will also be used to construct floodwall.

At both ends of the floodwall that ties into the typical levee section, six-inch concrete scour protection or grouted riprap would be used at the levee/T-wall transition. The concrete scour protection will wrap around the T-wall stem that extends into the full levee section and extend down both levee slopes. The scour protection will continue for a distance of 30 linear feet past the end of the T-wall. Uncapped cut-off sheet piling will extend horizontally 30 feet into the full levee section for erosion and seepage control (Figure 17).

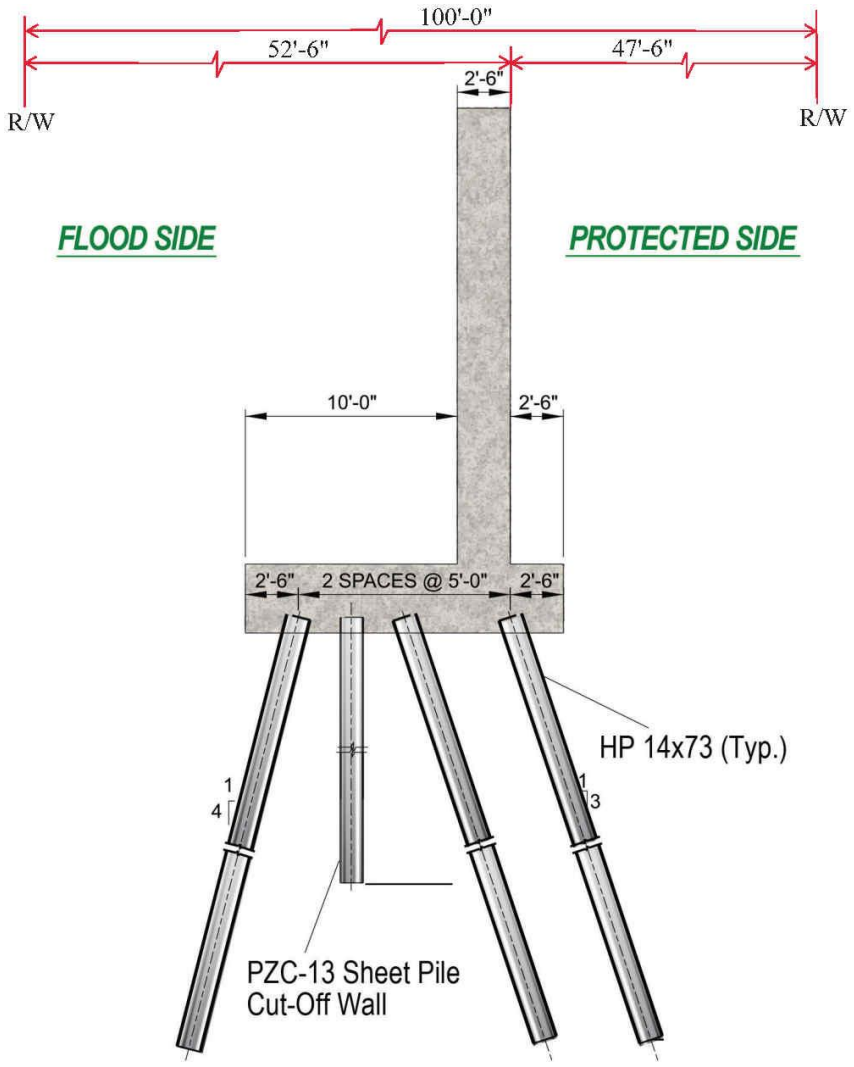


Figure 16. Southern End Floodwall Cross-section

Figure 17. Typical Scour Protection

4.2 GIWW-WEST FLOODGATE

The GIWW-West floodgate 225-foot-wide sector gate type of structure within the Reach A levee reach of the Morganza to the Gulf project approximately at the GIWW mile 48. A sector gate is a pie-slice structure that allows navigation to pass when the gate is in the open position within the gate bay recess of the structure. The floodgate would provide an opening in the system to allow unimpeded navigation, except when a tropical system approaches the Gulf of Mexico in which the gate would be closed. T-walls extend from the gate and tie into the adjacent levees with 650 total linear feet of T-walls. The floodwalls would have a top elevation of 16.5 NAVD88. Below is a sketch of a sector gate complex (Figure 18 - Figure 20).

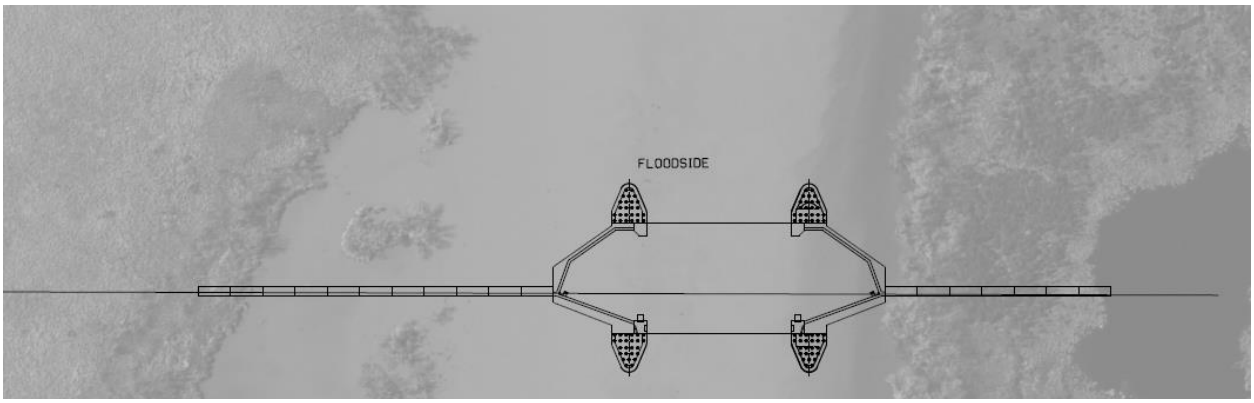


Figure 18. Conceptual sketch of sector gate complex

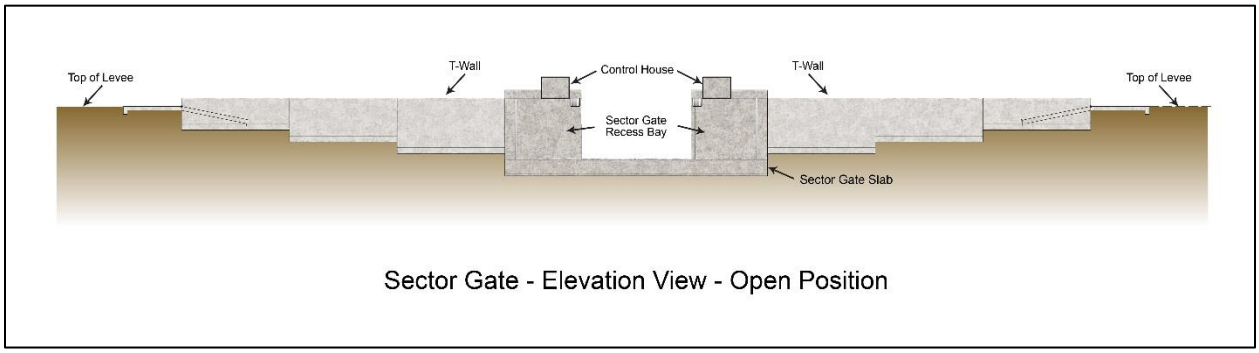


Figure 19. Sector Gate - Elevation View with Gate in Open Position

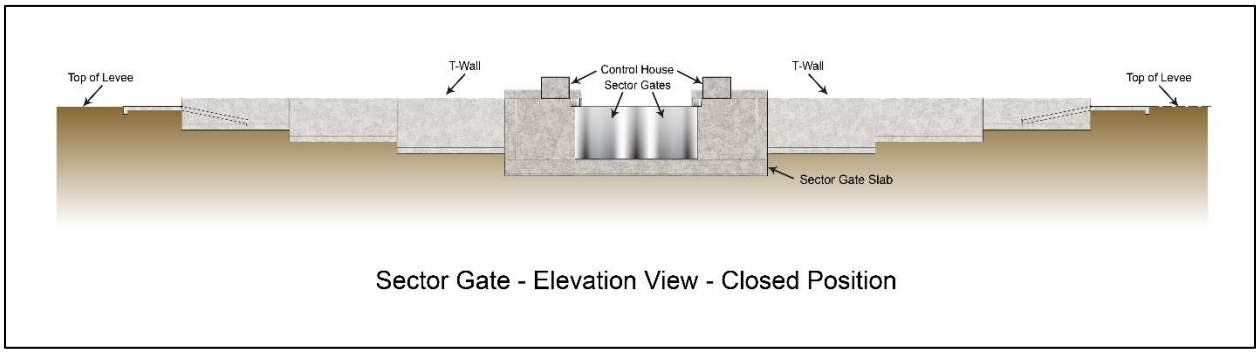


Figure 20. Sector Gate - Elevation View with Gate in Closed Position

Due to the opening of the gate, guide walls would not be required. However, bull nose dolphins would be placed at the entrance and exit of the gate to provide impact protection for navigation. A sketch of the bullnose dolphin is shown below (Figure 21).

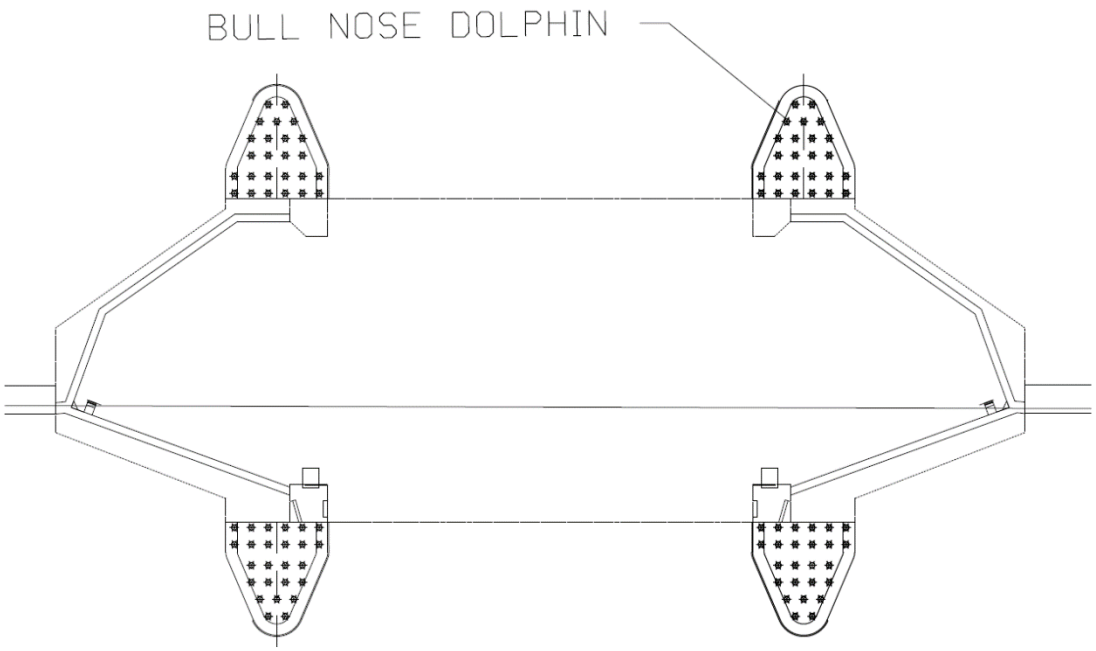


Figure 21. Bull nose dolphins

The sector gate would have a control house situated on the gate that would control the gate. The gate would be designed such that the individual gate bays would have the ability to be dewatered using needle girder beams and needle girders.

The T-wall monoliths vary with the tallest walls adjacent to the sector gate and the shortest walls that tie into the adjacent levee (Figure 22 - Figure 24, Table 3).

Six-inch concrete scour protection or grouted riprap would be used at the levee/ T-wall transition. The concrete scour protection the levee where the T-wall stem extends into the full levee section and extend down both levee slopes. The scour protection would continue for a distance of 30 linear feet past the end of the T-wall. Uncapped cut-off sheet piling would extend horizontally 30 feet into the full levee section for erosion and seepage control. See the sketches below for wall layout and cross-sections.

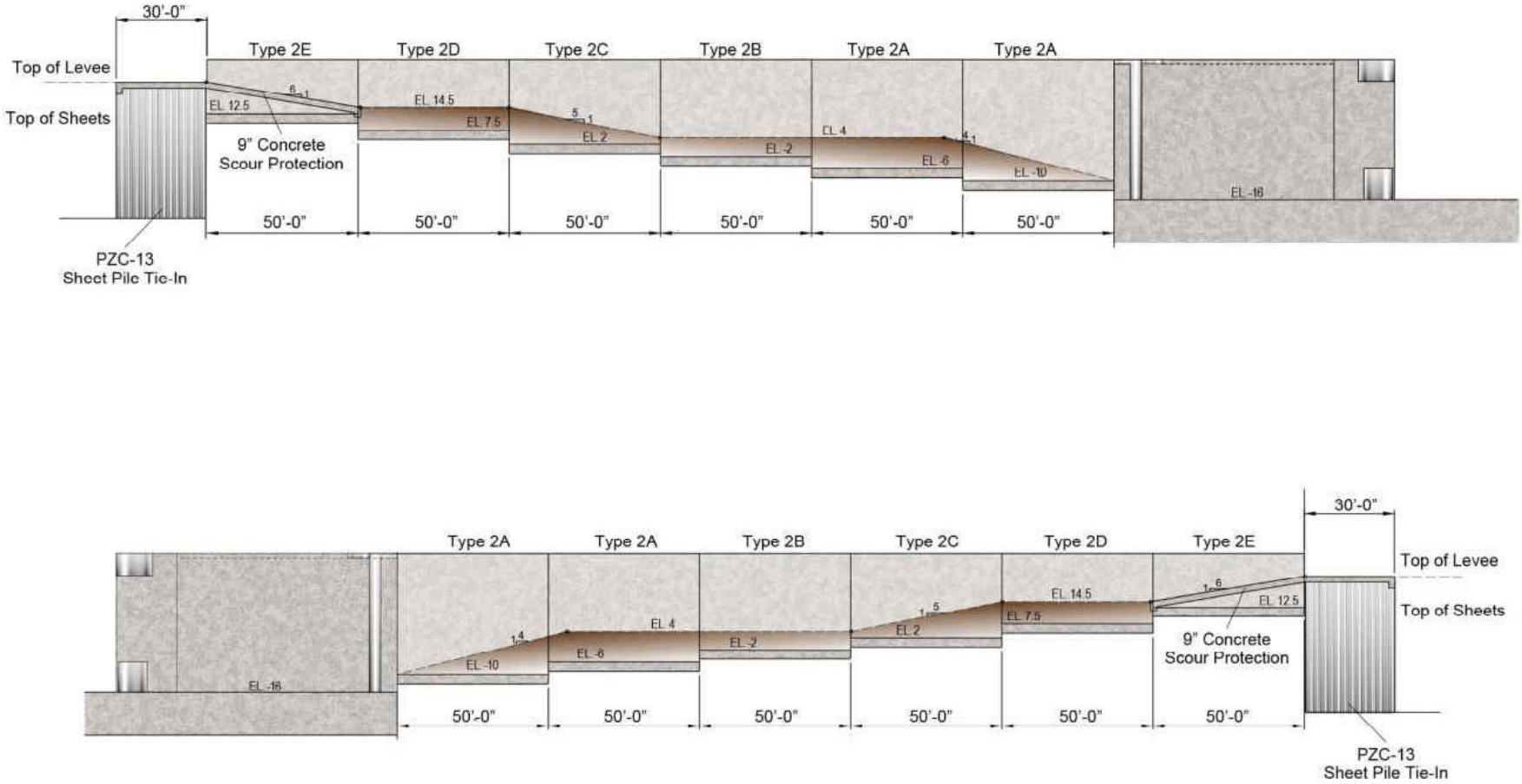


Figure 22. GIWW West Floodgate Tie-In Section

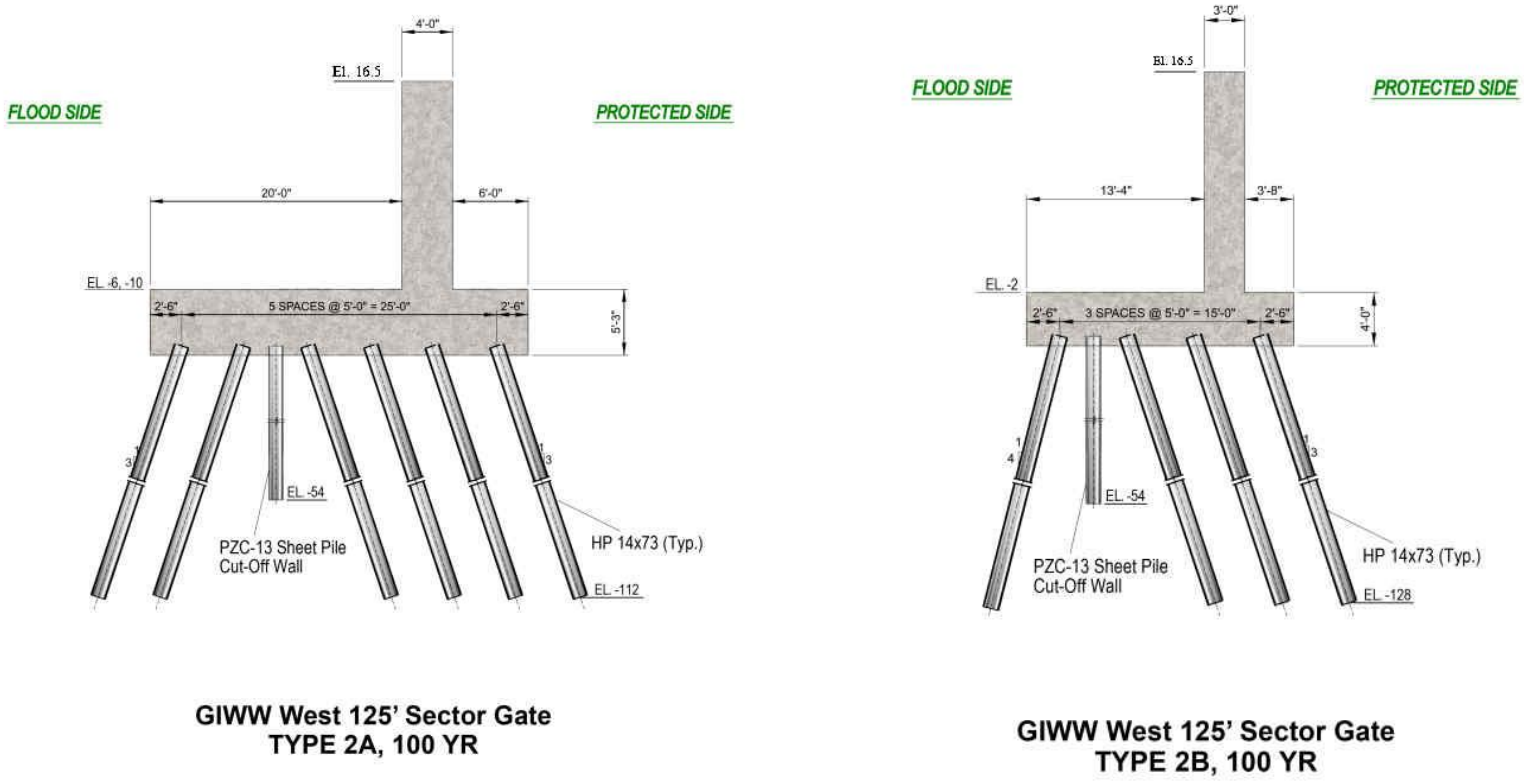


Figure 23. GIWW West Floodgate Floodwall tie-in details

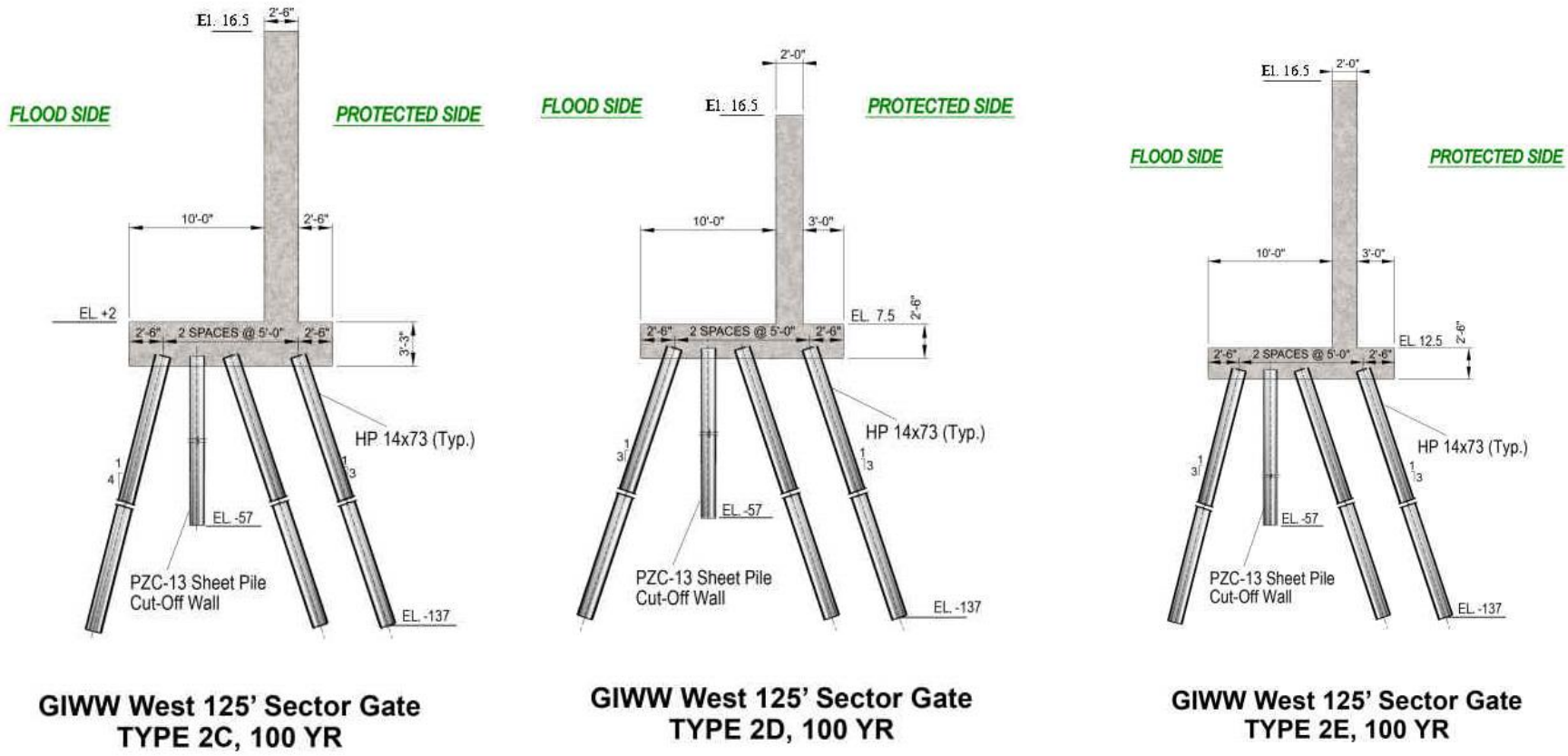


Figure 24. GIWW West Floodgate Floodwall tie-in details

Description of Floodwall Segment	Length of Floodwall Segment (ft)	Base of Slab BOS (ft)	Base of Wall BOW (ft)	Top of Wall TOW (ft)	Stem Height (ft)	Wall Thick (ft)	Slab Width (ft)	Number Of Piles Per Row
GIWW W Floodwall Tie-in Monoliths								
Type “A”	100	-15.25	-10.0	16.5	**26.5**	4	30.0	6
Type “A”	100	-11.25	-6.0	16.5	**22.5**	4	30.0	6
Type “B”	100	-6.0	-2.0	16.5	**18.5**	3.0	20.0	4
Type “C”	100	-1.25	2.0	16.5	**14.5**	2.5	15.0	3
Type “D”	100	5.0	7.5	16.5	**9.0**	2.0	15.0	3
Type “E”	100	10.0	12.5	16.0	**3.5**	2.0	15	3

Table 3. Floodwall Tie-in Details

The design of the new T-wall including the foundation is subject to change once detailed geotechnical investigations are conducted during PED.

The existing centerline of the GIWW has an approximate elevation of -16. The structure would match the invert of the existing channel. The channel width, directly upstream and downstream of the gate would be excavated to a width of 225’. The average cross-sectional flow area would be limited at the floodgate area to the width of the floodgate opening. The induced velocities around and through the gate would require the channel bottom to be layered with riprap. The channel 24” of riprap would be required on both the land and floodside of the floodgate, approximately 150 linear feet on each This riprap would be placed on separator. A riprap gradation is assumed to be class 250 - 1000 lb class stone LADOTD 2006 (Table 4). Gradation shall meet specifications for 250lb class stone, according to LADOTD 2016, Section 711

Table 4. Riprap gradations

Gradation Limits Individual Stone Size (lbs)	Spherical Diameter (ft)	Percent Finer (by Weight)
1250	2.5	100
500	1.83	45-100
250	1.46	15-50
80	1.00	0-15

It is assumed that minimal material would be removed from the channel. Only the material required to construct the structure foundation would be excavated and it is assumed this material would not be suitable for use in the project. The material would be hauled off site and disposed of in accordance with all state and federal laws.

The construction duration of the individual sector gate would be 24 months with an assumed work schedule of 5 days a week, 8 hours a day. The sector gate would be constructed using both floating equipment with a combination of land support. Below is the preliminary list of equipment anticipated to be utilized in the construction of the GIWW Floodgate (Table 5). The sector gate structure gate bays would be constructed in the dry within a cofferdam leaving a minimum of 160’ clear opening to allow for continuous navigation during the construction of the gate bays (Figure 25).

Table 5. Preliminary list of equipment for sector gate and floodwall construction

Project Component	Duration (days)	Equipment Used
Sector Gate Complex & Tie-in Floodwall	1460	150-Ton Crane
		80-Ton Crane
		Excavator
		Pile Driver
		Concrete Trucks
		Concrete Vibrators
		Welding Machine, Cutting Torch
Tie-in Levee		Dump Trucks
		Bull Dozers
		Fill Compactor
		Front End Loaded/Back-hoe
		Fuel Tanks
		Generator

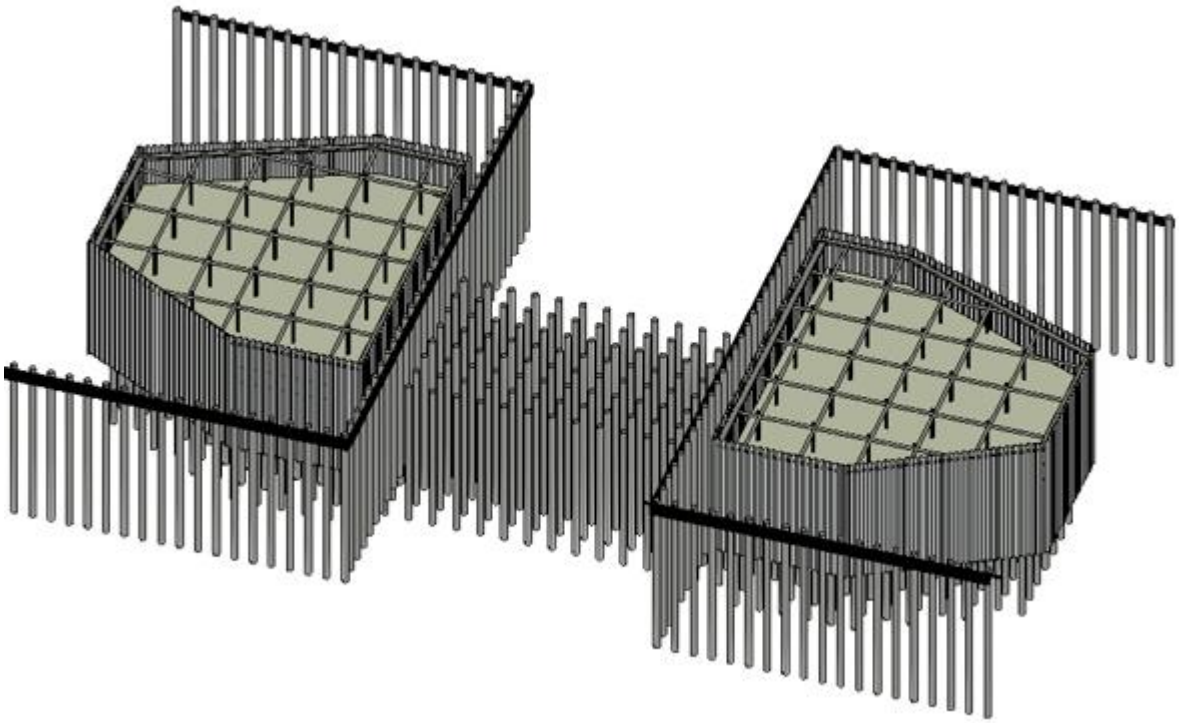


Figure 25. Cofferdams for sector gate bay construction

Reduced power may be required for vessels passing through the construction area to reduce the risk of impact to the cofferdam. Steel pipe piles would be provided along the cofferdam to minimize potential vessel impact on the cofferdam. The center slab would be constructed completely in the wet. Piles would be driven to grade with a follower to design grade. The center slab may be floated in place, lifted in place or cast in the wet.

A Phase 2 cofferdam would be required for the T-walls adjacent to the sector gate/sluice gate structures. Once navigation is re-routed, the Phase 2 cofferdam, needle girder storage platform, permanent guidewalls, end cell dolphins, tie-in T-walls and final civil site work can be completed.

All construction site access for the sector gate complex would be water base equipment using the GIWW to access the site. It is assumed the staging for this contract would be floating barges. There is no significant land to construct an at grade staging area.

4.3 MINORS CANAL FLOODGATE

This floodgate would be a 56-foot wide barge type floodgate gate with a top elevation of 16.5 NAVD88, and a slab invert elevation of -9.0 NAVD88. The floodgate would provide an opening in the system to allow unimpeded navigation, except when a tropical system

approaches the Gulf of Mexico in which the gate would be closed. T-walls extend from the gate and tie into the adjacent levees with 510 total linear feet of T-walls (255 linear feet on either side of the floodgate). The floodwalls would have a top elevation of 16.5 NAVD88.

A barge gate is a gate constructed in the shape of a barge and would consist of various structural shapes and plates in a hollow box configuration. See Figure 26 for an example barge gate. See Figure 27 and Figure 28 for conceptual gate cross-sections.

Figure 26. Barge Gate Example

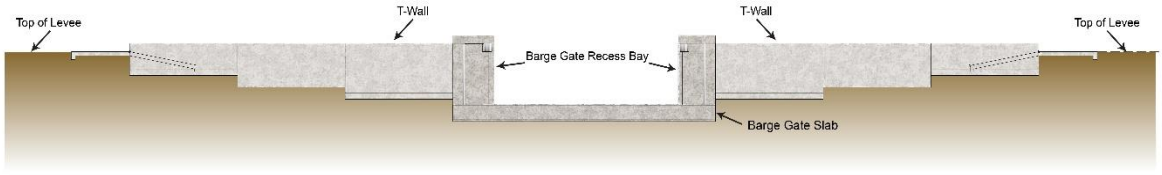


Figure 27. Barge Gate - Elevation View with Gate in Open Position

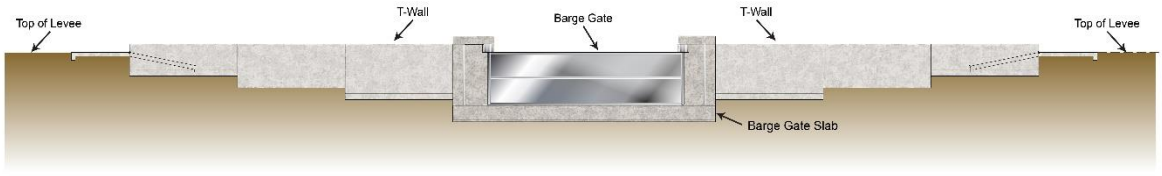


Figure 28. Barge Gate - Elevation View with Gate in Closed Position

Timber guide walls and pile clusters would be provided as aids to navigation and to protect the main flood gate structure from impact. The dimensions of the guide walls and fendering system are provided below (Figure 29).

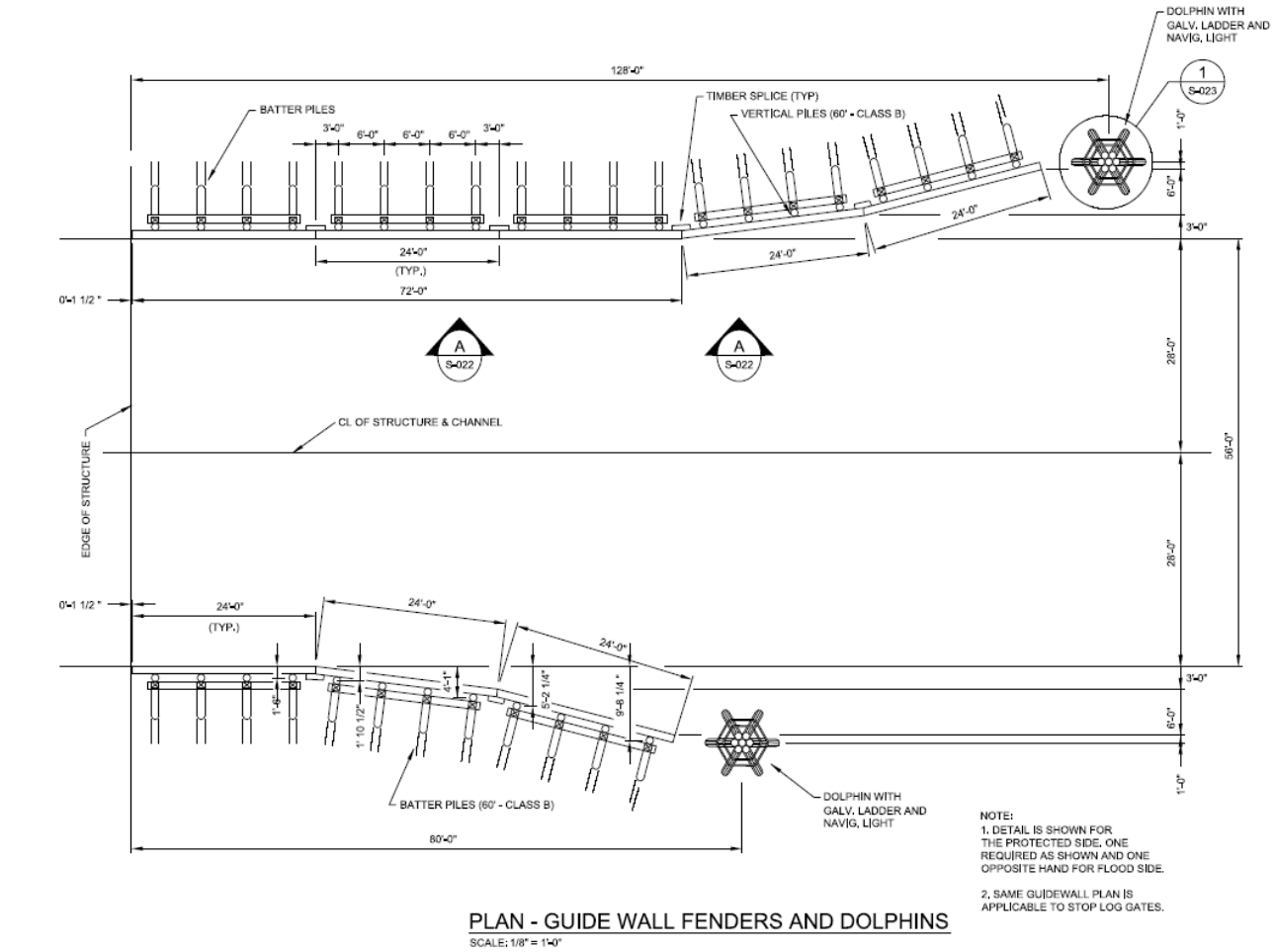


Figure 29. Guide wall fenders and dolphins

The design of the new barge gate including the foundation is subject to change once detailed geotechnical investigations are conducted during detailed design.

The T-wall monoliths vary with the tallest walls adjacent to the barge gate and the shortest walls that tie into the adjacent levee (Figure 30 - Figure 32). Table 6 provides details on the various sections of floodwall.

Six-inch concrete scour protection or grouted riprap would be used at the levee/ T-wall transition. The concrete scour protection the levee where the T-wall stem extends into the full levee section and extend down both levee slopes. The scour protection would continue for a distance of 30 linear feet past the end of the T-wall. Uncapped cut-off sheet piling would extend horizontally 30 feet into the full levee section for erosion and seepage control. See the sketches below for wall layout and cross-sections.

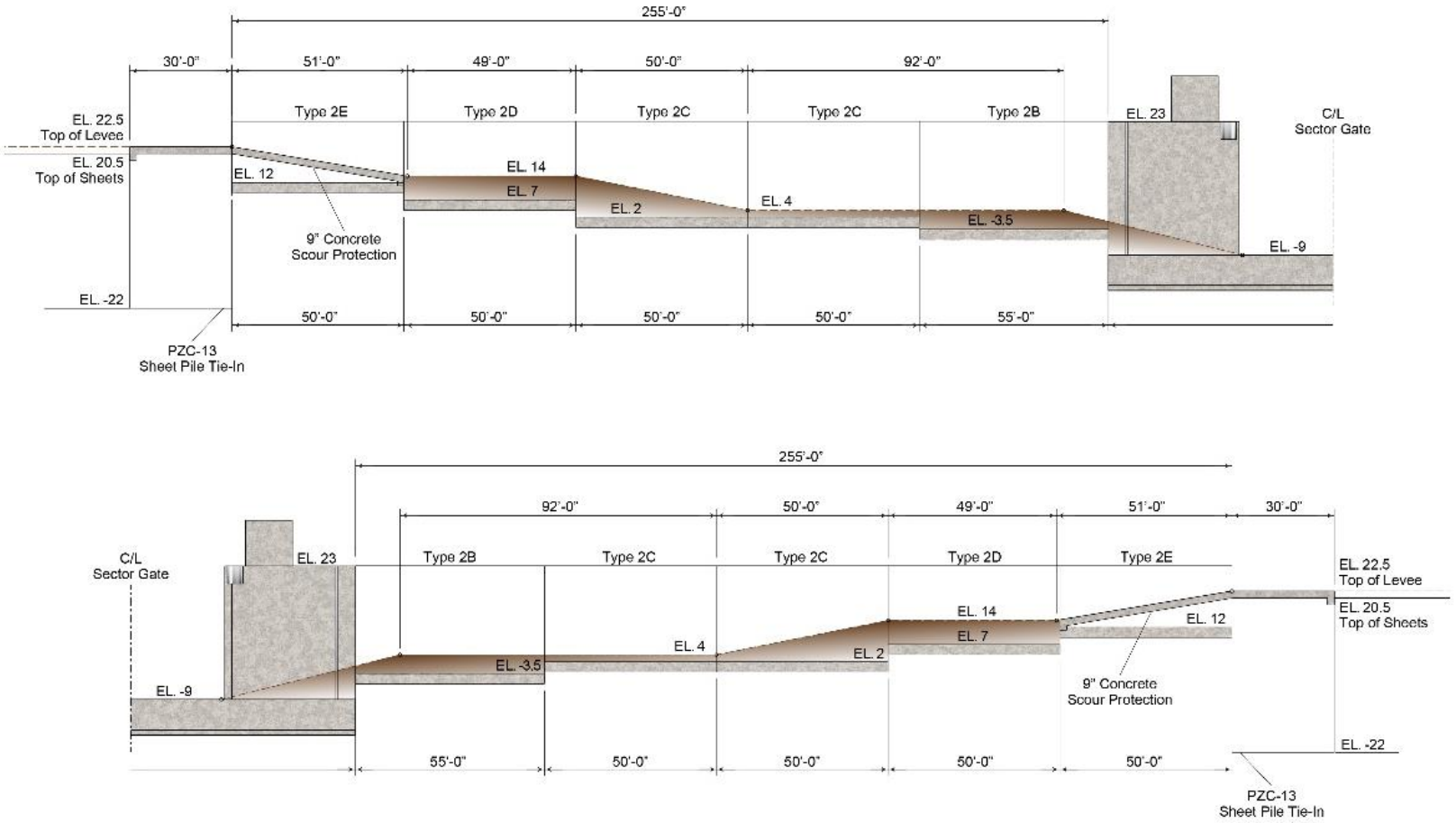


Figure 30. Minors Canal Barge Gate Floodwall Tie-ins

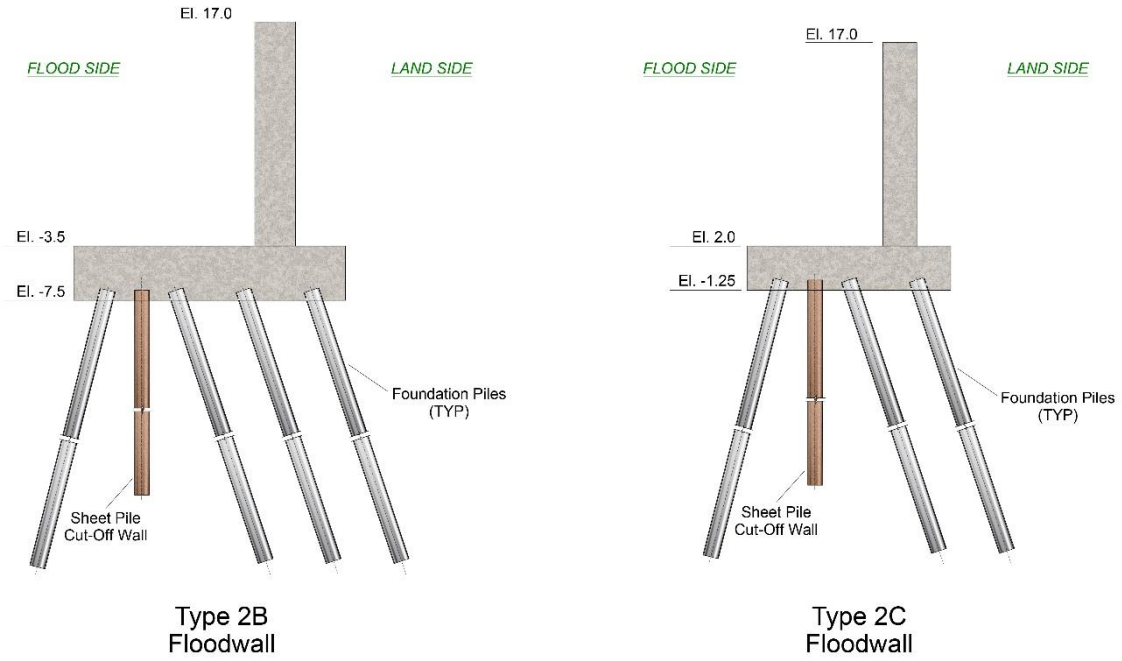


Figure 31. Minors Canal Barge Gate Floodwall Tie-ins

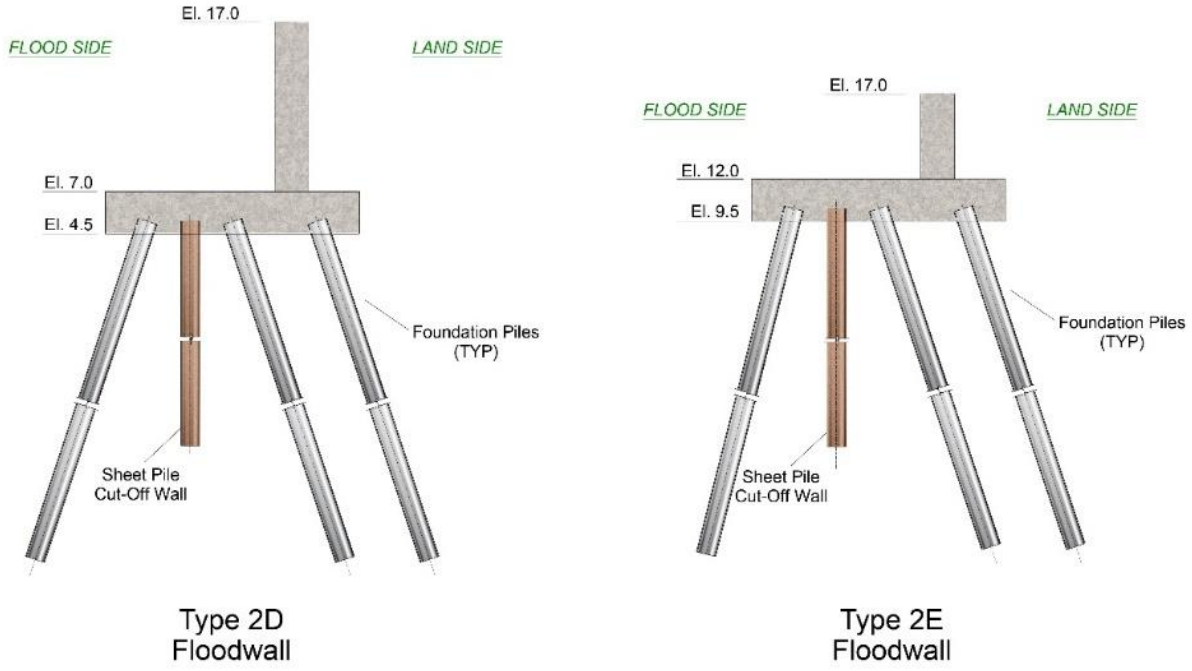


Figure 32. Minors Canal Barge Gate Floodwall Tie-ins

Table 6. Floodwall Tie-in Details

Description of Floodwall Segment	Length of Floodwall Segment (ft)	Base of Slab BOS (ft)	Base of Wall BOW (ft)	Top of Wall TOW (ft)	Stem Height (ft)	Wall Thick (ft)	Slab Width (ft)	Number Of Piles Per Row
Minors Canal Floodwall Tie-in Monoliths								
Type “B”	110	-7.5	-3.5	16.5	20.0	2.0	20.0	4
Type “C”	200	-1.25	2.0	16.5	14.5	2.0	15.0	3
Type “D”	100	4.5	7.0	16.5	9.5	2.0	15.0	3
Type “E”	100	9.5	12.0	16.5	4.5	2.0	15.0	3

The design of the new T-wall including the foundation is subject to change once detailed geotechnical investigations are conducted during PED.

The existing centerline of the Minors Canal has an approximate elevation of -5.5. The channel would be excavated to an elevation of -9.0 for the width of the gate (56 feet). The channel bottom would remain at elevation -9.0 for approximately 50’, both upstream and downstream of the newly constructed floodgate slab. The channel would then slope up to existing grade over a distance of approximately 100’ on both the land and flood side of the gate. The channel width, directly upstream and downstream of the barge gate would be excavated width ranging between 80’ to 125’. The average cross-sectional flow area would be limited at the floodgate area to the width of the floodgate opening. The induced velocities around and through the gate would require the channel bottom to be layered with riprap. The channel 24” of riprap is required on both the land and floodside of the floodgate, approximately 150 linear feet on each side. This riprap would be placed on separator geotextile that would be placed after dredging the channel to El. -12.0. A riprap gradation is assumed to be class 250 - 1000 lb stone (LADOTD 2016, Section 711). See Table 4 for example gradation limits for individual stone. Gradation shall meet specifications for 250lb class stone, according to LADOTD 2016, Section 711.

If the dredged material is found to be suitable to be used within the project levee footprint, the material would be used within the levee or used to create marsh within the overall project footprint, otherwise the material would be hauled off site and disposed in accordance with all state and federal laws.

The construction duration of the Minors Canal Floodgate would be 24 months with an assumed work schedule of 5 days a week, 8 hours a day. The barge floodgate would be constructed using both floating equipment with a combination of land support. Below is the preliminary list of equipment anticipated to be utilized in the construction of the Minors Canal Floodgate (Table 7).

All barge gates would be constructed approximately in the center of the existing channels. A minimum bottom channel width of 60-foot temporary bypass channel with an invert of El. -9.0 would be constructed as the first order of construction, allowing navigation passage during construction. See Figure 33 for a sketch of the bypass channel.

Table 7. Preliminary list of equipment for sector gate and floodwall construction

Project Component	Duration (days)	Equipment Used
Barge Gate Complex & Tie-in Floodwall	1095	150-Ton Crane
		80-Ton Crane
		Excavator
		Pile Driver
		Concrete Trucks
		Concrete Vibrators
		Welding Machine, Cutting Torch
Tie-in Levee		Dump Trucks
		Bull Dozers
		Fill Compactor
		Front End Loaded/Backhoe
		Fuel Tanks
		Generator

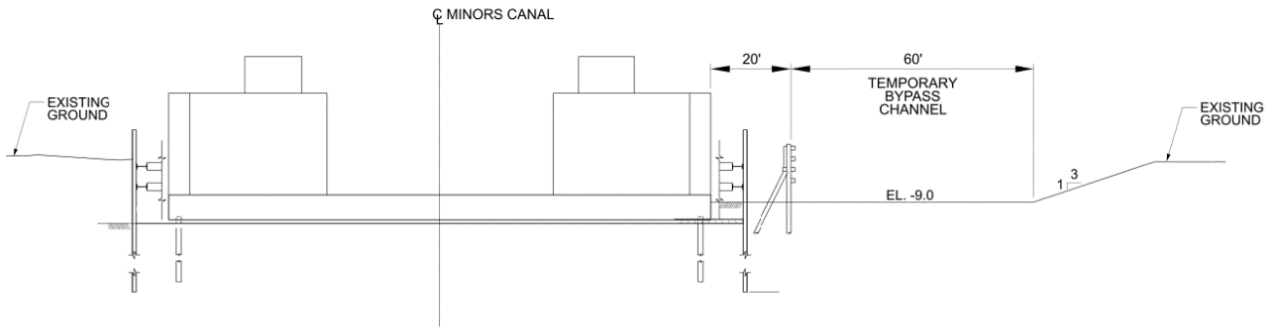


Figure 33. Bypass Channel Cross-Section

Once navigation is routed through the temporary bypass channel, a cofferdam would be constructed, permitting the construction of the 56-foot barge gate landing slab, receiving structure monoliths. Reduced power would be required for vessels passing through the construction area to reduce the risk of impact to the cofferdam. A timber guidewall and pile clusters would be provided along the bypass channel to prevent vessel impact on the cofferdam. Once construction of the 56-foot barge gate landing slab, pivot arm assembly, receiving structure monoliths, and sluice gate monoliths is completed, navigation would be re-routed through the permanent barge gate structure. A Phase 2 cofferdam would be required for the T-walls adjacent to the barge gate/sluice gate structures. Once navigation is re-routed, the Phase 2 cofferdam, permanent guidewalls and pile clusters, tie-in T-walls and final civil site work can be completed.

A Phase 1 cofferdam would be constructed to permit the in the dry construction of the barge gate concrete landing slab, pivot arm assembly, receiving structure concrete monoliths, and the sluice gate concrete monolith (if applicable). The cofferdam would be an internally braced cofferdam with wide flange walers and pipe braces supporting PZ sheet piling. A Phase 2 cofferdam would be constructed to permit the construction of the adjacent T-walls to the barge gate/sluice gate structures that would be in the water. The same anchor forces, moments, and tips used for the Phase cofferdams would be conservatively used for the Phase 2 cofferdams.

In general, construction site access would be obtained by both barge and land. Vehicle access would be via Highway 182 onto Sportsman Ct (local farm road) with access to an existing farm levee. Once adjacent to the floodgate, a new temporary 30’ crushed stone access road would be constructed thru the farmland to be acquired for the project. Upon completion of the construction of the floodgate, the access road would be restored to pre-construction condition. Upon completion of the tie-in levees, the 30-foot permeant access road would be constructed along the land side of the stability berm. The temporary and permeant access road would be within the temporary and permanent ROW required for the levee construction. The access road would be constructed of crush stone

material on a sand base. There would be a separator geotextile fabric separating the existing ground and the sand base.

Access Roads 1 and 2, as well as the GIWW and Minors Canal would be used to access the construction site (Figure 11).

The construction staging area would be a 300’ x 300’ along the bank of the Minors Canal. The staging area would have a crushed stone on top of a separator fabric (Figure 34). As this staging area is within wetlands, future design efforts for this programmatic feature would investigate relocation of the staging area to minimize and avoid impacts to wetlands.

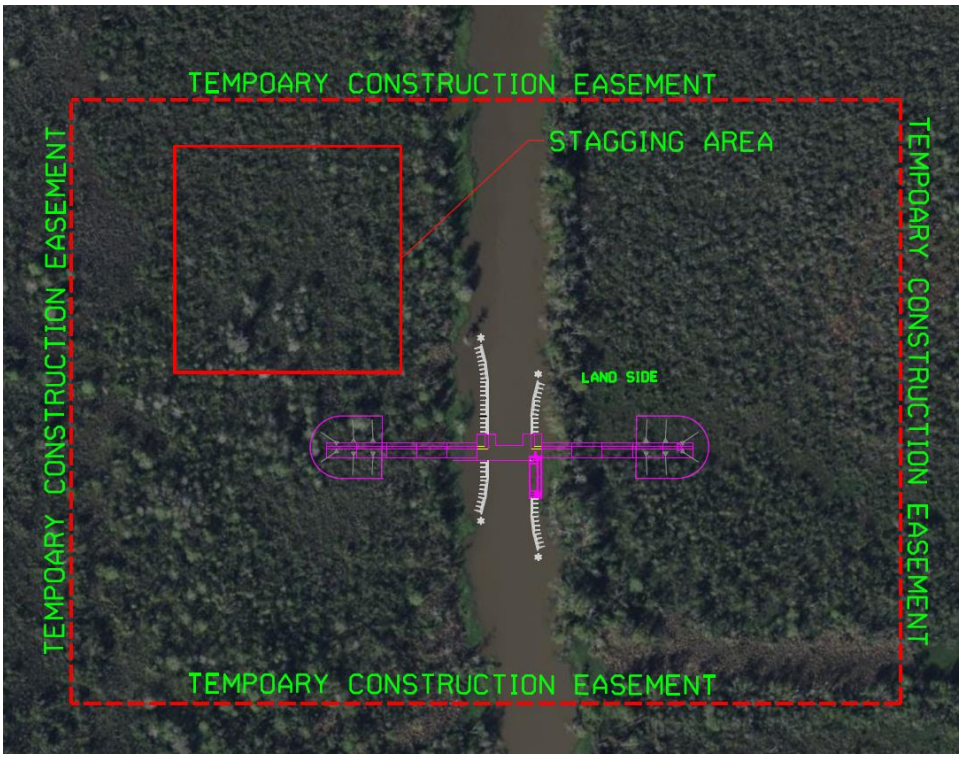


Figure 34. Map of Minors Canal Floodgate and staging areas

4.4 ENVIRONMENTAL CONTROL STRUCTURES

Eleven environmental control structures (ECS) would be installed within the Reach A levee (Figure 35). Environmental Control Structures 3, 4, 5, and 6 would be constructed at locations where Culverts 5, 3, 2, and 1, respectively, were previously installed during the first construction contract. These culverts would be removed and replaced with box culverts as part of ECS construction described in this section.

Nine of the structures would be box culverts with sluice gates, and two would be corrugated metal pipe with a flap gate. A sluice gate is a structure that contains a movable gate or series of movable gates that, when lifted, allow material and water to flow under it. The sluice gate would provide an opening in the system to allow unimpeded tidal flow, except when a tropical system approaches the Gulf of Mexico in which the gates would be closed (Figure 36 - Figure 38). Generally, sluice gates are not navigable as they do not raise high enough, or they have fixed components that do not allow vessels to pass through. Flap gates control water flow by only allowing water to flow in one direction. When the water level in the canal on the inside of the levee system is higher than the level in the canal outside of the levee system, the water would flow through the open flap gate. The gate would automatically close when the water level in the canal outside the levee system is higher than in the canal inside the levee system (Figure 39).

T-walls would extend from the control structures and tie into the adjacent levees with 860 total linear feet of T-walls (430 linear feet on either side of the floodgate). The floodwalls would have a top elevation of 16.5 NAVD88. Table 8 provides details regarding each drainage structure dimensions

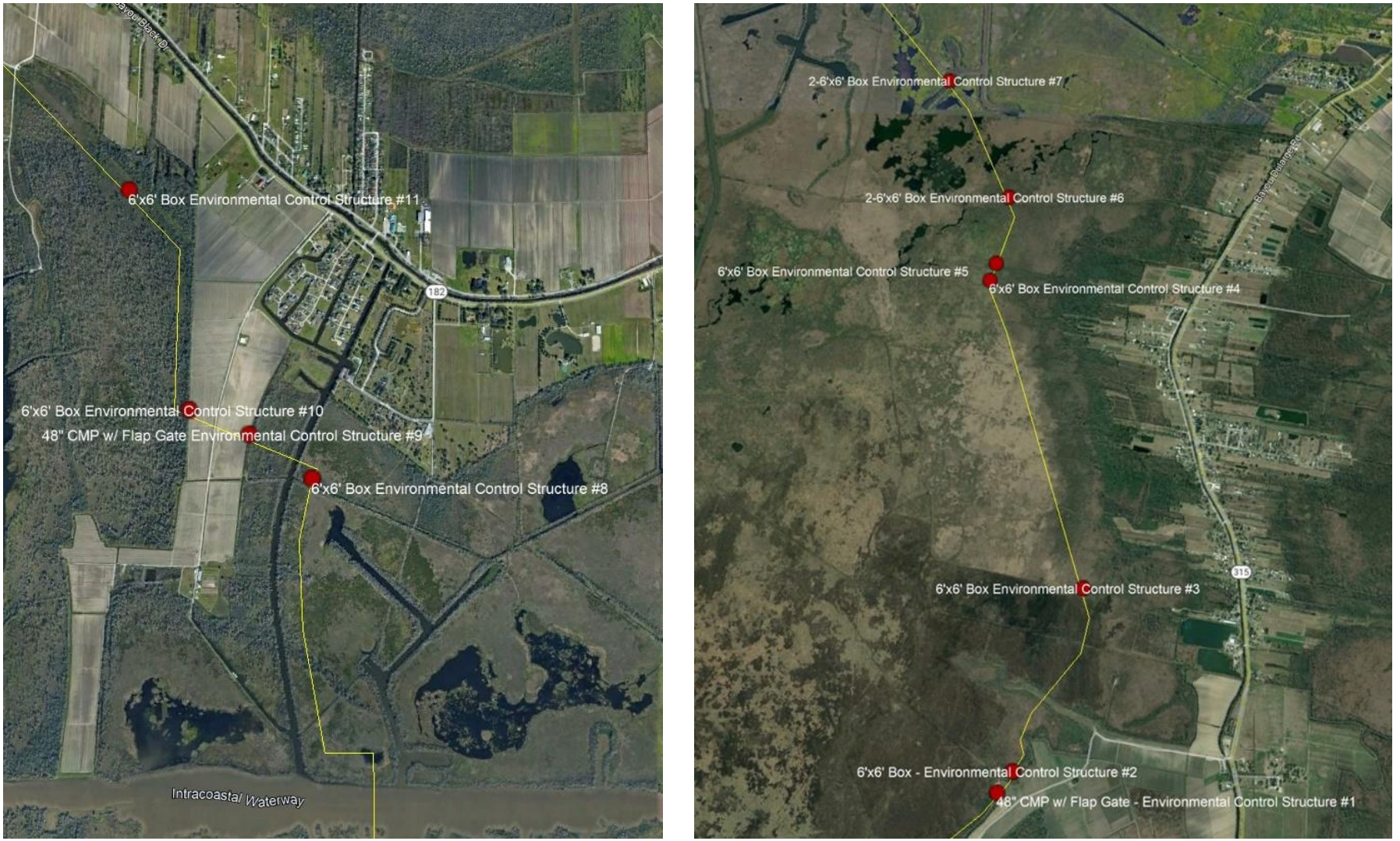


Figure 35. Approximate location of environmental control structures in levee north (left) and south (right) of the GIWW

Table 8. Environmental Control Structure Details

Drainage Structure #	# of Culverts	Culvert Size	Culvert Invert Elevation
1	1	48 in.	TBD
2	1	6 ft x 6 ft	TBD
3	1	6 ft x 6 ft	TBD
4	1	6 ft x 6 ft	TBD
5	1	6 ft x 6 ft	TBD
6	2	6 ft x 6 ft	TBD
7	2	6 ft x 6 ft	TBD
8	1	6 ft x 6 ft	TBD
9	1	48 in	TBD
10	1	6 ft x 6 ft	TBD
11	1	6 ft x 6 ft	TBD

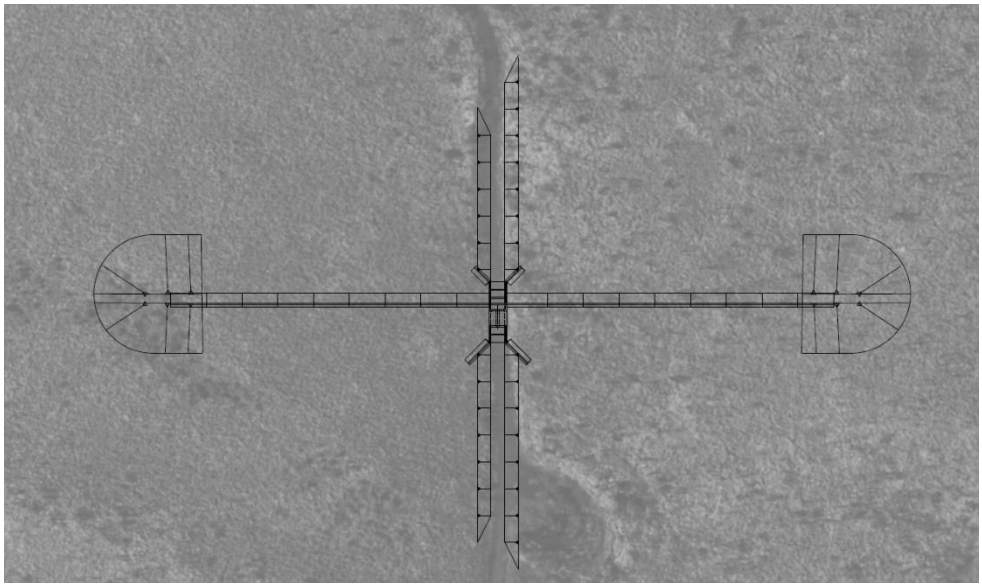


Figure 36. Typical Environmental Control Structure and associated project features

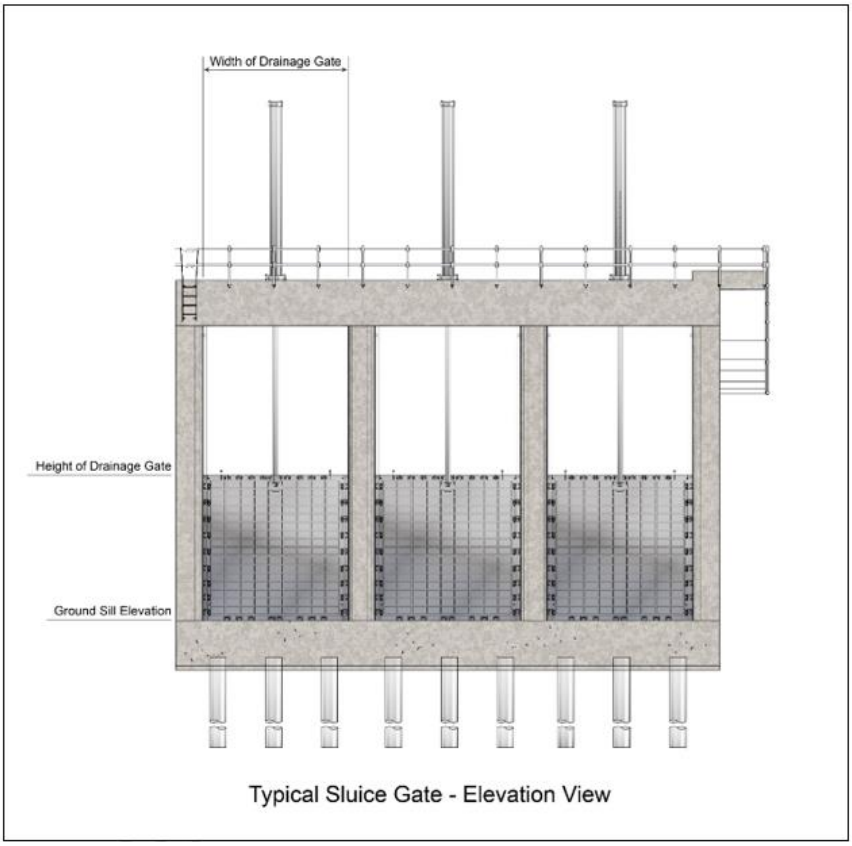


Figure 37. Typical Environmental Control Structure – Elevation View

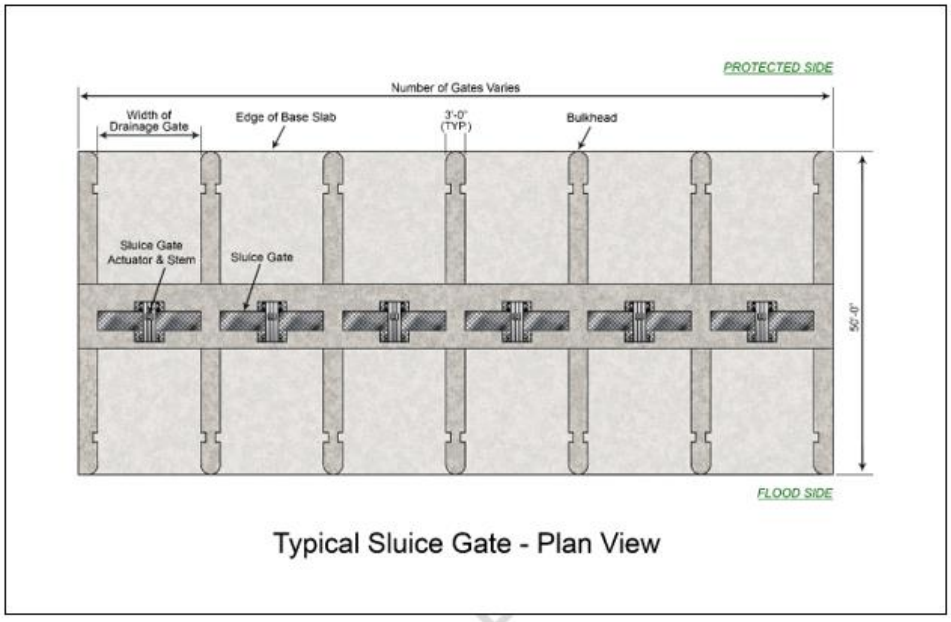


Figure 38. Typical Environmental Control Structure – Plan View

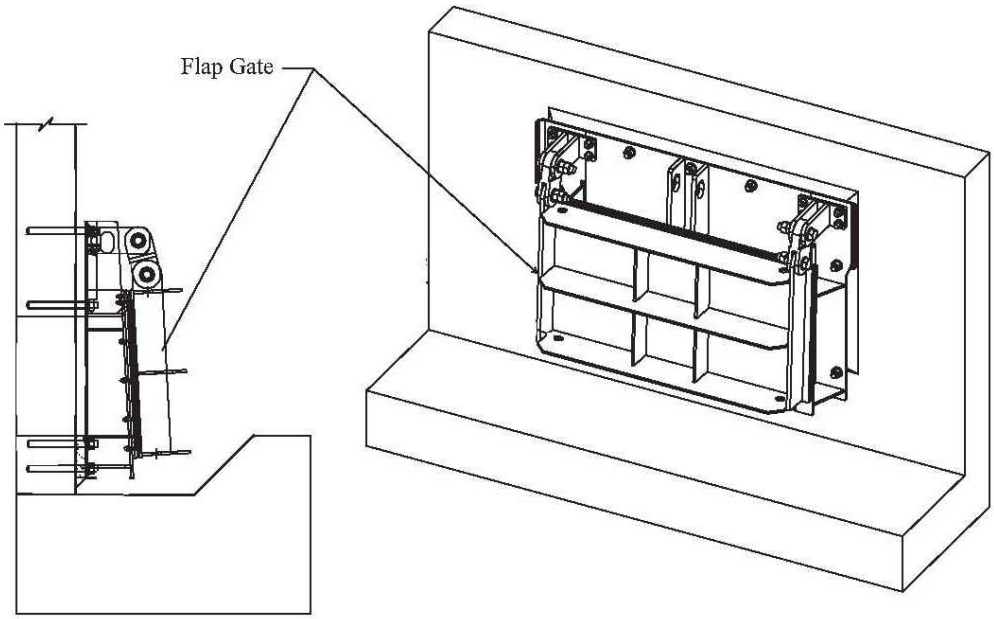


Figure 39. Typical Flap Gate

The design of the new environmental control structure including the foundation is subject to change once detailed geotechnical investigations are conducted during detailed design.

The T-wall monoliths vary with the tallest walls adjacent to the environmental control structure and the shortest walls that tie into the adjacent levee. Table 9 provides details regarding these monoliths.

Six-inch concrete scour protection or grouted riprap would be used at the levee/ T-wall transition. The concrete scour protection the levee where the T-wall stem extends into the full levee section and extend down both levee slopes. The scour protection would continue for a distance of 30 linear feet past the end of the T-wall. Uncapped cut-off sheet piling would extend horizontally 30 feet into the full levee section for erosion and seepage control. See the sketches below for wall layout and cross-sections (Figure 40 and Figure 41).

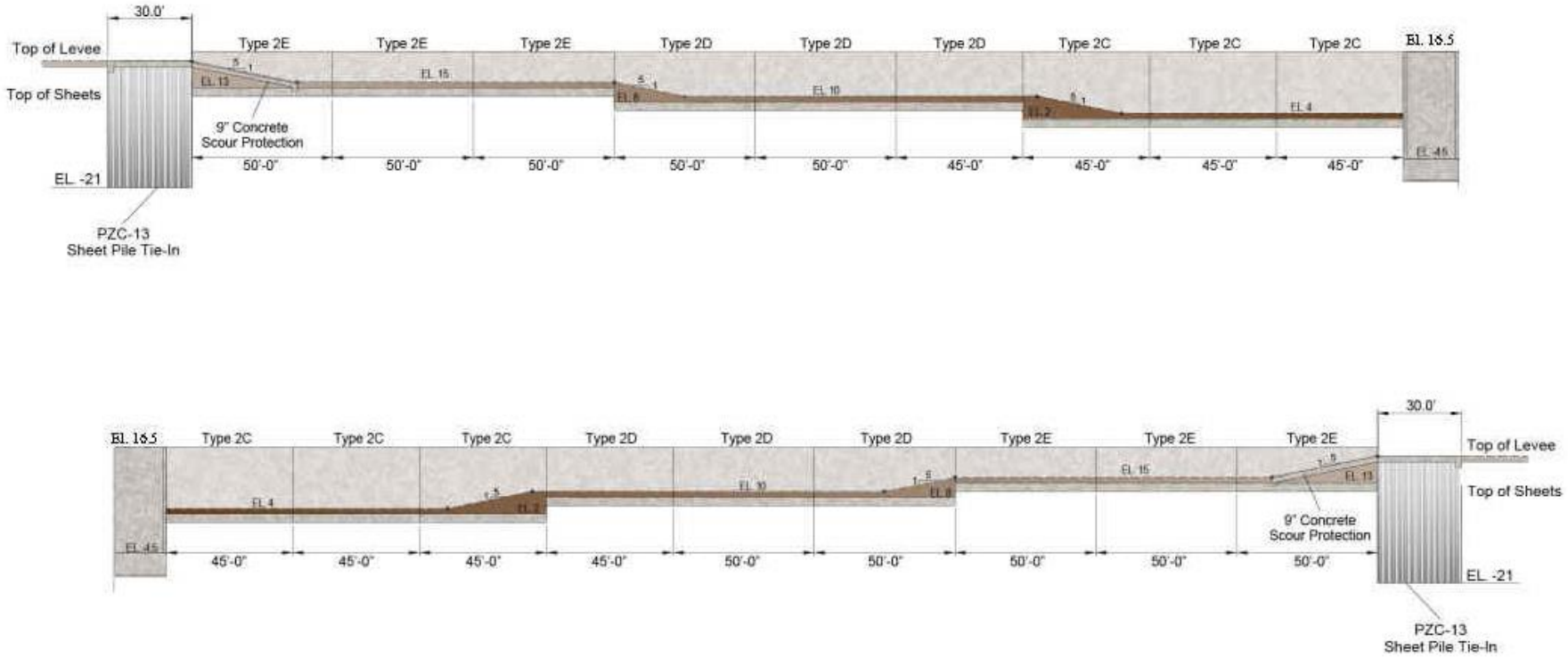


Figure 40. Typical Environmental Control Structure Tie-in Cross section

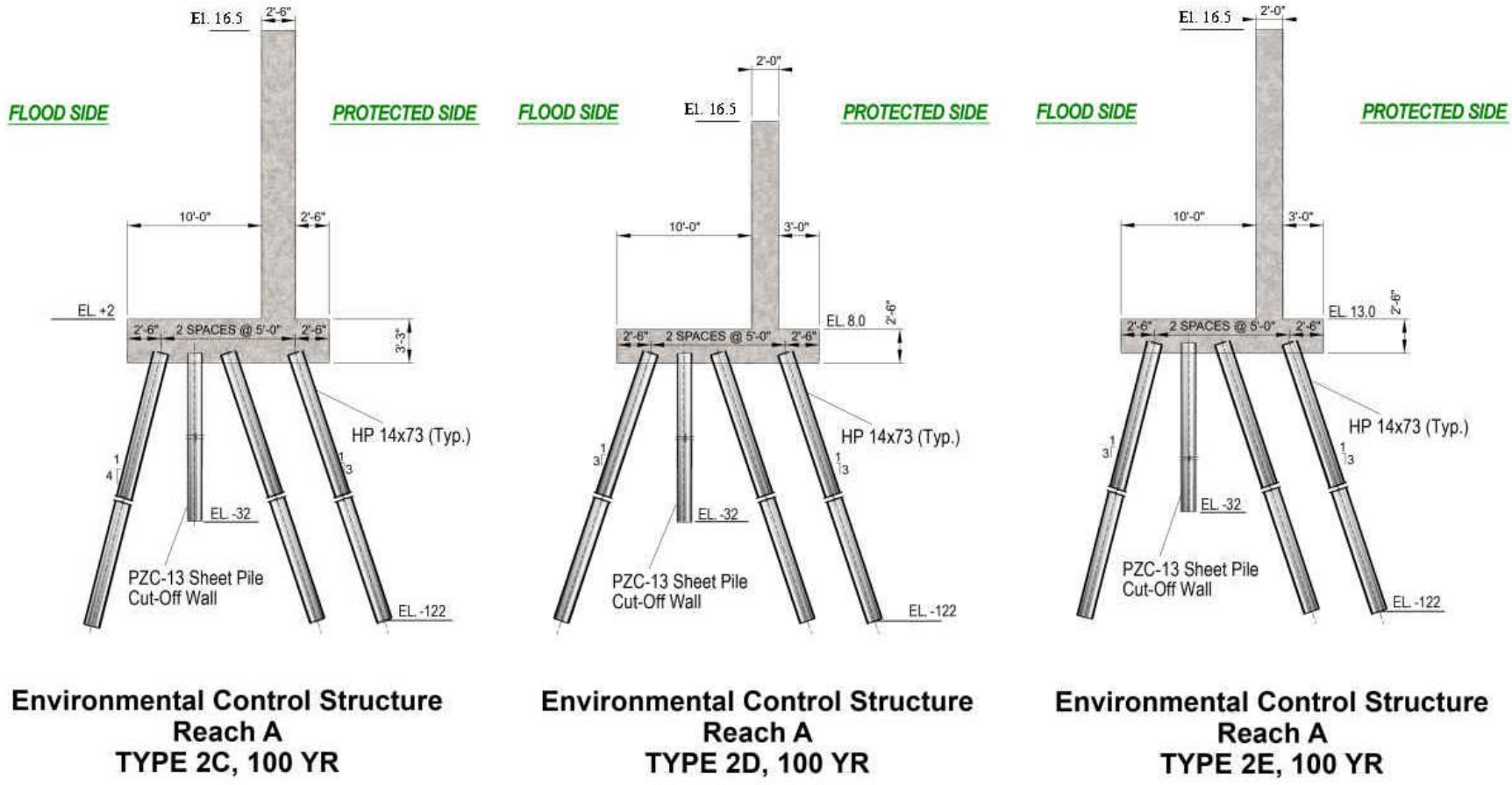


Figure 41. Typical Environmental Control Structure Tie-in Cross-section

Table 9. Environmental Control Structure Tie-in Details

Description of Floodwall Segment	Length of Floodwall Segment (ft)	Base of Slab BOS (ft)	Base of Wall BOW (ft)	Top of Wall TOW (ft)	Stem Height (ft)	Wall Thick (ft)	Slab Width (ft)	Number Of Piles Per Row
Environmental Control Structure Floodwall Tie-in Monoliths								
Type “C”	270	-1.25	2.0	16.5	14.5	2.5	15.0	3
Type “D”	290	5.5	8.0	16.5	8.5	2.0	15.0	3
Type “E”	300	10.5	13.0	16.5	3.5	2.0	15.0	3

The design of the new T-wall including the foundation is subject to change once detailed geotechnical investigations are conducted during PED.

The existing centerline of the adjacent channels has an approximate elevation of -3. The structure would match the invert of the existing channel. The channel width, directly upstream and downstream of the environmental control structure gate would be excavated to a width matching the box culvert size for any given ECS and gradually transition back to the existing channel width. The average cross-sectional flow area would be limited at the floodgate area to the width of the floodgate opening. The induced velocities around and through the gate would require the channel bottom to be layered with riprap. Within the channel 24” of riprap is required on both the land and floodside of the floodgate, approximately 150 linear feet on each. This riprap would be placed on separator. A riprap gradation is assumed to be class 250 - 1000lb stone (LADOTD 2016, Section 711). See Table 4 for example gradation limits for individual stone. Gradation shall meet specifications for 250lb class stone, according to LADOTD 2016, Section 711.

It is assumed that minimal material would be removed from the channel. Only the material required to construct the structure foundation would be excavated and it is assumed that this material would not be suitable for use in the project. The material would be hauled off site and disposed of in accordance with all state and federal laws.

The construction duration of the individual environmental control structures is 24 months with an assumed work schedule of 5 days a week, 8 hours a day. The environmental control structure would be constructed using both floating equipment with a combination of land support. Below is the preliminary list of equipment anticipated to be utilized in the construction of the environmental control structures Canal floodgate (Table 10).

Table 10. Preliminary list of equipment for Environmental Control Structures and tie-in construction

Project component	Duration (days)	Equipment used
Environmental Control Structure & Tie-in Floodwall	1095	150-Ton Crane
		80-Ton Crane
		Excavator
		Pile Driver
		Concrete Trucks
		Concrete Vibrators
		Welding Machine, Cutting Torch
Tie-in Levee		Dump Trucks
		Bull Dozers
		Fill Compactor
		Front End Loaded/Backhoe
		Fuel Tanks
		Generator

All environmental control structures would be constructed approximately in the center of the existing channels. A cofferdam would be constructed, permitting the construction of the environmental control structure concrete monolith and the wingwalls.

A cofferdam would be constructed to permit the in the dry construction of the environmental control structure. The cofferdam is an internally braced cofferdam with wide flange walers and pipe braces supporting PZ sheet piling. Anchor forces, bending moment in the sheet piling, and required sheet piling tip elevation calculated for Bayou du Large sector gate during the development of the PACR were conservatively used for the environmental control structures.

Construction site access for the environmental control structures would follow the same access routes as previously discussed for the construction of the Reach A levee portion of this project.

The construction staging area would be a 150 foot by x 150 foot along the landside of the construction site. The staging area would have a crushed stone on top of a separator fabric. There will be a staging area at each culvert through a wall and each Environmental Control Structure.

Culvert 4, constructed west of Falgout Road in the first construction contract, would be removed and replaced by levee, rather than an environmental control structure. To facilitate water exchange in an area that could otherwise experience collection of water on the landside of the levee, a canal would be constructed (shown in blue in Figure 42) to direct water from a canal near Falgout Court that would dead-end into the levee (shown in red in Figure 42) to a canal that empties through an environmental control structure (shown in green in Figure 42). This new canal would be approximately 1,060 feet long, 2 feet deep, with a bottom width of 3 feet, a top width of 19 feet, and side slopes of 4:1. Any material excavated for canal construction would be spread within the levee ROW to match the constructed embankment elevation and would be seeded.

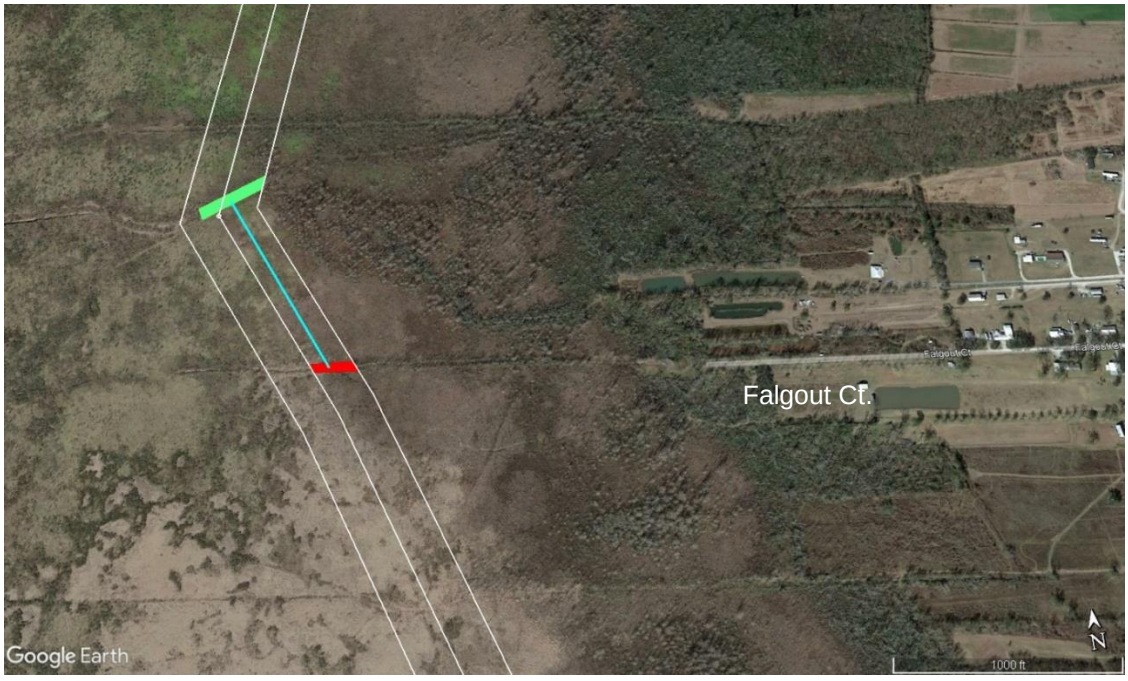


Figure 42. New canal (blue) to direct water from dead-end canal (red) to canal with water control structure (green)

Similarly, near the southern end of Reach A, a canal would be constructed (shown in blue in Figure 43) to direct water from a canal that would dead-end into the levee (shown in red in Figure 43) to a canal that empties through a water control structure (shown in green in Figure 43). This new canal would be approximately 1,042 feet long, 1.5 feet deep with a bottom width of 12 feet, a top width of 24 feet, and side slopes of 4:1. Any material excavated for

canal construction would be spread within the levee ROW to match the constructed embankment elevation and would be seeded.

Figure 43. New canal (blue) to direct water from dead-end canal (red) to canal with water control structure (green)