

2019

# Lake Pontchartrain and Vicinity GRR Civil Engineering – Appendix A



U.S. Army Corps of Engineers,  
New Orleans District

Non-Federal Sponsor: Coastal  
Protection and Restoration Authority  
Board

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## LAKE PONTCHARTRAIN & VICINITY GRR CIVIL ENGINEERING APPENDIX

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## EXISTING LEVEE SECTIONS APPENDIX

### 1 INTRODUCTION

#### 1.1 OVERVIEW

This appendix describes the methodology used to calculate quantities based on the projected levee lifts required to achieve the estimated design elevations for two alternatives - the 1% and 0.5% levels of risk reduction in the year 2073 for the intermediate sea level rise scenario. For the scope of this study and the size of the study area, representative reaches were chosen around the system to analyze. This appendix contains examples of representative cross sections from the representative levee reaches around the Lake Pontchartrain and Vicinity (LPV) project areas. The below cross sections depict the section at the time of the last levee lift, whether by USACE or by CPRAB and SLFPA-E or Pontchartrain Levee District (PLD) as an allowed Section 408 alteration to the levee reach. The elevation of last levee lift and the design grade for each reach is stated in the paragraphs below. All elevations are referenced to NAVD88 (2004.65), unless otherwise noted. The locations of the representative reaches discussed in this report are shown in Figure 1, highlighted in green. Explanation of why certain reaches were chosen can be found in Appendix B.

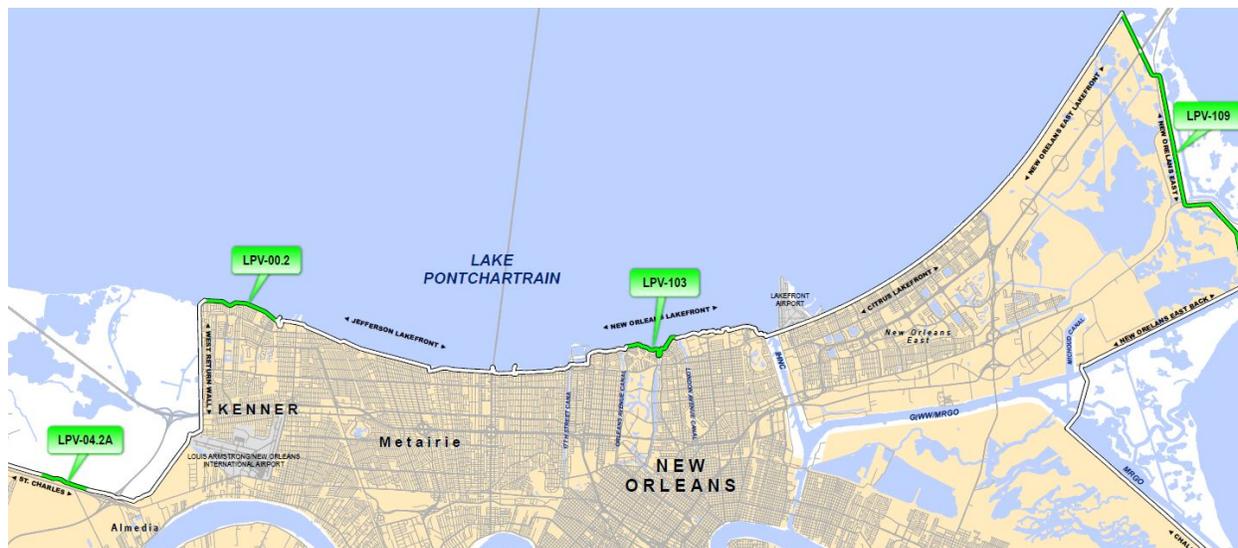


Figure 1. Lake Pontchartrain and Vicinity Representative Reach Locations

### 2 EXISTING LEVEE SECTIONS

#### 2.1 LPV-04.2A REACH 1A CROSS BAYOU TO ST. ROSE AND GULF SOUTH FLOODWALL, ST. CHARLES PARISH

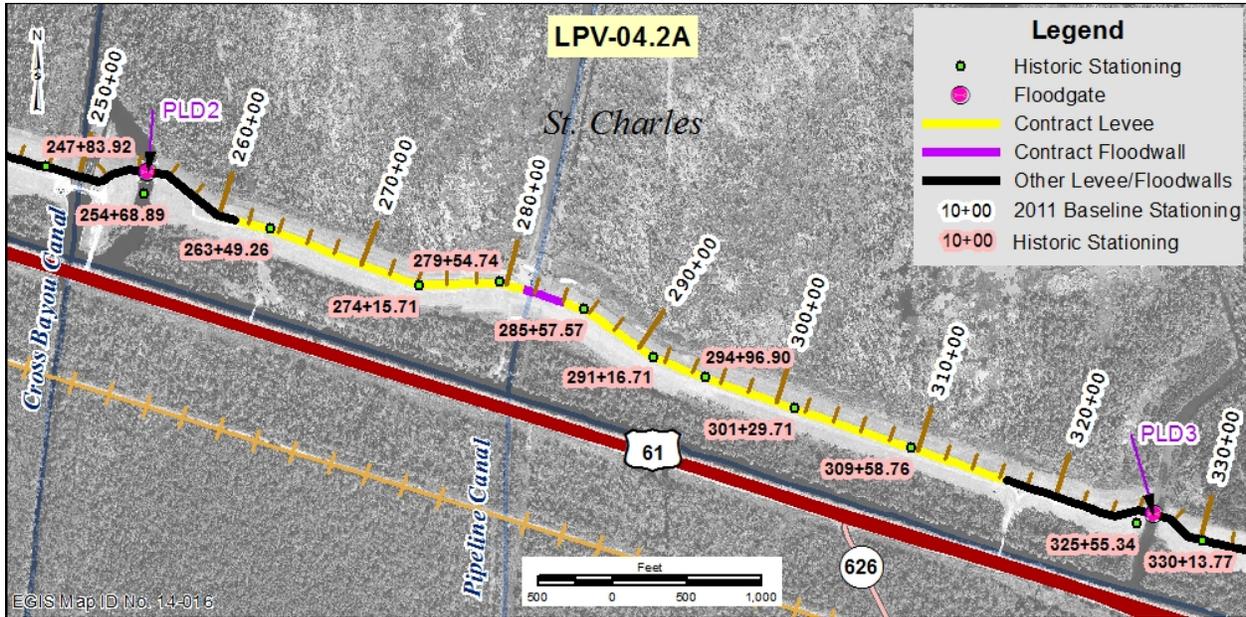
This levee reach was last lifted to El. 17.0 by CPRAB and PLD as a Section 408 alteration and armored by USACE in 2017 under the same USACE contract. LPV-04.2a was originally a levee reach from Cross Bayou to St. Rose and LPV-06d.2 was a floodwall for the Gulf South pipeline. During the preparation of the construction plans, the contracts were merged together resulting in “LPV-04.2a Levee-Reach 1A from Cross Bayou to St. Rose and Gulf South Floodwall-Phase 2”.

The final contract limits were from STA. 261+63.73 to STA. 316+40.12 and included 5,322 ft. of levee divided by a 404 ft. floodwall constructed from STA. 280+63.73 to STA. 284+67.01. These contract limits coincide with the Cross Bayou Drainage Complex on the west and the St. Rose Drainage Structure access bridge on the east. The required Hurricane and Storm Damage and Risk Reduction System (HSDRRS) hydraulic design elevation for the levee is 14.5 ft. in 2007 and 16.5 ft. in 2057. The levee construction portion of this contract consisted of excavating the existing levee to remove the existing geotextile fabric, placing a higher strength fabric, constructing a straddle lift placing embankment to elevation 17.0 with 1V on 3H side slopes, and raising the existing wave and stability berms on the flood side and protected side of the levee, as well as fertilizing and seeding and construction of a new access road. Floodwall construction consisted of demolition of the existing floodwall and adjacent scour protection, constructing a new pile-founded T-wall built to 17.0 ft., driving steel sheet piling, scour protection transitions, a new access road and a ramp which was constructed at STA. 262+250.

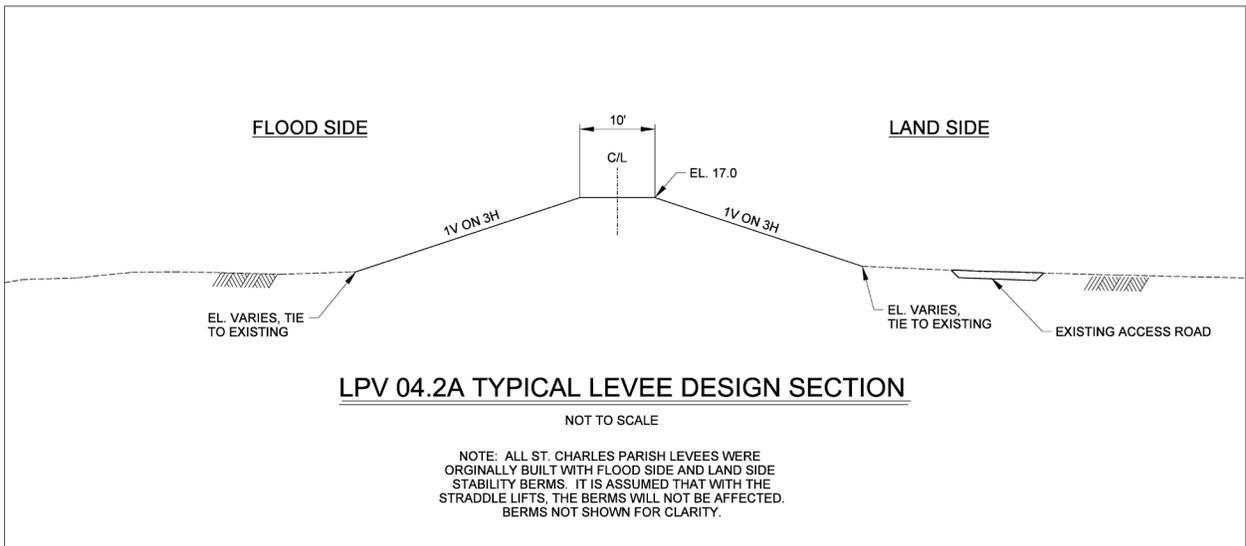
In 2017, this contract LPV-ARM-06 included a lift of the 2.8 mile long levee reach LPV04.2a and 04a.2b, by CPRAB and PLD which was included in the armoring contract. The LPV 04.2a portion on the contract, was from baseline Station 260+00 to 354+18. The levee construction portion of this contract consisted of a straddle lift placing compacted embankment to elevation 17.0 and 1V:3H side slopes. At several locations, the scour protection was removed, embankment placed, and the pavement replaced to an elevation of 17.0 feet to achieve a smooth transition to the newly lifted levee. This occurred at the east side of the Cross Bayou Drainage Structure, both sides of the Gulf South Floodwall, both sides of the St. Rose Drainage Structure, both sides of the I-310 Floodwall, both sides of the Almedia Drainage Structure, both sides of the Walker Drainage Structure, and the south of the ICRR Gate.

The armoring portion of the contract consisted of placing HPTRM along the crown, a portion of the flood side slope, and on the protected side of the levee. Once placed the HPTRM was covered with sod and fertilized and seeded. The HPTRM is secured using percussion driven earth anchors and 12 inch metal pins that are placed in a minimum 1 ft. by 1 ft. anchor trench. The HPTRM in this contract abuts to a hardened surface at several locations including tie-in at the newly placed scour protection locations, newly placed (as part of this contract) concrete ramp paving, and new concrete turn around pads. Where the HPTRM abuts or ties into to concrete, an anchor trench was placed running parallel to the edge of the hardened surface. In areas where the existing road was within 21 feet of the levee toe, the existing access roads had to be removed and relocated parallel to the existing road (a southeast shift). This occurred between B/L Stations 260+05 to 265+17, 276+71 to 281+48, 283+47 to 322+98, and 330+32 to 354+63. The existing access road was removed and the new access road consisted of separator geotextile and 8 inches of crushed stone.

Four existing ramps had to be reconstructed to the new levee elevation of 17.0 feet. This included the ramps at B/L Station 262+68, 278+33, 319+69, and 335+67. After placement of compacted fill, separator fabric and 3 inches of crushed stone was placed followed by 6 inch thick concrete pavement. A concrete turnaround pad was placed at B/L Station 305+30.



LPV-04.2A Levee Reach



LPV-04.2A Typical Levee Section

## 2.2 LPV 103 ORLEANS PARISH LAKEFRONT, ORLEANS AVE CANAL TO LONDON AVE CANAL

This levee reach was last lifted by USACE to 19.5 in 2008. The design grade is 16.0. This reach was armored in 2015.

The work within the LPV-103 reach was completed under three separate contracts. This appendix covers operations and maintenance of items constructed under these contracts: LPV-103.01, LPV-103.01a1, LPV-103.01a2 and LPV-ARM-02.

This segment of the HSDRRS consists of 2.62 miles of levee and floodwall, including 2 new swing gates. The contract reach area is located on the south shore of Lake Pontchartrain in Orleans Parish. The LPV-103 reach begins along the east bank of Orleans Ave canal and continues east parallel to Lakeshore Dr. to the west bank of London Ave canal. It includes the reaches along the east side of Orleans Ave canal, both sides of Bayou St. John, and the west side of London Ave canal. The portions of the contracts along the outfall canals extend from the lakefront levees to the interim closure structures on London Ave canal and Orleans Ave canal and the sector gates on Bayou St. John. Along the lakefront the levee ties into the Permanent Canal Closure and Pumps (PCCP) at London Ave canal and Orleans Ave canal.

The following provides a description of the work that was completed under each contract.

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### 2.2.1 LPV-103.01:

This segment begins near 2011 Baseline STA. 128+75 where it ties into the swing gate and floodwalls located at Marconi Drive (gate L-6 constructed under LPV-103.01a1). It then continues east parallel to Lakeshore Drive to the end of the contract reach at STA. 225+33 where it ties into the gate at the intersection of Lakeshore Drive and Lake Terrace (gate L-9 constructed under LPV-103.01a2), located on the west side of London Ave canal. Within the contract, STA. 222+45 to 223+79 was designated a no work area for utility crossings that went over the levee. The utilities were relocated and the levee lift was completed by Orleans Levee District Non-Flood Asset Management Authority after construction was complete. Along the east and west bank of Bayou St. John, there are two reaches of levee that were raised under LPV-103.01. Additional work for the floodwalls and sector gate along Bayou St. John was completed under the LPV-103.01a2 contract. The Rail St. Gate located at STA. 154+41 to 157+76 was designated a no work area and this work was completed under the LPV-103.01a2 contract.

For the levee reach that parallels the lakefront, the required 1% hydraulic design elevation for the levee is 16.0 ft. in 2007 and 19.0 ft. in 2057. This levee reach was raised to a construction grade of 19.5 ft. providing approximately 3.5 ft. of overbuild to extend the period of effective risk reduction. For the levee reaches along Bayou St. John, the 1% required hydraulic design elevation is 15.0 ft. in 2007 and 16.5 ft. in 2057. This levee reach was built to elevation 16.5 ft. providing 1.5 ft. of overbuild to extend the period of effective risk reduction. The typical levee section for this contract includes a wave berm. The elevation of the wave berm must be monitored since it is a factor for establishing the required 1% hydraulic design elevation for the levee crown.

Scour protection is located throughout the reach where the levee transitions to floodwall.

### 2.2.2 LPV-103.01A1:

This contract begins along the east side of Orleans Ave canal at the interim closure structure. From the interim closure structure to the east end of the floodwall adjacent to the Marconi gate, the 1% design elevation for the floodwalls and gate is 16 ft in 2057. Along the east bank of the canal, where the wall turns east and runs to the Marconi Gate, the existing I-walls were converted to L-walls. The top of wall elevation varies from 17 ft. to 19.5 ft. Note, a portion of the existing I-wall from the Orleans Ave PCCP to the Lakeshore Drive Bridge was retrofitted by LPV-103.1a3. East of the Marconi gate, approximately 100 ft. of existing I-wall that is at elevation 17 ft., was converted to L-wall. There is a miter gate which crosses Marconi Drive. The existing gate was not replaced since the gate elevation is 16.5 ft. which exceeds the 1% (2057) design elevation. Work on the gate included welding a 3/8 in x 6 in plate to the front of the top beam and repainting of the gate. Note this plate did not increase the height of the gate. It was welded to the front of the gate, and did not extend above the top of the gate. Another 25 ft. of L-wall was constructed to transition to the levee. This L-wall transitions from elevation 17.0 ft. to 19.5 ft.

The existing I-walls along Bayou St. John were removed and replaced with a T-wall. The constructed elevation of the T-wall varies between elevation 16 ft. and 18.5 ft. Work also included modifications to the Bayou St. John sector gate. A six inch plate was welded to the top of the gate to increase the height to meet the 1% (2057) design elevation of 16 ft. New concrete walkway, stairwells, and guardrails were constructed to provide access to the gate structure.

The original Bayou St. John sector gate structure was funded and built by the Orleans Levee District. The subsequent raise and additional work on the Bayou St. John sector gate was a part of the LPV HSDRRS.

The main features of the Bayou St. John sector gate consist of the sector gate bay concrete monoliths, sector gate leaves, sluice gate structure, control room, tie in walls, pre-cast concrete sheet pile bulkhead, and dewatering needles and needle girders. Additional information on the sector gates can be found in the Periodic Inspection reports.

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### 2.2.3 LPV-103.01A2:

Under LPV-103.01a2, work was completed on gate L-7 at Rail St. and gate L-9 at Lake Terrace. On the west side of the Rail St. gate, from the levee tie-in to the gate column, approximately 165 ft. of T-wall was constructed to El. 18.0 ft. (includes two (2) ft. of structural superiority). A miter swing gate was constructed to El. 18.0 ft., across Lakeshore Dr. with gate pilasters at El. 27.6 ft. on both sides of the gate. On the east side of the gate, approximately 45 ft. of T-wall was constructed to El. 18.0 ft. Approximately 280 ft. of existing I-wall (at El. 19.5 ft.) was converted to an L-wall. This L-wall then ties back into the LPV-103.01 levee section. The asphalt ramp which crosses through the gate was removed and replaced with new asphalt. New concrete sidewalk, curb, and gutters were placed. Storm water drainage and street lighting were relocated by the contractor. Security fans and a two (2) ft. high security fence were placed along the top of the floodwall. Concrete capped sheet pile and scour protection were placed at both ends of the floodwall where it transitions into the levee section. The 1% (2057) design elevation for the gate and floodwalls is El. 16.0 ft.

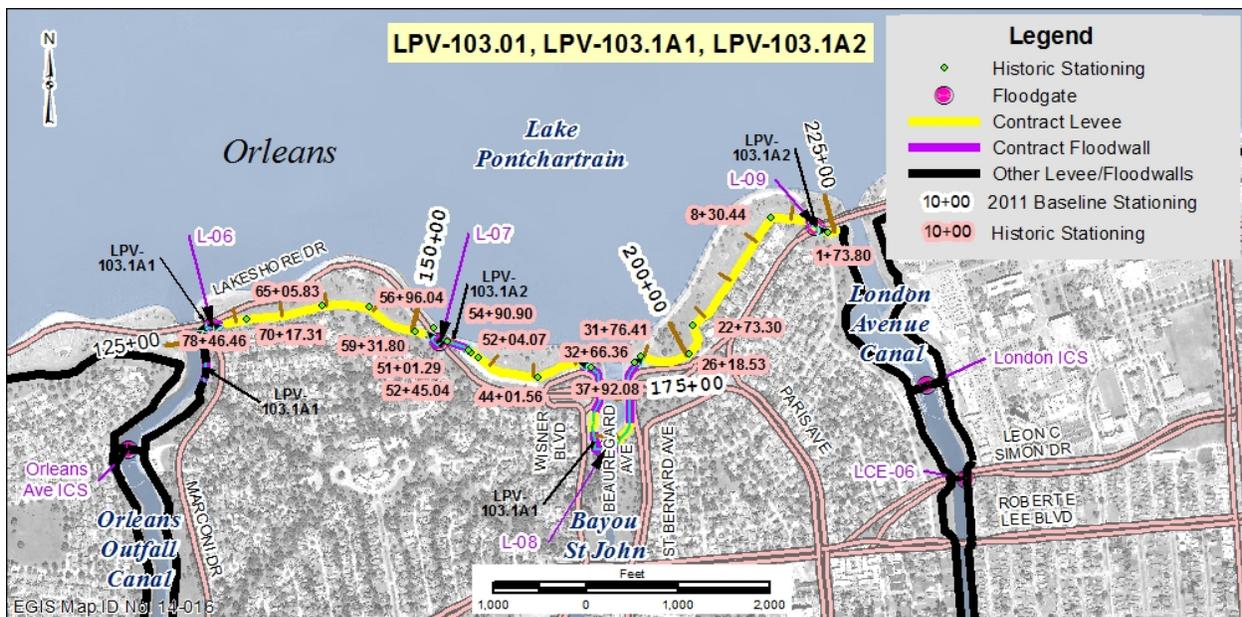
At the Lake Terrace gate, on the west side of the gate from the levee tie-in to the gate column 60 ft. of T-wall was constructed to El. 18.5 ft. A miter swing gate was constructed to El. 18.5 ft. across Lakeshore Dr. with gate pilasters at El. 28.5 ft. on both sides of the gate. On the east side of the gate, approximately 90 ft. of T-wall was constructed to El. 18.5 ft. Sheet pile and scour protection were placed at both ends of the floodwall where it transitions into the levee section. The 1% (2057) design elevation for the gate and floodwalls is El. 18.5 ft.

#### 2.2.4 LPV-ARM-02:

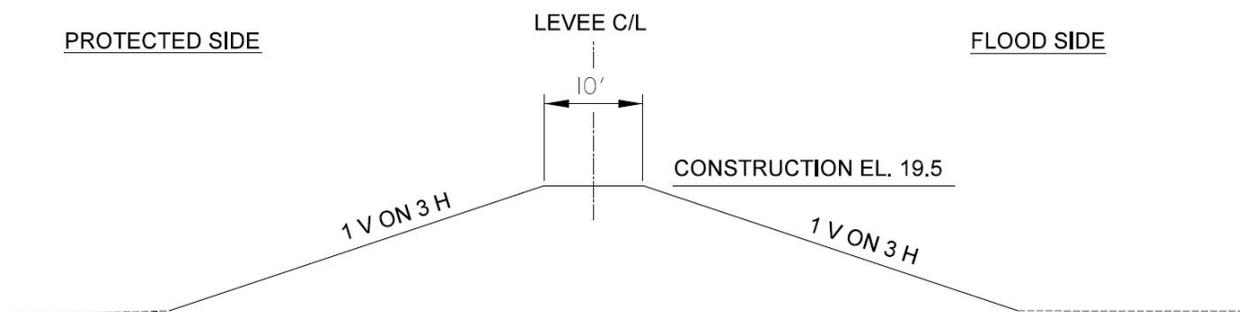
This armoring contract LPV-ARM-02 included armoring a segment of the HSDRRS from 2011 baseline STA. 37+74 to STA. 403+67, consisting of 3 miles of levee. The armoring contract is comprised of three contract reaches (LPV-102, 103, and 104) that were constructed under the original LPV contracts.

The armoring contract consisted of placing HPTRM along the flood side crown edge, levee crown, and the landside of the levee. Once placed, the HPTRM was covered with sod and fertilized. The HPTRM is secured using percussion driven earth anchors and 12 in metal pins that are placed in a minimum 1 ft. by 1 ft. anchor trench.

There are several locations in the contract reach where the HPTRM abuts to a hardened surface. At some locations this abutment occurs where concrete scour protection is placed at the intersection of a levee and floodwall. In addition to abutment at scour protection, the HPTRM also abuts to hardened surfaces at concrete ramps, miscellaneous concrete pads, and/or turn around pads throughout the reach. Where the HPTRM abuts to a hardened surface, an anchor trench is placed parallel to the edge of the hardened surface. Existing crushed stone ramps located on the landside of the levee were concrete paved during the armoring contracts by placing 6 in thick concrete on top of the existing crushed stone. Concrete ramp is located at 2011 baseline station 168+78.



LPV-103.01, LPV-103.1A1, LPV-103.1A2 Levee Reaches



## LPV-103 TYPICAL LEVEE DESIGN SECTION

N.T.S

### LPV-103 Typical Levee Section

#### 2.3 LPV-109

The last completed lift of this reach by USACE raised it to El. 18.5 in 2011. The design grade is 17. This contract is currently being lifted by CPRAB and SLFPA-E as a Section 408 alteration to the levee to previous construction grade plus six inches and armored by USACE under the same contract. Completion is estimated in 2020.

This segment of the HSDRRS consists of 7.5 miles of levee and floodwall. There are two floodgates located where the reach crosses U.S. Highway (Hwy) 11 and U.S. Highway (Hwy) 90. The contract reach also includes four drainage structures and two pump stations. The contract reach is located on the south shore of Lake Pontchartrain in Orleans Parish, along the eastern side of the Bayou Sauvage National Wildlife Refuge. The levee portions of the contract were identified by five hydraulic reaches, each with its own design – reaches “NE31”, “NE10-A”, “NE10-B”, “NE10-C” and “NE11-A”.

##### 2.3.1 LPV-109.02A1-2009

Prior to construction of the LPV-109.02a levee, this contract was constructed to install a test section for the wick drains. The test section included excavation of the existing berm, installation of the sand drainage blanket, placement of the wick drains, and then placement of embankment fill on top. The test section was installed between Baseline STA 1029+00 to Baseline STA 1032+00. The wick drain test section was removed during construction of LPV-109.02a. Refer to as-built drawing C-612 for details on removal of wick drain section.

##### 2.3.2 LPV-109.02A2 - 2010

This contract was designed, awarded, and constructed prior to construction of the LPV-109.02a Levee enlargement. The contract was approximately 38,500 ft. long and extended from South Point to CSX railroad (RR) crossing. The purpose of the contract was to place a 2 ft. to 3 ft.

sand drainage blanket, to improve the foundation of the levee, which would be offset from the existing levee and constructed under LPV-109.02a.

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### 2.3.3 LPV-109.02A - 2011

The contract begins at 2011 Baseline STA 663+75. The work between 2011 Baseline STA 663+75 and Baseline STA 662+00, was constructed within LPV-108 Right of Way. It extends to the drainage structure, which extends from STA 667+01 to STA 668+05. The levee resumes on the southeast side of the Drainage Structure No. 1 (as named on as-built drawings), and continues to STA 719+81, where it ties into the I-10 crossing over the levee. The I-10 crossing was constructed under a separate contract designated as LPV-109.02b. From STA 663+75 to STA 719+81, the levee was constructed to elevation 18.5 ft. The required 1% hydraulic design elevation for the levee in this reach (hydraulic reach “NE31”) is 16.5 ft. in 2007 and 18.0 ft. in 2057.

The LPV-109.02a levee resumes on the south east side of the I-10 crossing at Baseline STA 724+38 and it continues southeast to approximate STA 761+30, where it ties into the concrete T-Wall monoliths constructed for the Hwy11 crossing. The required 1% hydraulic design elevation for the levee in this reach (hydraulic reach “NE10-A”), is 17 ft. in 2007 and 18.0 ft. in 2057. The levee ends and the T-Wall monoliths begin at approximate STA 724+38. The T-Wall monoliths and gate opening extend to approximate STA 765+52. The gate storage monoliths and gate opening from STA 762+48 to STA 763+68 were designed under contract name LPV-109.02c (US11 and US90 Gates and Crossings) but were awarded and constructed under the contract LPV-109.02a. The T-wall and gate in this reach were constructed to elevation 18.5 ft. The required 1% hydraulic design elevation for the floodwall is 18.0 ft. in 2057.

The levee resumes at STA 765+52 on the southeast side of the Hwy 11 crossing and continues to approximate STA 799+30, where there is a pump station (identified as Pump Station 1 on the as-built drawings). The drainage pipes for the pump station were constructed up and over the levee. Adjacent to the pump station is a Drainage Structure No. 2. The levee resumes on the southeast side of the drainage structure at STA 802+39 and continues to Drainage Structure No. 3, which begins at STA 928+33. The drainage structure ends and the levee resumes at STA 930+83. The levee continues to approximate STA 940+00, where it ties-into the T-Wall monoliths for the Hwy 90 crossing. From STA 765+52 to STA 940+00, the levee was constructed to an elevation of 19 ft. The hydraulic reach changes approximately at STA 799+76. Within this reach there are two hydraulic reaches, “NE10-B” and “NE10-C”. Refer to the Hydraulic Design Elevation Report for approximate transition between the hydraulic reaches. The required 1% hydraulic design elevation for “NE10-B” is 17 ft. in 2007 and 18 ft. in 2057. The required 1% hydraulic design elevation for “NE10-C” is 17 ft. in 2007 and 19 ft. in 2057. The typical levee section for both of these reaches includes a wave berm. The elevation for the wave berm must be monitored, since it was a factor for establishing the required 1% hydraulic design elevation for the levee crown.

The levee ends and the T-Wall monoliths for the Hwy 90 crossing begin at approximate STA 940+00. The T-Wall monoliths and gate opening extend to approximate STA 943+82.62. The gate storage monoliths and gate opening from STA 940+86.46 to STA 943+07.50 were designed under contract name LPV-109.02c (US11 and US90 Gates and Crossings) but were

awarded and constructed under the contract LPV-109.02a. The T-wall and gate in this reach were constructed to elevation 22 ft. The required 1% hydraulic design elevation for the floodwall (hydraulic reach "NE14") is 22.0 ft. in 2057.

The levee resumes at STA 943+82.62 on the southeast side of the Hwy 90 crossing and continues to approximate STA 1055+00, where it connects to Drainage Structure No. 4. From STA 943+82.62 to STA 1055+00, the levee was constructed to an elevation of 25 ft. The required 1% hydraulic design elevation for the levee in this reach (hydraulic reach "NE11-A"), is 22 ft. in 2007 and 23.5 ft. in 2057. From STA 1028+00 to STA 1033+00, there is a wick drain test section constructed under LPV-109.02a1. During construction, the wick drain test section was removed, and rebuilt in conformance with the plans and specifications of the contract.

On the south side of the drainage structure, beginning at STA 1058+57 and extending to STA 1060+00, three T-Wall monoliths were constructed to elevation 27.5 ft. The required 1% hydraulic design elevation for the floodwall is 27.5 ft. in 2057. LPV-109.02a contract ends at STA 1060+00, and ties into the T-Wall constructed under LPV-110.

Throughout the contract reach the levee was offset from the original levee centerline towards the landside. The levee enlargement includes a wave berm and a stability berm. Throughout the contract reach a drainage blanket was placed (under LPV-109.02a2), and wick drains were installed prior to placing embankment for the levee enlargement. A 12-inch layer of 6-inch stone riprap was placed where the landside stability berm ties into the existing ground.

Scour protection was constructed throughout the contract reach at transitions between floodwalls and levees. Refer to the as-built drawings for exact location of the scour protection. At Hwy 11 and Hwy 90 crossing roller gates were placed. Emergency access ramps were installed to provide access up and over the floodwall in the event the gates are closed. The access ramps are asphalt and include drainage for rainfall runoff.

Pump Station No. 1 and No. 2 are operated by U.S. Fish and Wildlife Service (USFWS). Pump Station No. 1 has 2 pumps designated by USFWS as Conservation Treatment Unit (CTU)-3 and CTU-4.

Pump Station No. 2 has one (1) pump designated as CTU-5. The discharge pipes for Pump Stations No. 1 & No. 2 were relocated to pass over the new levee design sections; therefore, positive closures are not required at these pump stations. Below is a summary of pipes:

Pump Station No. 1 (CTU-3 and CTU-4): Pipes 1 and 2 invert at crown of levee = 18.0 ft.

Pump Station No. 2 (CTU-5): Pipe 1 invert at crown of levee = 23.0 ft.

There are four gravity drainage structures that were reconstructed for this contract. All gravity-drainage structures are similar in structure, except for the number of drainage pipes. At each drainage structure on the intake side of each drainage pipe is installed a stationary trash screen. On the discharge side of each drainage pipe is a flapper gate and in between is a sluice gate for positive closure of the system. The drainage structures are pile supported.

Number of discharge/drainage pipes:

Pump Station No. 1 (2 – 42 inch Steel Pipes)

Drainage Structure No. 1 (5 – 54 inch Reinforced Concrete Pipe (RCP))  
Drainage Structure No. 2 (3 – 48 inch RCPs)  
Drainage Structure No. 3 (3 – 48 inch RCPs)  
Drainage Structure No. 4 (4 – 54 inch RCPs)  
Pump Station No. 2 (1 – 36 inch Steel Pipe)

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#### 2.3.4 LPV-109.02A ADDITIONAL WORK -2011

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##### 2.3.4.1 LEVEE LIFT

This contract is currently being lifted by CPRAB and SLFPA-E as a Section 408 alteration to the levee to the prior construction grade plus six inches. Initial Construction of the levee was completed in June 2011. In January 2013, prior to the completion of construction of the levee, a survey of the levee showed portions of the levee crown were below the initial construction grade. MVM Hired Labor Crew placed embankment to elevation 19 ft. From STA 724+42 to STA 781+85 a total of 2,227 ft. (non-continuous) was raised with a straddle of the levee centerline. From STA 745+80 to STA 938+85, a total 1,955 ft. (non-continuous) was raised by placing a cap on the levee crown (hydraulic reaches “NE10-A”, “NE10-B” and “NE10-C”). Levee maintenance lift was designated as LPV-109.02a3.

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##### 2.3.4.2 HWY 11 REMEDIAL ACTION

After completion of the construction contract, a Top-of-Wall survey was performed in October 2011. The data from the Top-of-Wall survey and a site visit confirmed differential movement of the floodwall monoliths. After completing the engineering analysis, remedial action was taken to reduce any potential future settlement in the area, and to reduce the stresses in the piles. Remedial action was completed by Keiland, which consisted of degrading the soil adjacent to monoliths to elevation 6 ft. Joints in the slope pavement which had separated were cleaned and filled with cold-mix asphalt. The vertical joints in the monoliths were repaired. The bypass ramp was repaired, and a 22-inch drainage culvert was installed.

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##### 2.3.4.3 VEGETATIVE FREE ZONE

Within the LPV-109.02a contract, the toe of the landside stability berm is at the edge of the U.S. Fish and Wildlife Refuge. In order to avoid clearing vegetation in the wildlife refuge, the stability berm was reanalyzed and it was determined that the effective width of the stability berm could be reduced by 15 ft. to accommodate the vegetative free zone. The non-federal sponsor is required to keep the stability berm free and clear of vegetation.

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##### 2.3.4.4 CSX RR SLOPE PAVEMENT REPLACEMENT AND FILLING OF SEPARATED EXPANSION JOINTS

At the end of construction in June 2011, the slope pavement adjacent to the three T-Wall monoliths that tie-into LPV-110 (STA 1058+57 to STA 1060+00) showed signs of settlement of the fill beneath the slope pavement. This caused horizontal and vertical displacement between the slope pavement joints. Based on geotechnical analysis, it was determined that the fill would continue to settle. A contract was issued to APC construction to remove the slope pavement and replace with grouted rip rap.

In addition, APC performed work to repair expansion joints in slope pavement at Hwy 11, Hwy 90, and Pump Stations 3 and 4. The contractor cleared the joints of vegetation and debris and filled the joint with asphaltic material.

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#### 2.3.4.5 TRASH RACK REPLACEMENT

Prior to issuing notice of construction complete, the trash racks at each of the drainage structures were replaced with ones fabricated from stainless steel. The trash racks were installed by Keiland Construction, LLC.

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#### 2.3.5 LPV-109.02C

The gate storage monoliths and gate opening from STA 762+48 to STA 763+68 were designed under contract name LPV-109.02c (US11 and US90 Gates and Crossings) but were awarded and constructed under the contract LPV-109.02a. The T-wall and gate in this reach were constructed to elevation 18.5 ft. The required 1% hydraulic design elevation for the floodwall is 18.0 ft. in 2057.

The gate storage monoliths and gate opening from STA 940+86.46 to STA 943+07.50 were designed under contract name LPV-109.02c (US11 and US90 Gates and Crossings) but were awarded and constructed under the contract LPV-109.02a. The T-wall and gate in this reach were constructed to elevation 22 ft. The required 1% hydraulic design elevation for the floodwall is 22.0 ft. in 2057.

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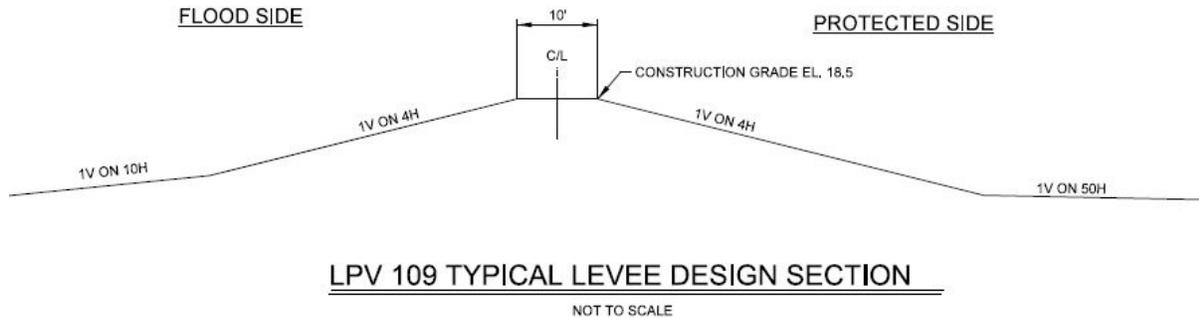
#### 2.3.6 LPV-ARM-05 SYSTEM ARMORING (LPV-109)

This contract is currently being armored by USACE in 2019 to 2020. The armoring contract also includes a lift to the prior construction grade plus 6 inches by CPRAB and SLFPA-E as a Section 408 alteration. The armoring contract will consist of placing HPTRM along the crown and land side of the levee. Once placed the HPTRM was covered with sod and fertilized. The HPTRM is secured with percussion driven earth anchors and 12-inch metal pins that are placed in a minimum 1 ft. by 1 ft. trench.

There are a few locations in the contract reach where the HPTRM abuts a hardened surface. This abutment occurs where concrete scour protection is placed at the intersection of a levee and ramp. Where the HPTRM abuts a hardened surface, the HPTRM is placed underneath the hardened surface.



**LPV-0109.02a Levee Reach**



**LPV-109 Typical Levee Section**

## 2.4 LPV-00.2 REACH 1 LAKEFRONT LEVEE.

This segment of the HSDRRS consists of approximately 2.0 miles of levee along the East Jefferson lakefront. The contract begins at 2011 Baseline STA. 708+05.60, which is adjacent to the northern most end of the West Return Floodwall and proceeds East to STA. 813+91.89 where it ties-in to the floodwall of Pump Station #4 (Duncan). The required 1% hydraulic design elevation for the levee is 15.5 ft. in 2007 and 17.5 ft. in 2057. The Phase 1 contract (LPV-00.1) constructed the levee to an elevation of 17.0 ft. This levee reach was last lifted by CPRAB and SLFPA-E as an allowed Section 408 alteration in 2017 to elevation 17.0. The Jefferson Parish Lakefront levees contain a layer of high strength geotextile fabric at their base.

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### 2.4.1 LPV-00.2

The USACE contract (LPV-00.2) expanded the crown of the levee to 10 ft. wide and softened the side slopes but did not add additional elevation since the levee elevation was already above the required 1% hydraulic elevation and therefore provided at least 1ft of overbuild achieving a construction grade of approximately elevation 16.5 ft. The typical levee section for this contract includes a wave berm. The elevation for the wave berm must be monitored since it was a factor for establishing the required 1% hydraulic design elevation for the levee crown.

On the protected side of the levee there is a stability berm and an adjacent landside rainfall runoff collection and drainage system that runs parallel to the levee for the entire levee reach, which was not impacted by this contract. The landside rainfall runoff collection and drainage system is not essential to the function of the system.

Foreshore protection and a wave attenuation berm were constructed under contract LPV-01.2 on the flood side to provide erosion protection from daily wave action. Some additional features of this levee reach are (1) an all-weather access roadway that runs the entire length of the levee reach and (2) ramps. One ramp crosses the levee near 2011 Baseline STA. 706+94.22 and another crosses near STA. 813+74.34. Although the ramps are not essential to the function of the system, they are required for inspection and maintenance access and shall be maintained in accordance with this manual.

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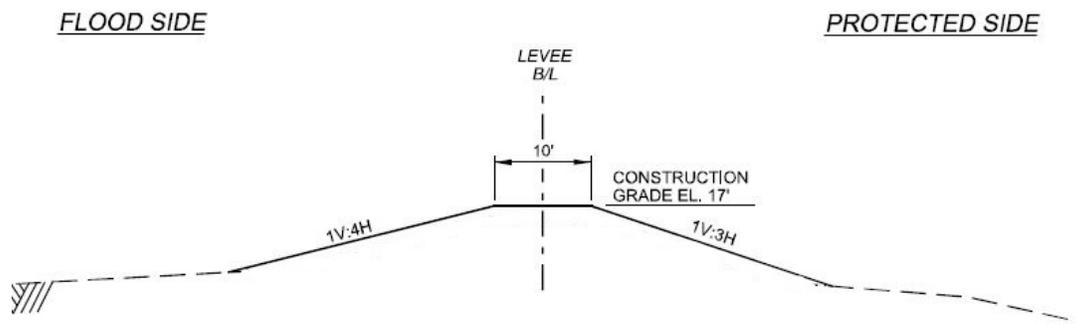
### 2.4.2 LPV-ARM-08 SYSTEM ARMORING (LPV-00.2)

This contract was armored in 2017-2018 and consisted of placing HPTRM along the land side of the levee. Once placed the HPTRM was covered with sod and fertilized. The HPTRM is secured with percussion driven earth anchors and 12-inch metal pins that are placed in a minimum 1 ft. by 1 ft. trench.

There are a few locations in the contract reach where the HPTRM abuts a hardened surface. This abutment occurs where concrete scour protection is placed at the intersection of a levee and ramp. Where the HPTRM abuts a hardened surface, the HPTRM is placed underneath the hardened surface.



**LPV-00.2 Levee Reach**



**LPV-00.2 TYPICAL LEVEE DESIGN SECTION**

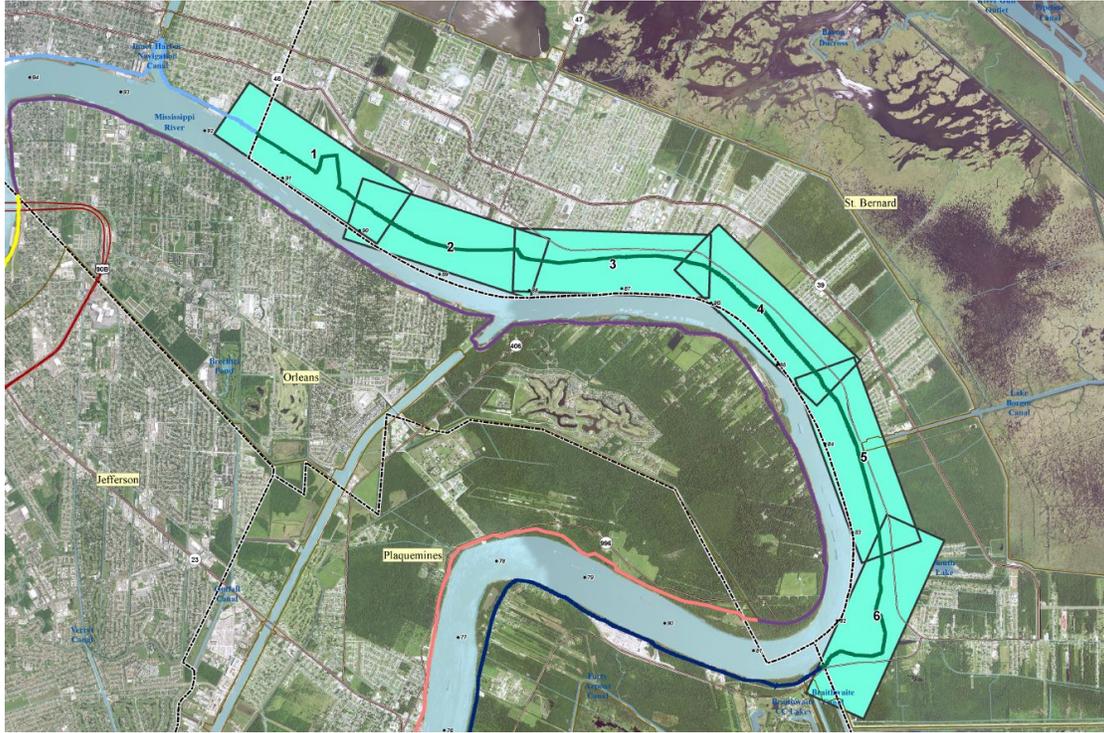
N.T.S.  
LEVEE C/L = LEVEE B/L UNLESS OTHERWISE NOTED

**LPV-00.2 Typical Levee Section**

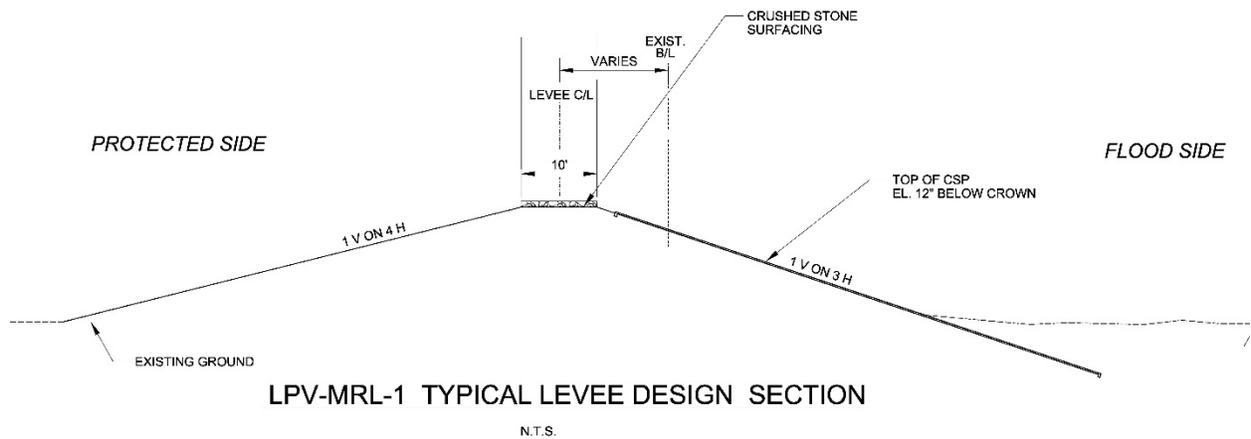
## 2.5 LPV-MRL-1

This levee reach is not part of LPV as it was north of the east bank 2011 1% HSDRRS cross over point at river mile 77.3. The new 2073 cross over point, however, is at river mile 90.5 for the intermediate condition. For explanation on adjusted crossover points see the H&H appendix. Included in the Lake Borgne Levee District, this levee reach of the LPV MRL starts east of the

IHNC Lock runs along the MRL to Caernarvon. The MR&T design grade or MRL 1973 refined project grade for the reach varies from EL 21.5 to 19.8. The 1% 2011 HSDRRS design grade is EL 18.5. The MRL levees have a crushed stone surfacing crown and concrete slope paving (CSP) on the flood side slope. Between the upstream limit of this reach and the new crossover point at river mile 90.5 is a portion of the LPV-MRL-2 reach. I-type floodwalls were constructed in this reach for stability.



**LPV-MRL-1 Levee Reach**



**LPV-MRL-1 Typical Levee Section**

### 3 QUANTITY CALCULATION – INTERMEDIATE 1% DESIGN STORM

Due to the enormity of the entire system, representative reaches were chosen and lift schedules were developed for some reaches and applied to representative reaches. For explanation on development of lift schedules refer to the Geotechnical Appendix. The following table represents the results of the geotechnical analysis and lift schedules for each reach. These represent conservative estimates of when the next lift may be required, and should NOT be interpreted as predictions of when a reach may become deficient.

Contract ID	Contract	1st Lift			2nd Lift			3rd Lift			4th Lift		
		Year	Lift Elevation	Height (FT)									
LPV-MRL-23B	Bonne Carre Guide Levee	2056		3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-00.2	Reach 1 Lakefront Levee	2024	19.5	3	2053	20	3	N/A	1.5	1.5	N/A	N/A	N/A
LPV-01.1	Reach 2 Lakefront Levee	2024	19.5	3	2053	20	3	N/A	1	1	N/A	N/A	N/A
LPV-02.2	Reach 3 Lakefront Levee	2024	19.5	3	2053	20	3	N/A	1	1	N/A	N/A	N/A
LPV-03d.2	Airport Runway 10 Levee	2024	17.5	2	2032	18	2	2048	19	2	2065	19	1
LPV-04.2A	Levee - Reach 1A from Cross Bayou to St. Rose and Gulf South Floodwall	2024	17.5	2	2032	18	2	2048	19	2	2065	19	1
LPV-05.2A	Levee - Reach 2A Shell Pipeline to Goodhope and Shell Pipeline Floodwall	2024	17.5	2	2032	18	2	2048	19	2	2065	19	1
LPV-19.2	Reach 4 Lakefront Levee	2024	19.5	3	2053	20	3	N/A	19	N/A	N/A	19	N/A
LPV-20.1	Reach 5 Lakefront Levee	2024	19.5	3	2053	20	3	N/A	19	N/A	N/A	19	N/A
LPV-102.01	Lake Marina Ave to Orleans Ave Canal	2051	20	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-103.01	Orleans Ave Canal to London Ave Canal	2051	20	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-104.01	London Ave Canal to IHNC	2051	20	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPV-108	Paris Road to South Point	2040	19	1.5	2053	20	1.5	2063	20	1.5	N/A	N/A	N/A
LPV-109.02a	South Point to CSX RR	2040	19	1.5	2053	20	1.5	2063	20	1.5	N/A	N/A	N/A
LPV-111.01	CSX RR to Michoud Canal	2040	19	1.5	2053	20	1.5	2063	20	1.5	N/A	N/A	N/A
LPV-MRL-1	IHNC Lock to Caemarvon	2040	19	3	2053	20	3	2063	20	3	N/A	N/A	N/A

#### Intermediate 1% Design Storm Lift Schedules

### 3.1 LEVEE LIFT QUANTITY CALCULATION ASSUMPTIONS

Quantities for each lift were calculated based on cross sectional area. It was assumed that all lifts are straddle lifts and no berms are affected. The only site investigations that was done is a profile survey of the levee crown elevations.

Some levee reaches have concrete paved transitions from levee to floodwall. It is assumed that with each lift, the slope paving would need to be removed and replaced to 1 foot below the levee design elevation. Existing slope pavement could potentially, as done in the past, be placed as a toe dike 10 feet riverward of the flood side levee toe to act as a wave break during high river stages.

Silt fence quantities were calculated by doubling the reach length and adding 25% contingency for staging areas.

Embankment quantities were calculated using cross sectional areas. Clearing and grubbing and seeding and mulching quantities are assumed to be the same, in acres per lift.

Quantities calculated for each reach are located in Enclosure 1 at the end of this appendix.

### 3.2 ARMORING

It is assumed that all previously placed armoring for each reach would need to be removed before each lift and then replaced after construction of each lift. Armoring consists of either

HPTRM or ACB. As previously done, because MRL levees have all-weather access roads on the crown, so ACBs were placed on these reaches as the method of armoring. All other reaches have HPTRM with the exception of LPV-108. This reach has an adjacent railroad and the crown is used for access so ACBs were also applied to this reach.

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### 3.2.1 LPV-MRL-1 AND LPV-108

The HPTRM will be placed on the landside of the levee and generally extend a distance of 15-ft. past the land side levee toe and terminate in an anchor trench. After the initial placement of the HPTRM on the land side, the HPTRM is anchored using percussion driven earth anchors in a specific pattern so that the HPTRM maintains contact with the levee surface. Additional steel pins are used, in between the percussion driven earth anchors to further anchor the HPTRM.

ACBs are placed on the crown of the levee, extending down the land and flood side levee slopes for a distance of approximately 7 feet. On the flood side, the ACBs terminate in an anchor trench. On the land side, the ACBs and filter fabric are placed on top of the HPTRM and anchored. As part of the installation of the ACBs, crushed stone was added and graded on the levee crown and side slopes.

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### 3.2.2 ALL OTHER LPV REACHES

HPTRM armoring is placed from a distance of 4 feet down the flood side slope from the levee crown and extends across the levee crown, down the land side slope, and then extends an additional 15 feet past the landside toe. The HPTRM is secured with percussion driven earth anchors and 12 inch metal pins that are placed in a minimum 1 foot by 1 foot anchor trench. Once placed the HPTRM was covered with Bermuda sod and fertilized.

## 3.3 MRL SLOPE PAVING

LPV-MRL-1 has concrete slope paving on the flood side slope. It is assumed for this alternative that the slope paving will need to be removed and replaced with expansion of the levee footprint. The quantities are included in enclosure 1.

## 3.4 FORESHORE FRONTING PROTECTION RIPRAP

Along the LPV lakefront, foreshore protection was added per HSDRRS guidelines to prevent foreshore shore erosion along the lakefront. It is assumed that to maintain the 1% level of protection additional foreshore riprap would need to be replaced. It is assumed that an additional 15 foot width of riprap would need to be replaced. Quantities are calculated in enclosure 1 at the end of this appendix.

## 4 QUANTITY CALCULATION – INTERMEDIATE 0.5% DESIGN STORM

Hydraulic design elevations were calculated for the 0.5% intermediate design or 200 year storm. For explanation on these calculations see the H&H appendix. Due to time constraints, lift schedules and curves were not developed for this option. Design elevations for the 200 year storm were interpolated from the 100 and 500 year intermediate design storm elevation to come up with an estimation of lifts. The increase in lift from the 100 year elevation was either added to the last 100 year lift or an additional lift was added, in keeping with the previous maximum lift of

3 feet. See enclosure 2 for lift schedules and estimates quantities. The same assumptions from the 1% design quantity calculations apply.

## 5 GENERAL ASSUMPTIONS

### 5.1 UTILITY RELOCATIONS

Because all lifts would generally straddle the footprint of a previous lift, it is assumed that no utility relocations would be required.

### 5.2 RIGHT OF WAY

For the intermediate 1% and 0.5% design storm, the new footprint was compared to the existing right of way limits for the last levee lift for the representative reaches to determine if any new right of way would be required. For LPV, the only areas that stood out as possibly needing additional right of way were along the New Orleans Lakefront and the LPV MRL.

#### 5.2.1 NEW ORLEANS LAKEFRONT

For the LPV-103 reach a lift would be bounded by Lakeshore drive at the beginning project in the vicinity of C/L Sta. 62+89 to 65+22. In the vicinity of Sta. 101+00 an additional 0.21 ACRES may be required on the flood side and along Bayou St. John on the east side, because the existing right of way limit is already at the existing toe. A possible t-wall may be required here between Sta. 119+31.70 to 121+10.55. At LPV-104, between Sta. 9+00 and 14+00, the existing levee toe abuts the U.S. Naval & Marine Reserve property therefore a flood side shift is probably required however no additional easement should be required for the intermediate condition. Between Sta. 17+71 and 19+97, for the intermediate condition, if a land side shift is done, no additional easement will be required. From 65+50 to 69+00 and from 78+70 to 80+60, the existing flood side toe abuts Lakeshore Dr. therefore a land side shift might be required. All shifts would need to be analyzed for stability. This was not done during this phase of this study.

#### 5.2.2 LPV MRL

For this reach, between Sta. 264+61 to 491+00 new land side right of way would be required. For other areas of this reach, a flood side shift would prevent the need for additional easements. Between Stations 325+00 and 491+00 the batture is narrow and there is a steep underwater slope. Land side shift would probably be required however there is a railroad that runs adjacent to the levee toe.

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