Mississippi Valley Division,
Regional Planning and Environment Division South

South Central Coast Louisiana

Feasibility Study with Integrated Environmental Impact Statement

Hurricane Ike flooding in Delcambre, Louisiana 2008.

Appendix M - Cost Appendix

May 2022

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Section 1
Purpose

This appendix summarizes the cost analysis and engineering work completed to support the components of the South Central Coast Louisiana (SCCL) Study.

1.1 COST ESTIMATES

The cost estimates for the measures and alternatives were prepared based on readily available USACE data and quantities provided by the project delivery team (USACE). The cost estimate was developed in the TRACES MII cost estimating software and used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, and sub- and prime contractor markups. All features were estimated based on standard construction methods that are common to USACE and South Louisiana. The estimates assumed access was available to proposed areas unless otherwise stated. This philosophy was taken wherever practical. It was supplemented with estimating information from other sources, where necessary, such as quotes, historical bid data, A-E estimates, and previously approved similar studies (Southwest Coastal Louisiana Study, Morganza to the Gulf). The intent was to provide or convey a “fair and reasonable” estimate that depicts the local market conditions.

1.2 STRUCTURAL MEASURES COST ESTIMATE WORKFLOW PROCESS

At each step in the screening process, different levels of cost estimates were calculated. For initial screenings of measures in which the USACE had initial cost estimates, such as the CPRA State Master Plan Alignment and the Highway 90 Alternative, the cost estimates from the Arcadis report (Arcadis, 2017) (Tables M;6 7-21) were used, along with the economics benefits calculated by the USACE, to determine an initial Benefit Cost Ratio (BCR). The intent of this was to identify any measures that either passed an initial screening or could be identified as close to a unity BCR and thus required more investigation and refinement of the cost estimates to determine a final BCR. In this scenario, neither the CPRA State Master Plan alignment nor the Highway 90 alignment were close to unity and were therefore screened.

After the USACE reviewed other possible measures based upon economic impact clusters (Measure 5- Levees West of Berwick, Measure 6- Morgan City Back Levee, Measure 7- Ring Levees 1, Measure 8- Ring Levee 2 (and Measure 8 var.- Ring Levee 1+2) and Measure 9- Ring Levee 3, respectively), cost estimates for levees were developed using quantities based upon typical sections and existing ground elevations or existing levee elevations, depending upon the scenario. In addition, known pipeline crossings that would need to be raised were identified and costs were determined based upon historical costs for pipeline crossings. For all gates, barge gates, and all other non-levee structural features, the length of those proposed features were measured (using aerial imagery) and costed using historical costs of similar non-levee structural features.

Measures 5-9 initially had a BCR closer to unity. Therefore, more investigation and research was initiated, and cost estimates were refined further. For these measures, as much information as was available was gathered and included in the cost estimates (Tables M;6 1-6) to determine a more resilient BCR. After the BCR was calculated, the USACE was informed that the initial determination that all structural measures were to be designed using EM 1110-2-1913 criteria was incorrect and that the more robust HSDRRS criteria was to be used. At this point in the process, only Measure 6- Morgan City was near a BCR unity. It was determined that due to additional costs associated with the HSDRRS criteria, any further investigation and refinement of costs for the structural measures would be purely academic and not provide any viable structural measures meeting or exceeding unity.

1.2.1 Structural Measures Estimate Assumptions

Estimate Structure: The estimate is structured to reflect the projects performed. The estimates are subdivided by alternative alignments.

Bid competition: It is assumed that there will not be an economically saturated market and that bidding competition will be present.

Contract Acquisition Strategy: It is assumed that the contract acquisition strategy will be similar to past projects with some negotiated contracts, focus and preference of small business/8(a), and large, unrestricted design/bid/build contracts. There is no declared contract acquisition plan/types at this time, so typical USACE goals have been included.

Labor Shortages: It is assumed there will be a normal labor market.

Labor Rates: Local labor market wages are above the local Davis-Bacon Wage Determination and actual rates have been used. This is based upon local information and payroll data received from the USACE Construction Representatives and estimators with experiences in past years.

Materials: Cost quotes are used on major construction items when available. Recent quotes may include borrow material, concrete, steel and concrete piling, rock, gravel, and sand. Assumptions include:

- Materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials. Prices include delivery of materials.
- Concrete - will be purchased from commercial batch plants.
- Borrow Material and Haul - Borrow material is considered the highest risk in the contracts, given the large quantities required, uncertainties of sources and materials near the many contract locations. Specific borrow sources have not been established so a conservative estimated haul distance was used when using off-site material. Borrow pits currently in use are within this distance. Borrow material for the measures are assumed Government furnished borrow. Adjacent borrow pits to the levees were eliminated at this stage due to previous utilization of adjacent borrow pits to existing levees and the existing infrastructure and development to new levees.

The borrow quantity calculations followed the USACE Geotechnical guidance:

- Hauled Levee: 10 BCY (bank cubic yards) of borrow material = 12 LCY (loose cubic yards) hauled = 8 ECY (embankment cubic yards) compacted.
- An assumed average one-way haul distance of 20 miles was used unless a committed borrow source has been confirmed available. This decision is based upon discussions with USACE cost engineers and USACE.
- Haul speeds are estimated using 40 mph speed average given the long distances and rural areas.

Staged construction was eliminated as a potential cost savings measure based on historic levee performance in the vicinity of the study area. Levee slopes steeper than 1V:4H have been known to have issues with slope instability, with slides occurring regularly in the study area. Therefore, given USACE's experience with constructing levees in the project area, we do not believe cost savings using staged construction would result in a B/C ratio over 1.0.

The fourth iteration B/C ratios intentionally over estimated benefits and assumed 100 percent of the damages were mitigated over the 50-year life of the project. Along with the over estimation in benefits, costs were based upon standard levee design (rather than HSDRRS design criteria) which was an intended underestimation. Fourth iteration B/C cost ratios of 0.66, 0.36, 0.42, and 0.96 were the result of the overestimation of benefits and the underestimation of costs. The B/C ratios (all of which were below unity) are anticipated to significantly decrease during refined evaluations as a result of design criteria and refined 50 year damage assumptions. Additionally, Measure 6-Morgan City Back levees under standard design criteria cost only included closing existing unprotected sections.

If HSDRRS criteria would be applied to the Morgan City Back levees, the required HSDRRS criteria would require all of the Morgan City levees/floodwalls to be replaced with “T” walls (currently all floodwall/levees are “I” walls and do not have the higher stability required under the HSDRRS design criteria). This would result in significant cost increases without additional benefits being accumulated.

Rock and stone - The Louisiana area has no rock sources. Historically, rock is barged from northern sources on the Mississippi River. This decision is based upon local knowledge and experience and is supported with cost quotes.

Equipment: Rates used are based from the latest USACE EP-1110-1-8, Region III. Adjustments are made for fuel, filters, oil, and grease (FOG) prices and facility capital cost of money (FCCM). Use of owned verses rental rates was considered based on small business, large business, and local equipment availability.

- Trucking: The estimate assumed independent self-employed trucking subcontractors due to the large numbers of trucks required.
- Dozers: dozers of the D-5/D-6 variety were chosen based on historical knowledge. Heavier equipment gets mired in the mud and soft soils.
- Severe Rates: Severe equipment rates were used where appropriate.

Fuel: Fuels (gasoline, on and off-road diesel) were based on local market averages for on-road and off-road. The USACE found that fuels fluctuate irrationally and used an average.

Crews: Major crew and productivity rates were developed and studied by senior USACE estimators familiar with the type of work. All of the work is typical to USACE. The crews and productivities were checked by local USACE estimators, discussions with contractors, and comparisons with historical cost data. Major crews include haul, earthwork, piling, concrete, and deep soil mixing.

Unit Prices: The unit prices found within the various project estimates will fluctuate within a range between similar construction units such as floodwall concrete, earthwork, and piling. Variances are a result of differing haul distances (trucked or barged), small or large business markups, subcontracted items, designs, and estimates by others.

Relocation Cost: Relocation costs are defined as the relocation of public roads, bridges, railroads, and utilities required for project purposes. Due to the limited time available for investigation, only pipeline utility costs were computed.

Mobilization: Contractor mobilization and demobilization are based on the assumption that many of the contractors will be coming from within a 500 mile radius. Based on historical studies, pre- Hurricane Katrina detailed Government estimates for mobilization averaged 4.9 to 5 percent of the construction costs. The estimate utilizes the approximately 5 percent value at each contract. The 5 percent value matches well with the 5 percent value prescribed by Walla Walla District, which has studied historical rates.

Field Office Overhead: The estimate used a field office overhead rate of 12 percent for the prime contractor at budget level development. Based on historical studies and experience, Walla Walla District has recommended typical rates ranging from 9 percent to 12 percent for large civil works projects. The 12 percent rate considers the possibility of maintenance and management of work camps and kitchens. The applied rates were previously discussed on similar projects among numerous USACE district cost engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans.

Overhead assumptions include: Superintendent, office manager, pickups, periodic travel, costs, communications, temporary offices (contractor and government), office furniture, office supplies, computers and software, as-built drawings and minor designs, tool trailers, staging setup, utility service, toilets, safety equipment, security and fencing, small hand and power tools, project signs, traffic control, surveys, temp fuel tank station, generators, compressors, lighting, and minor miscellaneous.

Home Office Overhead: Estimate percentages range based upon consideration of 8(a), small business and unrestricted prime contractors. The rates are based upon estimating and negotiating experience, and consultation with local construction representatives. Different percentages are used when considering the contract acquisition strategy regarding small business 8(a), competitive small business and large business, high to low respectively. The applied rates were previously discussed on similar projects among numerous USACE district

cost engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans.

Taxes: Local taxes will be applied, using an average between the parishes that contain the work. Reference the Louisiana parish tax rate website: http://www.laota.com/pta.htm

Bond: Bond is assumed 1 percent applied against the prime contractor, assuming large contracts. No differentiation was made between large and small businesses.

Contingency: An abbreviated cost risk analysis was performed with the USACE identifying associated risks with the estimated costs shown in the report. Through this analysis, a contingency for each alternative was identified. The contingency ranged from 25 percent for real estate costs to 46 percent for Alternative 3 construction costs. See the individual alternative cost tables for each alternative's calculated contingency.

E&D and S&A: USACE Costs to manage design (PED) and construction (S&A) are based on USACE Programmatic Cost Estimate guidance:

- Planning, Engineering & Design (PED): The PED cost includes such costs as project management, engineering, planning, designs, investigations, studies, reviews, value engineering, and engineering during construction (EDC). Historically, USACE has used an approximate 12 percent rate for E&D/EDC, plus 8 percent for other support features for a total of 20 percent. This percentage is applied against the estimated construction costs.
- Supervision & Administration (S&A): Historically, a range from 5 percent to 15 percent, depending on project size and type, applied against the estimated construction costs for USACE projects. Other USACE civil works districts such as St. Paul, Memphis, and St. Louis report values ranging from 7.5-10 percent. Consideration includes that a portion of the S&A effort could be performed by contractors. Currently, USACE utilizes an S&A rate of 9 percent for this type and size of project.

1.2.2 Structural Measures Cost Risk And Uncertainty

Emergent and forested wetlands were not accounted for in Real Estate costs.

Relocation costs are defined as the relocation of public roads, bridges, railroads, and utilities required for project purposes. Due to the limited time available for investigation, only pipeline utility costs were computed.

Foundation Design: No site specific boring data was available for this effort. Existing data in the vicinity was used to develop levee designs. One levee design was done for use in all new levee measures.

Structures: An effort was made to identify the major structures that would be required but it is possible that more structures would be needed.

Mitigation requirements not required.

A conservative estimate was assumed for Real Estate Requirements for all levee measures.

Pumping requirements used were considered minimal amounts. Actual requirements may be different. Additional drainage work may be needed to get the water to the pumping stations.

Levee alignments were developed using existing mapping. These preliminary alignments were used to develop cost estimates. Alignments may need to be shifted to avoid existing structures or for other reasons.

Quantities developed assume levee for the entirety of each alignment. There is a possibility that some reaches of floodwall may be needed in more developed areas.

Because no borrow sites have been identified, borrow was assumed to be available within a 20 mile radius. Borrow may be available at a closer distance.

The base estimate assumes open and competition bidding which is the traditional employed contract procurement method. However, often competition will be limited due to certain small groups of pre-approved contractors, or with the intent of improving overall quality of construction (best value procurements). The house elevating costs are based on the limited pool available in the Louisiana area, so some limited competition could be considered to already be built into the costs. There is a risk not knowing exact implementation plan could cause increased levels of tiered subcontracting and/or limit the pool of contractors.

Due to the extended period of completion there could be future design/technical changes to design criteria or hydraulic analysis that would result in increased requirements and cost.

One typical ROW width for Real Estate estimates was utilized for parametric cost estimates. This width will be used to develop a Real Estate estimate for measure and alternative alignment costs.

Use of limited data may result in under designing project features.

Future levee lifts were included in future with project cost estimates. All final array measures did not include straight O&M costs. Following TSP, develop O&M estimates for included project features. Costs may be underestimated leading to an unrealistic expectation by the Local Sponsor as to their requirements.

There is the potential for a high water event to occur during construction which could result in longer construction period and additional cost due to storm damage.

Engineering and cost estimates on structural project features were developed from other similar studies and constructed projects. Future lifts and OMRR&R estimate for the recommended plan will be further refined during feasibility level of design.

Borrow material was assumed that environmental resources investigations would allow for significant impacts to be avoided. Cost estimates assume 20 mile haul costs for source material. Source material distance may change. Investigations for environmental re- sources may result in an impact to project schedule during final design.

Change in USACE design guidance and or interpretation could result in redesign and/or reanalysis.

Using existing data including geotechnical and H&H from outside sources, data may be several years old and not representative of current conditions.

LOP raises affected structure foundations which would result in structures needing to be replaced in lieu of raising.

Unknown subsurface conditions, or assumptions based on regional data that may not represent conditions within project area

LSAC rating could change on levees within study area resulting in changes to risk or consequences

Seepage or stability berms may occur during study or in PED phase resulting in additional berms, increasing costs.

HTRW material may be within the project area and areas of levee alignment, resulting in increased costs.

Table M:1-1. Measure 7- Ring Levee 1 Cost Estimate (table indicates "Alternative 1," the Data Dhown is Correct for Measure 7, Ring Levee 1)

Alternative 1 - Ring Levee 1

Updated 14-Jan-20

Estimate of Probable Cost for Alternate 1

WBS	DESCRIPTION	COST	Contingency	Contingency Cost	TOTAL COST
01	Lands and Damges	$21,447,200	25%	$5,361,800	$26,809,000
02	Relocations	$11,632,000	40%	$4,652,800	$16,284,800
06	Fish and Wildlife Facilities	-			
11	Levees and Floodwalls	$340,484,000	40%	$136,193,600	$476,677,600
15	Floodway Control & Diversion Structure	$42,000,000	40%	$16,800,000	$58,800,000
18	Cultural Resource Preservation	-			
30	Planning, Engineering and Design (20%)	$78,824,000	40%	$31,529,600	$110,353,600
31	Construction Management (9%)	$35,471,000	40%	$14,188,400	$49,659,400
	TOTAL	$529,858,200		$208,726,200	$738,584,400

Table M:1-2. Measure 8- Ring Levee 2 Cost Estimate (table indicates "Alternative 2," the Data Shown is Correct for Measure 8, Ring Levee 2)

Alternative 2 - Ring Levee 2

Updated 14-Jan-20

Estimate of Probable Cost for Alternate 2

WBS	DESCRIPTION	COST	Contingency	Contingency Cost	TOTAL COST
01	Lands and Damges	$7,532,800	25%	$1,883,200	$9,416,000
02	Relocations	$18,343,000	42%	$7,704,060	$26,047,060
06	Fish and Wildlife Facilities	$19,450,000	42%	$8,169,000	$27,619,000
11	Levees and Floodwalls	$438,888,000	42%	$184,332,960	$623,220,960
15	Floodway Control & Diversion Structure	$87,750,000	42%	$36,855,000	$124,605,000
18	Cultural Resource Preservation	$520,000	42%	$218,400	$738,400
30	Planning, Engineering and Design (20%)	$112,991,000	42%	$47,456,220	$160,447,220
31	Construction Management (9%)	$50,846,000	42%	$21,355,320	$72,201,320
	TOTAL	$736,320,800		$307,974,160	$1,044,294,960

Table M:1-3. Measure 9- Ring Levee 3 Cost Estimates (table indicates "Alternative 3," the Data Shown is Correct for Measure 9, Ring Levee 3)

Alternative 3 - Ring Levee 3

Updated 14-Jan-20

Estimate of Probable Cost for Alternate 3

WBS	DESCRIPTION	COST	Contingency	Contingency Cost	TOTAL COST
01	Lands and Damges	$1,720,800	25%	$430,200	$2,151,000
02	Relocations	$21,536,000	46%	$9,906,560	$31,442,560
06	Fish and Wildlife Facilities	-			
11	Levees and Floodwalls	$128,429,000	46%	$59,077,340	$187,506,340
15	Floodway Control & Diversion Structure	$137,750,000	46%	$63,365,000	$201,115,000
18	Cultural Resource Preservation	-			
30	Planning, Engineering and Design (20%)	$57,543,000	46%	$26,469,780	$84,012,780
31	Construction Management (9%)	$25,895,000	46%	$11,911,700	$37,806,700
	TOTAL	$372,873,800		$171,160,580	$544,034,380

Table M:1-4. Measure 8 var. Ring Levee 1+2 Cost Estimate (table indicates "Alternative 4," the Data Shown is Correct for Measure 8 var., Ring Levee 1+2)

Alternative 4 - Ring Levee 1 + 2

Updated 14-Jan-20

Estimate of Probable Cost for Alternate 4

WBS	DESCRIPTION	COST	Contingency	Contingency Cost	TOTAL COST
01	Lands and Damges	$26,836,800	25%	$6,709,200	$33,546,000
02	Relocations	$25,319,000	38%	$9,621,220	$34,940,220
06	Fish and Wildlife Facilities	$16,309,000	38%	$6,197,420	$22,506,420
11	Levees and Floodwalls	$709,342,000	38%	$269,549,960	$978,891,960
15	Floodway Control & Diversion Structure	$125,000,000	38%	$47,500,000	$172,500,000
18	Cultural Resource Preservation	$114,675,000	38%	$43,576,500	$158,251,500
30	Planning, Engineering and Design (20%)	$198,129,000	38%	$75,289,020	$273,418,020
31	Construction Management (9%)	$89,159,000	38%	$33,880,420	$123,039,420
	TOTAL	$1,304,769,800		$492,323,740	$1,797,093,540

Table M:1-5. Measure 5- Levees West of Berwick Cost Estimate (table indicates "Alternative 5," the Data Shown is Correct for Measure 5, Levees West of Berwick)

Alternative 5 - Ex-1, Berwick Levee Raises

Updated 14-Jan-20

Estimate of Probable Cost for Alternate 5

WBS	DESCRIPTION	COST	Contingency	Contingency Cost	TOTAL COST
01	Lands and Damges	$1,248,000	25%	$312,000	$1,560,000
02	Relocations	$3,324,000	38%	$1,263,120	$4,587,120
06	Fish and Wildlife Facilities	$923,000	38%	$350,740	$1,273,740
11	Levees and Floodwalls	$105,903,000	38%	$40,243,140	$146,146,140
18	Cultural Resource Preservation	$100,000	38%	$38,000	$138,000
30	Planning, Engineering and Design (20%)	$20,192,000	38%	$7,672,960	$27,864,960
31	Construction Management (9%)	$9,087,000	38%	$3,453,060	$12,540,060
	TOTAL	$140,777,000		$53,333,020	$194,110,020

Table M:1-6. Measure 6- Morgan City Cost Estimate (table indicates "Alternative 6," the Data Shown is Correct for Measure 6, Morgan City Levee)

Alternative 6 - Ex-1, Morgan City Levee Raise

Updated 14-Jan-20

Estimate of Probable Cost for Alternate 2

WBS	DESCRIPTION	COST	Contingency	Contingency Cost	TOTAL COST
01	Lands and Damges	$672,800	25%	$168,200	$841,000
02	Relocations	-			
06	Fish and Wildlife Facilities	-			
11	Levees and Floodwalls	$32,515,000	45%	$14,631,750	$47,146,750
15	Floodway Control & Diversion Structure	$30,000,000	45%	$13,500,000	$43,500,000
18	Cultural Resource Preservation	$195,000	45%	$87,750	$282,750
30	Planning, Engineering and Design (20%)	$12,542,000	45%	$5,643,900	$18,185,900
31	Construction Management (9%)	$5,644,000	45%	$2,539,800	$8,183,800
	TOTAL	$81,568,800			$118,140,200

Table M:1-7. PRA/B-1 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary PrA/B-1								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	PrA/B-1						
0.2	Parish	Iberia						
0.3	Updated Reach Length	31,229	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$18,106,122	$4,526,530	$22,632,652	**$43,524,331**
1.2	Permitting			1.0%	$2,785,557	$696,389	$3,481,946	
1.3	Construction Management			5.0%	$13,927,786	$3,481,946	$17,409,732	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	395	ft.					**$25,649,803**
	Width: Levee Surface	133	ft.					
	Height	19.0	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	283	Ac	$4,293	$1,215,815	$303,954	$1,519,769	
2.3	Local Borrow Fill	1,390,860	CY	$14	$18,934,249	$4,733,562	$23,667,811	
2.4	Fertilize, Seed & Mulch	95	Ac	$3,875	$369,778	$92,445	$462,223	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	3	EA	$2,263,115	$6,789,346	$1,697,337	$8,486,683	**$8,486,683**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	7	LS	$211,530	$1,480,713	$370,178	$1,850,891	**$1,850,891**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	11,050	CFS	$15,812	$174,727,851	$43,681,963	$218,409,814	**$218,409,814**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	2	LS	$11,100,108	$22,200,216	$5,550,054	$27,750,270	**$62,027,089**
10.2	110' Barge Gates	1	LS	$27,421,455	$27,421,455	$6,855,364	$34,276,819	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	283	Ac	$5,000	$1,415,900	$353,975	$1,769,875	**$3,063,677**
11.2	Title Research and Legal Proceedings	5.9	Mi	$175,000	$1,035,042	$258,760	$1,293,802	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	57	Ac	$232,474	$13,309,615	$3,327,404	$16,637,018	**$28,706,693**
12.2	Emergent Wetlands	114	Ac	$84,403	$9,655,740	$2,413,935	$12,069,674	

Itemized Cost Summary PrA/B-1								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	214	ft.					**$4,765,547**
	Width: Levee Surface	137	ft.					
	Height	19.5	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	252,145	CY	$14	$3,432,541	$858,135	$4,290,677	
13.2	Fertilize, Seed & Mulch	98	Ac	$3,875	$379,897	$94,974	$474,871	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	215	ft.					**$1,527,960**
	Width: Levee Surface	148	ft.					
	Height	21.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	59,656	CY	$14	$812,116	$203,029	$1,015,146	
14.2	Fertilize, Seed & Mulch	106	Ac	$3,875	$410,252	$102,563	$512,815	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	283	Ac/yr	$157	$2,224,052	$556,013	$2,780,065	**$35,295,004**
15.2	Gate Maintenance	3	EA/yr	$73,303	$10,995,390.00	$2,748,848	$13,744,238	
15.3	Pump Station Maintenance	3	EA/yr	$100,110	$15,016,561.20	$3,754,140	$18,770,702	
	Total Cost				**$346,645,994**	**$86,661,499**	**$433,307,493**	**$433,307,493**

Table M:1-8. PRA/B-2 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary PrA/B-2								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	PrA/B-2						
0.2	Parish	Iberia						
0.3	Updated Reach Length	13,993	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$2,555,742	$638,936	$3,194,678	**$6,143,611**
1.2	Permitting			1.0%	$393,191	$98,298	$491,489	
1.3	Construction Management			5.0%	$1,965,956	$491,489	$2,457,444	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	349	ft.					**$8,330,859**
	Width: Levee Surface	111	ft.					
	Height	16.5	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	112	Ac	$4,293	$480,659	$120,165	$600,824	
2.3	Local Borrow Fill	444,089	CY	$14	$6,045,538	$1,511,385	$7,556,923	
2.4	Fertilize, Seed & Mulch	36	Ac	$3,875	$138,490	$34,622	$173,112	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	9	EA	$2,263,115	$20,368,038	$5,092,010	$25,460,048	**$25,460,048**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	1	LS	$6,178,362	$6,178,362	$1,544,591	$7,722,953	**$7,722,953**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	6	LS	$211,530	$1,269,182	$317,296	$1,586,478	**$1,586,478**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	112	Ac	$5,000	$559,760	$139,940	$699,700	**$1,279,438**
11.2	Title Research and Legal Proceedings	2.7	Mi	$175,000	$463,790	$115,948	$579,738	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	15	Ac	$232,474	$3,424,668	$856,167	$4,280,835	**$4,769,115**

Itemized Cost Summary PrA/B-2								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.2	Emergent Wetlands	5	Ac	$84,403	$390,624	$97,656	$488,280	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	188	ft.					**$664,538**
	Width: Levee Surface	114	ft.					
	Height	16.9	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	28,613	CY	$14	$389,513	$97,378	$486,892	
13.2	Fertilize, Seed & Mulch	37	Ac	$3,875	$142,117	$35,529	$177,646	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	189	ft.					**$1,740,218**
	Width: Levee Surface	122	ft.					
	Height	18.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	91,093	CY	$14	$1,240,083	$310,021	$1,550,104	
14.2	Fertilize, Seed & Mulch	39	Ac	$3,875	$152,092	$38,023	$190,114	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	112	Ac/yr	$157	$879,254	$219,813	$1,099,067	**$5,680,480**
15.2	Gate Maintenance	1	EA/yr	$73,303	$3,665,130.00	$916,283	$4,581,413	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$50,702,189**	**$12,675,547**	**$63,377,737**	**$63,377,737**

Table M:1-9. PRA/B-3 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary PrA/B-3								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	PrA/B-3						
0.2	Parish	Iberia						
0.3	Updated Reach Length	32,810	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$13,803,237	$3,450,809	$17,254,046	**$33,180,858**
1.2	Permitting			1.0%	$2,123,575	$530,894	$2,654,469	
1.3	Construction Management			5.0%	$10,617,875	$2,654,469	$13,272,343	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	334	ft.					**$17,775,843**
	Width: Levee Surface	103	ft.					
	Height	15.5	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	252	Ac	$4,293	$1,080,112	$270,028	$1,350,140	
2.3	Local Borrow Fill	943,136	CY	$14	$12,839,233	$3,209,808	$16,049,041	
2.4	Fertilize, Seed & Mulch	78	Ac	$3,875	$301,330	$75,333	$376,663	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	12	EA	$2,263,115	$27,157,385	$6,789,346	$33,946,731	**$33,946,731**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	1	LS	$6,178,362	$6,178,362	$1,544,591	$7,722,953	**$7,722,953**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	10	LS	$211,530	$2,115,304	$528,826	$2,644,130	**$2,644,130**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	5,200	CFS	$15,812	$82,224,574	$20,556,143	$102,780,717	**$102,780,717**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	1	LS	$11,100,108	$11,100,108	$2,775,027	$13,875,135	**$75,573,410**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	1	LS	$49,358,620	$49,358,620	$12,339,655	$61,698,275	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	252	Ac	$5,000	$1,257,864	$314,466	$1,572,330	**$2,931,643**
11.2	Title Research and Legal Proceedings	6.2	Mi	$175,000	$1,087,451	$271,863	$1,359,313	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	72	Ac	$232,474	$16,691,054	$4,172,763	$20,863,817	**$22,071,439**

Itemized Cost Summary
PrA/B-3

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.2	Emergent Wetlands	11	Ac	$84,403	$966,097	$241,524	$1,207,621	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	182	ft.					**$1,440,871**
	Width: Levee Surface	107	ft.					
	Height	16.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demob*						
13.1	Opposite Cast	61,758	CY	$14	$840,736	$210,184	$1,050,920	
13.2	Fertilize, Seed & Mulch	81	Ac	$3,875	$311,961	$77,990	$389,951	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	184	ft.					**$3,801,543**
	Width: Levee Surface	118	ft.					
	Height	17.5	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demob*						
14.1	Opposite Cast	198,143	CY	$14	$2,697,382	$674,345	$3,371,727	
14.2	Fertilize, Seed & Mulch	89	Ac	$3,875	$343,853	$85,963	$429,816	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	252	Ac/yr	$157	$1,975,814	$493,954	$2,469,768	**$22,470,906**
15.2	Gate Maintenance	3	EA/yr	$73,303	$10,995,390.00	$2,748,848	$13,744,238	
15.3	Pump Station Maintenance	1	EA/yr	$100,110	$5,005,520.40	$1,251,380	$6,256,901	
	Total Cost				**$261,072,834**	**$65,268,208**	**$326,341,042**	**$326,341,042**

Table M:1-10. PRA/B-4 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary PrA/B-4								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	PrA/B-4						
0.2	Parish	Iberia						
0.3	Updated Reach Length	25,629	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$8,122,850	$2,030,713	$10,153,563	**$19,526,082**
1.2	Permitting			1.0%	$1,249,669	$312,417	$1,562,087	
1.3	Construction Management			5.0%	$6,248,346	$1,562,087	$7,810,433	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	341	ft.					**$13,359,511**
	Width: Levee Surface	100	ft.					
	Height	14.7	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	201	Ac	$4,293	$861,410	$215,352	$1,076,762	
2.3	Local Borrow Fill	705,126	CY	$14	$9,599,120	$2,399,780	$11,998,900	
2.4	Fertilize, Seed & Mulch	59	Ac	$3,875	$227,079	$56,770	$283,849	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	17	EA	$2,263,115	$38,472,961	$9,618,240	$48,091,202	**$48,091,202**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	2	LS	$211,530	$423,061	$105,765	$528,826	**$528,826**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	2,419	CFS	$15,812	$38,252,769	$9,563,192	$47,815,961	**$47,815,961**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	2	LS	$11,100,108	$22,200,216	$5,550,054	$27,750,270	**$27,750,270**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	201	Ac	$5,000	$1,003,170	$250,793	$1,253,963	**$2,315,788**
11.2	Title Research and Legal Proceedings	4.9	Mi	$175,000	$849,460	$212,365	$1,061,824	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	42	Ac	$232,474	$9,712,032	$2,428,008	$12,140,040	**$16,347,096**

Itemized Cost Summary PrA/B-4								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.2	Emergent Wetlands	40	Ac	$84,403	$3,365,645	$841,411	$4,207,056	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	186	ft.					**$1,916,487**
	Width: Levee Surface	106	ft.					
	Height	15.6	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	94,845	CY	$14	$1,291,163	$322,791	$1,613,953	
13.2	Fertilize, Seed & Mulch	62	Ac	$3,875	$242,027	$60,507	$302,533	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	186	ft.					**$2,959,610**
	Width: Levee Surface	116	ft.					
	Height	17.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	154,437	CY	$14	$2,102,410	$525,602	$2,628,012	
14.2	Fertilize, Seed & Mulch	68	Ac	$3,875	$265,278	$66,320	$331,598	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	201	Ac/yr	$157	$1,575,750	$393,937	$1,969,687	**$17,389,412**
15.2	Gate Maintenance	2	EA/yr	$73,303	$7,330,260.00	$1,832,565	$9,162,825	
15.3	Pump Station Maintenance	1	EA/yr	$100,110	$5,005,520.40	$1,251,380	$6,256,901	
	Total Cost				**$158,400,196**	**$39,600,049**	**$198,000,245**	**$198,000,245**

Table M:1-11. PRA-4 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary PrA-4								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
0	**Reach Characteristics**							
0.1	Reach Name	PrA-4						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	56,907	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$5,279,613	$1,319,903	$6,599,517	**$12,691,378**
1.2	Permitting			1.0%	$812,248	$203,062	$1,015,310	
1.3	Construction Management			5.0%	$4,061,241	$1,015,310	$5,076,551	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	333	ft.					**$24,311,672**
	Width: Levee Surface	92	ft.					
	Height	13.5	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	434	Ac	$4,293	$1,864,985	$466,246	$2,331,232	
2.3	Local Borrow Fill	1,257,372	CY	$14	$17,117,026	$4,279,257	$21,396,283	
2.4	Fertilize, Seed & Mulch	121	Ac	$3,875	$467,326	$116,832	$584,158	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	8	EA	$2,263,115	$18,104,923	$4,526,231	$22,631,154	**$22,631,154**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	1	LS	$6,178,362	$6,178,362	$1,544,591	$7,722,953	**$7,722,953**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	1	LS	$4,921,746	$4,921,746	$1,230,437	$6,152,183	**$6,152,183**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	12	LS	$211,530	$2,538,364	$634,591	$3,172,955	**$3,172,955**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	790	CFS	$15,812	$12,491,810	$3,122,953	$15,614,763	**$15,614,763**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	434	Ac	$5,000	$2,171,903	$542,976	$2,714,879	**$5,072,538**
11.2	Title Research and Legal Proceedings	10.8	Mi	$175,000	$1,886,128	$471,532	$2,357,660	
12	**Mitigation Acreages**							**Sum Mitigation**

Itemized Cost Summary
PrA-4

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.1	Forested Wetlands	51	Ac	$232,474	$11,921,495	$2,980,374	$14,901,869	**$16,852,810**
12.2	Emergent Wetlands	18	Ac	$84,403	$1,560,753	$390,188	$1,950,941	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	179	ft.					**$3,895,375**
	Width: Levee Surface	100	ft.					
	Height	14.5	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	191,878	CY	$14	$2,612,097	$653,024	$3,265,121	
13.2	Fertilize, Seed & Mulch	130	Ac	$3,875	$504,203	$126,051	$630,254	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	183	ft.					**$8,011,097**
	Width: Levee Surface	114	ft.					
	Height	16.5	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	428,324	CY	$14	$5,830,921	$1,457,730	$7,288,651	
14.2	Fertilize, Seed & Mulch	149	Ac	$3,875	$577,957	$144,489	$722,446	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	434	Ac/yr	$157	$3,411,559	$852,890	$4,264,448	**$19,684,174**
15.2	Gate Maintenance	2	EA/yr	$73,303	$7,330,260.00	$1,832,565	$9,162,825	
15.3	Pump Station Maintenance	1	EA/yr	$100,110	$5,005,520.40	$1,251,380	$6,256,901	
	Total Cost				**$116,650,441**	**$29,162,610**	**$145,813,051**	**$145,813,051**

Table M:1-12. PRA-5 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary PrA-5								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
0	**Reach Characteristics**							
0.1	Reach Name	PrA-5						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	29,791	ft.					
0.4	Conversion factor	43,560	ft^2/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$3,134,924	$783,731	$3,918,655	**$7,535,876**
1.2	Permitting			1.0%	$482,296	$120,574	$602,870	
1.3	Construction Management			5.0%	$2,411,480	$602,870	$3,014,350	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	365	ft.					**$18,851,051**
	Width: Levee Surface	111	ft.					
	Height	16.0	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	249	Ac	$4,293	$1,070,286	$267,572	$1,337,858	
2.3	Local Borrow Fill	1,007,662	CY	$14	$13,717,645	$3,429,411	$17,147,056	
2.4	Fertilize, Seed & Mulch	76	Ac	$3,875	$292,909	$73,227	$366,137	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	3	EA	$2,263,115	$6,789,346	$1,697,337	$8,486,683	**$8,486,683**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	1	LS	$6,178,362	$6,178,362	$1,544,591	$7,722,953	**$7,722,953**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	5	LS	$211,530	$1,057,652	$264,413	$1,322,065	**$1,322,065**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	249	Ac	$5,000	$1,246,421	$311,605	$1,558,027	**$2,792,267**
11.2	Title Research and Legal Proceedings	5.6	Mi	$175,000	$987,392	$246,848	$1,234,240	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	52	Ac	$232,474	$12,099,213	$3,024,803	$15,124,016	**$21,111,987**
12.2	Emergent Wetlands	57	Ac	$84,403	$4,790,377	$1,197,594	$5,987,971	

Itemized Cost Summary PrA-5								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	199	ft.					**$1,412,194**
	Width: Levee Surface	114	ft.					
	Height	16.5	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	60,763	CY	$14	$827,193	$206,798	$1,033,992	
13.2	Fertilize, Seed & Mulch	78	Ac	$3,875	$302,562	$75,640	$378,202	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	200	ft.					**$3,679,965**
	Width: Levee Surface	125	ft.					
	Height	18.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	191,904	CY	$14	$2,612,452	$653,113	$3,265,565	
14.2	Fertilize, Seed & Mulch	86	Ac	$3,875	$331,519	$82,880	$414,399	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	249	Ac/yr	$157	$1,957,841	$489,460	$2,447,301	**$7,028,713**
15.2	Gate Maintenance	1	EA/yr	$73,303	$3,665,130.00	$916,283	$4,581,413	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$63,955,002**	**$15,988,750**	**$79,943,752**	**$79,943,752**

Table M:1-13. PRA-6 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary PrA-6								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	PrA-6						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	57,051	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$14,305,602	$3,576,401	$17,882,003	**$34,388,467**
1.2	Permitting			1.0%	$2,200,862	$550,215	$2,751,077	
1.3	Construction Management			5.0%	$11,004,309	$2,751,077	$13,755,387	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	337	ft.					**$24,185,570**
	Width: Levee Surface	90	ft.					
	Height	13.2	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	441	Ac	$4,293	$1,895,006	$473,751	$2,368,757	
2.3	Local Borrow Fill	1,248,484	CY	$14	$16,996,034	$4,249,008	$21,245,042	
2.4	Fertilize, Seed & Mulch	118	Ac	$3,875	$457,417	$114,354	$571,771	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	16	EA	$2,263,115	$36,209,846	$9,052,462	$45,262,308	**$45,262,308**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	2	LS	$4,921,746	$9,843,492	$2,460,873	$12,304,365	**$12,304,365**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	13	LS	$211,530	$2,749,895	$687,474	$3,437,368	**$3,437,368**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	6,442	CFS	$15,812	$101,865,178	$25,466,294	$127,331,472	**$127,331,472**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	1	LS	$11,100,108	$11,100,108	$2,775,027	$13,875,135	**$48,151,954**
10.2	110' Barge Gates	1	LS	$27,421,455	$27,421,455	$6,855,364	$34,276,819	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	441	Ac	$5,000	$2,206,863	$551,716	$2,758,579	**$5,122,201**
11.2	Title Research and Legal Proceedings	10.8	Mi	$175,000	$1,890,897	$472,724	$2,363,621	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	27	Ac	$232,474	$6,234,529	$1,558,632	$7,793,161	**$9,312,497**

Itemized Cost Summary
PrA-6

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.2	Emergent Wetlands	14	Ac	$84,403	$1,215,469	$303,867	$1,519,336	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	177	ft.					**$5,489,142**
	Width: Levee Surface	92	ft.					
	Height	13.4	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	288,430	CY	$14	$3,926,502	$981,626	$4,908,128	
13.2	Fertilize, Seed & Mulch	120	Ac	$3,875	$464,811	$116,203	$581,014	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	177	ft.					**$4,235,720**
	Width: Levee Surface	103	ft.					
	Height	15.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	210,427	CY	$14	$2,864,613	$716,153	$3,580,766	
14.2	Fertilize, Seed & Mulch	135	Ac	$3,875	$523,963	$130,991	$654,954	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	441	Ac/yr	$157	$3,466,474	$866,618	$4,333,092	**$35,172,543**
15.2	Gate Maintenance	4	EA/yr	$73,303	$14,660,520.00	$3,665,130	$18,325,650	
15.3	Pump Station Maintenance	2	EA/yr	$100,110	$10,011,040.80	$2,502,760	$12,513,801	
	Total Cost				**$283,514,885**	**$70,878,721**	**$354,393,607**	**$354,393,607**

Table M:1-14. PRB-4 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary
PrB-4

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
0	**Reach Characteristics**							
0.1	Reach Name	PrB-4						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	25,707	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$2,537,177	$634,294	$3,171,471	**$6,098,983**
1.2	Permitting			1.0%	$390,335	$97,584	$487,919	
1.3	Construction Management			5.0%	$1,951,675	$487,919	$2,439,593	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	341	ft.					**$13,400,129**
	Width: Levee Surface	100	ft.					
	Height	14.7	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demob*						
2.2	Clearing & Grubbing	201	Ac	$4,293	$864,029	$216,007	$1,080,036	
2.3	Local Borrow Fill	707,270	CY	$14	$9,628,305	$2,407,076	$12,035,381	
2.4	Fertilize, Seed & Mulch	59	Ac	$3,875	$227,770	$56,942	$284,712	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	6	EA	$2,263,115	$13,578,692	$3,394,673	$16,973,365	**$16,973,365**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	1	LS	$6,178,362	$6,178,362	$1,544,591	$7,722,953	**$7,722,953**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	6	LS	$211,530	$1,269,182	$317,296	$1,586,478	**$1,586,478**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	90	CFS	$15,812	$1,428,652	$357,163	$1,785,815	**$1,785,815**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	201	Ac	$5,000	$1,006,221	$251,555	$1,257,776	**$2,322,829**
11.2	Title Research and Legal Proceedings	4.9	Mi	$175,000	$852,042	$213,011	$1,065,053	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	14	Ac	$232,474	$3,208,525	$802,131	$4,010,656	**$5,000,295**

Itemized Cost Summary
PrB-4

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.2	Emergent Wetlands	9	Ac	$84,403	$791,711	$197,928	$989,639	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	186	ft.					**$1,922,314**
	Width: Levee Surface	106	ft.					
	Height	15.6	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	95,134	CY	$14	$1,295,088	$323,772	$1,618,861	
13.2	Fertilize, Seed & Mulch	63	Ac	$3,875	$242,762	$60,691	$303,453	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	186	ft.					**$2,968,609**
	Width: Levee Surface	116	ft.					
	Height	17.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	154,907	CY	$14	$2,108,802	$527,201	$2,636,003	
14.2	Fertilize, Seed & Mulch	69	Ac	$3,875	$266,085	$66,521	$332,606	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	201	Ac/yr	$157	$1,580,540	$395,135	$1,975,676	**$12,813,989**
15.2	Gate Maintenance	1	EA/yr	$73,303	$3,665,130.00	$916,283	$4,581,413	
15.3	Pump Station Maintenance	1	EA/yr	$100,110	$5,005,520.40	$1,251,380	$6,256,901	
	Total Cost				**$58,076,606**	**$14,519,151**	**$72,595,757**	**$72,595,757**

Table M:1-15. PRB-5 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary
PrB-5

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
0	**Reach Characteristics**							
0.1	Reach Name	PrB-5						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	38,640	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$13,217,813	$3,304,453	$16,522,266	**$31,773,589**
1.2	Permitting			1.0%	$2,033,510	$508,377	$2,541,887	
1.3	Construction Management			5.0%	$10,167,548	$2,541,887	$12,709,436	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	322	ft.					**$16,677,711**
	Width: Levee Surface	90	ft.					
	Height	13.2	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	286	Ac	$4,293	$1,226,337	$306,584	$1,532,921	
2.3	Local Borrow Fill	867,240	CY	$14	$11,806,029	$2,951,507	$14,757,536	
2.4	Fertilize, Seed & Mulch	80	Ac	$3,875	$309,803	$77,451	$387,254	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	16	EA	$2,263,115	$36,209,846	$9,052,462	$45,262,308	**$45,262,308**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	1	LS	$4,921,746	$4,921,746	$1,230,437	$6,152,183	**$6,152,183**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	8	LS	$211,530	$1,692,243	$423,061	$2,115,304	**$2,115,304**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	6,442	CFS	$15,812	$101,865,178	$25,466,294	$127,331,472	**$127,331,472**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	1	LS	$11,100,108	$11,100,108	$2,775,027	$13,875,135	**$48,151,954**
10.2	110' Barge Gates	1	LS	$27,421,455	$27,421,455	$6,855,364	$34,276,819	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	286	Ac	$5,000	$1,428,153	$357,038	$1,785,191	**$3,386,043**
11.2	Title Research and Legal Proceedings	7.3	Mi	$175,000	$1,280,682	$320,170	$1,600,852	
12	**Mitigation Acreages**							**Sum Mitigation**

Itemized Cost Summary PrB-5								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
12.1	Forested Wetlands	13	Ac	$232,474	$3,069,233	$767,308	$3,836,541	**$5,111,737**
12.2	Emergent Wetlands	12	Ac	$84,403	$1,020,157	$255,039	$1,275,196	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	177	ft.					**$3,735,379**
	Width: Levee Surface	92	ft.					
	Height	13.4	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demob*						
13.1	Opposite Cast	196,388	CY	$14	$2,673,492	$668,373	$3,341,865	
13.2	Fertilize, Seed & Mulch	81	Ac	$3,875	$314,811	$78,703	$393,513	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	177	ft.					**$2,877,073**
	Width: Levee Surface	103	ft.					
	Height	15.0	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demob*						
14.1	Opposite Cast	143,006	CY	$14	$1,946,785	$486,696	$2,433,481	
14.2	Fertilize, Seed & Mulch	92	Ac	$3,875	$354,874	$88,718	$443,592	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	286	Ac/yr	$157	$2,243,299	$560,825	$2,804,124	**$29,062,162**
15.2	Gate Maintenance	3	EA/yr	$73,303	$10,995,390.00	$2,748,848	$13,744,238	
15.3	Pump Station Maintenance	2	EA/yr	$100,110	$10,011,040.80	$2,502,760	$12,513,801	
	Total Cost				**$257,309,531**	**$64,327,383**	**$321,636,914**	**$321,636,914**

Table M:1-16. EX2 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary Ex-2								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	Ex-2						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	30,320	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$2,315,098	$578,775	$2,893,873	**$5,565,140**
1.2	Permitting			1.0%	$356,169	$89,042	$445,211	
1.3	Construction Management			5.0%	$1,780,845	$445,211	$2,226,056	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	101	ft.					**$15,143,623**
	Width: Levee Surface	105	ft.					
	Height	13.0	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	0	Ac	$4,293	$0	$0	$0	
2.3	Local Borrow Fill	418,496	CY	$28	$11,832,502	$2,958,126	$14,790,628	
2.4	Fertilize, Seed & Mulch	73	Ac	$3,875	$282,396	$70,599	$352,995	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	0	EA	$2,263,115	$0	$0	$0	**$0**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	0	LS	$211,530	$0	$0	$0	**$0**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	850	LF	$25,132	$21,362,472	$5,340,618	$26,703,090	**$26,703,090**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	70	Ac	$5,000	$351,511	$87,878	$439,389	**$1,695,563**
11.2	Title Research and Legal Proceedings	5.7	Mi	$175,000	$1,004,940	$251,235	$1,256,175	
12	**Mitigation Acreages**							**Sum Mitigation**

Itemized Cost Summary Ex-2								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
12.1	Forested Wetlands	3	Ac	$232,474	$605,201	$151,300	$756,501	**$978,843**
12.2	Emergent Wetlands	2	Ac	$84,403	$177,873	$44,468	$222,342	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	0	CY	$28	$0	$0	$0	
13.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	0	CY	$28	$0	$0	$0	
14.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	70	Ac/yr	$157	$552,143	$138,036	$690,179	**$690,179**
15.2	Gate Maintenance	0	EA/yr	$73,303	$0.00	$0	$0	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$40,621,150**	**$10,155,288**	**$50,776,438**	**$50,776,438**

Table M:1-17. EX3 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary

Ex-3

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
0	**Reach Characteristics**							
0.1	Reach Name	Ex-3						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	30,772	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$1,477,168	$369,292	$1,846,460	**$3,550,884**
1.2	Permitting			1.0%	$227,257	$56,814	$284,071	
1.3	Construction Management			5.0%	$1,136,283	$284,071	$1,420,354	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	115	ft.					**$17,519,254**
	Width: Levee Surface	119	ft.					
	Height	15.0	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demob*						
2.2	Clearing & Grubbing	0	Ac	$4,293	$0	$0	$0	
2.3	Local Borrow Fill	484,155	CY	$28	$13,688,921	$3,422,230	$17,111,152	
2.4	Fertilize, Seed & Mulch	84	Ac	$3,875	$326,482	$81,620	$408,102	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	0	EA	$2,263,115	$0	$0	$0	**$0**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	0	LS	$211,530	$0	$0	$0	**$0**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	250	LF	$25,132	$6,283,080	$1,570,770	$7,853,850	**$7,853,850**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	81	Ac	$5,000	$406,194	$101,548	$507,742	**$1,782,618**
11.2	Title Research and Legal Proceedings	5.8	Mi	$175,000	$1,019,901	$254,975	$1,274,876	
12	**Mitigation Acreages**							**Sum Mitigation**

Itemized Cost Summary
Ex-3

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.1	Forested Wetlands	4	Ac	$232,474	$898,195	$224,549	$1,122,744	**$1,251,353**
12.2	Emergent Wetlands	1	Ac	$84,403	$102,888	$25,722	$128,609	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	0	CY	$28	$0	$0	$0	
13.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	0	CY	$28	$0	$0	$0	
14.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	81	Ac/yr	$157	$638,037	$159,509	$797,546	**$797,546**
15.2	Gate Maintenance	0	EA/yr	$73,303	$0.00	$0	$0	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$26,204,404**	**$6,551,101**	**$32,755,505**	**$32,755,505**

Table M:1-18. EX4 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary Ex-4								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	Ex-4						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	17,368	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$1,678,605	$419,651	$2,098,257	**$4,035,109**
1.2	Permitting			1.0%	$258,247	$64,562	$322,809	
1.3	Construction Management			5.0%	$1,291,235	$322,809	$1,614,044	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	143	ft.					**$22,586,055**
	Width: Levee Surface	148	ft.					
	Height	19.0	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	0	Ac	$4,293	$0	$0	$0	
2.3	Local Borrow Fill	630,956	CY	$28	$17,839,556	$4,459,889	$22,299,445	
2.4	Fertilize, Seed & Mulch	59	Ac	$3,875	$229,288	$57,322	$286,610	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	0	EA	$2,263,115	$0	$0	$0	**$0**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	0	LS	$211,530	$0	$0	$0	**$0**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	250	LF	$25,132	$6,283,080	$1,570,770	$7,853,850	**$7,853,850**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	57	Ac	$5,000	$285,079	$71,270	$356,348	**$1,075,898**
11.2	Title Research and Legal Proceedings	3.3	Mi	$175,000	$575,640	$143,910	$719,550	
12	**Mitigation Acreages**							**Sum Mitigation**

Itemized Cost Summary Ex-4								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
12.1	Forested Wetlands	2	Ac	$232,474	$528,350	$132,087	$660,437	**$765,069**
12.2	Emergent Wetlands	1	Ac	$84,403	$83,705	$20,926	$104,631	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	0	CY	$28	$0	$0	$0	
13.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	0	CY	$28	$0	$0	$0	
14.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	57	Ac/yr	$157	$447,793	$111,948	$559,741	**$559,741**
15.2	Gate Maintenance	0	EA/yr	$73,303	$0.00	$0	$0	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$29,500,577**	**$7,375,144**	**$36,875,722**	**$36,875,722**

Table M:1-19. EX5 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary Ex-5								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	Ex-5						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	19,701	ft.					
0.4	Conversion factor	43,560	ft^2/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$1,611,822	$402,956	$2,014,778	**$3,874,573**
1.2	Permitting			1.0%	$247,973	$61,993	$309,966	
1.3	Construction Management			5.0%	$1,239,863	$309,966	$1,549,829	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	133	ft.					**$21,641,900**
	Width: Levee Surface	137	ft.					
	Height	17.5	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	0	Ac	$4,293	$0	$0	$0	
2.3	Local Borrow Fill	603,829	CY	$28	$17,072,580	$4,268,145	$21,340,724	
2.4	Fertilize, Seed & Mulch	62	Ac	$3,875	$240,940	$60,235	$301,176	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	0	EA	$2,263,115	$0	$0	$0	**$0**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	1	LS	$6,178,362	$6,178,362	$1,544,591	$7,722,953	**$7,722,953**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	0	LS	$211,530	$0	$0	$0	**$0**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	60	Ac	$5,000	$299,632	$74,908	$374,540	**$1,190,755**
11.2	Title Research and Legal Proceedings	3.7	Mi	$175,000	$652,972	$163,243	$816,215	
12	**Mitigation Acreages**							**Sum Mitigation**

Itemized Cost Summary
Ex-5

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.1	Forested Wetlands	0	Ac	$232,474	$52,835	$13,209	$66,044	**$440,973**
12.2	Emergent Wetlands	4	Ac	$84,403	$299,944	$74,986	$374,929	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	0	CY	$28	$0	$0	$0	
13.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	0	CY	$28	$0	$0	$0	
14.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	60	Ac/yr	$157	$470,653	$117,663	$588,316	**$5,169,729**
15.2	Gate Maintenance	1	EA/yr	$73,303	$3,665,130.00	$916,283	$4,581,413	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$32,032,706**	**$8,008,176**	**$40,040,882**	**$40,040,882**

Table M:1-20. EX6 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary Ex-6								
Item No.	**Item Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**	**25% Contingency**	**Total with Contingency**	**Subtotals**
0	**Reach Characteristics**							
0.1	Reach Name	Ex-6						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	27,555	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$656,260	$164,065	$820,325	**$1,577,549**
1.2	Permitting			1.0%	$100,963	$25,241	$126,204	
1.3	Construction Management			5.0%	$504,816	$126,204	$631,019	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	112	ft.					**$10,360,241**
	Width: Levee Surface	116	ft.					
	Height	14.5	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	0	Ac	$4,293	$0	$0	$0	
2.3	Local Borrow Fill	283,116	CY	$28	$8,004,770	$2,001,193	$10,005,963	
2.4	Fertilize, Seed & Mulch	73	Ac	$3,875	$283,423	$70,856	$354,278	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	0	EA	$2,263,115	$0	$0	$0	**$0**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	0	LF	$8,377	$0	$0	$0	**$0**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	0	LS	$211,530	$0	$0	$0	**$0**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	0	LF	$25,132	$0	$0	$0	**$0**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	71	Ac	$5,000	$352,660	$88,165	$440,824	**$1,582,422**
11.2	Title Research and Legal Proceedings	5.2	Mi	$175,000	$913,278	$228,320	$1,141,598	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	2	Ac	$232,474	$451,499	$112,875	$564,374	**$677,725**

Itemized Cost Summary
Ex-6

Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
12.2	Emergent Wetlands	1	Ac	$84,403	$90,681	$22,670	$113,351	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	0	CY	$28	$0	$0	$0	
13.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	0	CY	$28	$0	$0	$0	
14.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	71	Ac/yr	$157	$553,947	$138,487	$692,434	**$692,434**
15.2	Gate Maintenance	0	EA/yr	$73,303	$0.00	$0	$0	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$11,912,296**	**$2,978,074**	**$14,890,370**	**$14,890,370**

Table M:1-21. EX7 Cost Estimate (Arcadis, 2017)

Itemized Cost Summary Ex-7								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
0	**Reach Characteristics**							
0.1	Reach Name	Ex-7						
0.2	Parish	St. Mary						
0.3	Updated Reach Length	30,937	ft.					
0.4	Conversion factor	43,560	ft²/acre					
0.5	Month	5						
0.6	Year	2017						
0.7	CPI Inflation Rate	1.05						
1	**Planning, Engineering, Design, Permitting, and Construction Management**							**Sum PED, Perm., and CM**
1.1	Planning, Engineering, and Design			6.5%	$1,521,306	$380,327	$1,901,633	**$3,656,987**
1.2	Permitting			1.0%	$234,047	$58,512	$292,559	
1.3	Construction Management			5.0%	$1,170,236	$292,559	$1,462,795	
2	**Levee Construction**							**Sum First Lift**
	Width: Total + ROW (Incl. Borrow Canal)	105	ft.					**$6,157,009**
	Width: Levee Surface	108	ft.					
	Height	13.5	ft.					
2.1	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
2.2	Clearing & Grubbing	0	Ac	$4,293	$0	$0	$0	
2.3	Local Borrow Fill	163,665	CY	$28	$4,627,448	$1,156,862	$5,784,310	
2.4	Fertilize, Seed & Mulch	77	Ac	$3,875	$298,159	$74,540	$372,699	
3	**Drainage Structures**							**Sum Drainage Structures**
3.1	Total 10'X10' Box with Sluice Drainage Structures	0	EA	$2,263,115	$0	$0	$0	**$0**
4	**T-Walls**							**Sum Walls**
4.1	Total Length of T-Wall	800	LF	$8,377	$6,701,952	$1,675,488	$8,377,440	**$8,377,440**
5	**2-Lane Highway Gates**							**Sum Hwy Gates**
5.1	Total Count of Highway Gates	0	LS	$6,178,362	$0	$0	$0	**$0**
6	**Railroad Gates**							**Sum RR Gates**
6.1	Total Count of Railroad Gates	0	LS	$4,921,746	$0	$0	$0	**$0**
7	**Pipeline/Utility Crossings**							**Sum Crossings**
7.1	Total Crossings	0	LS	$211,530	$0	$0	$0	**$0**
8	**Pump Station Frontal Protection**							**Sum Frontal Protection**
8.1	Total Length of Protection	400	LF	$25,132	$10,052,928	$2,513,232	$12,566,160	**$12,566,160**
9	**New Pump Stations**							**Sum New PS's**
9.1	Total Capacity	0	CFS	$15,812	$0	$0	$0	**$0**
10	**Navigation Gates**							**Sum Nav. Gates**
10.1	30' Barge Gates	0	LS	$11,100,108	$0	$0	$0	**$0**
10.2	110' Barge Gates	0	LS	$27,421,455	$0	$0	$0	
10.3	200' Barge Gates	0	LS	$49,358,620	$0	$0	$0	
11	**Real Estate**							**Sum ROW**
11.1	Right-of-Way (Total Levee Footprint)	74	Ac	$5,000	$371,083	$92,771	$463,854	**$1,745,558**

Itemized Cost Summary Ex-7								
Item No.	Item Description	Quantity	Unit	Unit Cost	Total	25% Contingency	Total with Contingency	Subtotals
11.2	Title Research and Legal Proceedings	5.9	Mi	$175,000	$1,025,363	$256,341	$1,281,704	
12	**Mitigation Acreages**							**Sum Mitigation**
12.1	Forested Wetlands	1	Ac	$232,474	$235,356	$58,839	$294,195	**$409,725**
12.2	Emergent Wetlands	1	Ac	$84,403	$92,424	$23,106	$115,531	
13	**First Levee Lift, Year 10**							**Sum 2nd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
13.1	Opposite Cast	0	CY	$28	$0	$0	$0	
13.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
14	**Second Levee Lift, Year 25**							**Sum 3rd Lift**
	Width: Total + ROW (No Borrow Canal)	N/A	ft.					**$0**
	Width: Levee Surface	N/A	ft.					
	Height	N/A	ft.					
	Mobilization & Demobilization	*All other unit costs are loaded costs and include mob/demod*						
14.1	Opposite Cast	0	CY	$28	$0	$0	$0	
14.2	Fertilize, Seed & Mulch	0	Ac	$3,875	$0	$0	$0	
15	**Operations and Maintenance (50 Years)**							**Sum O&M**
15.1	Right of Way Maintenance	74	Ac/yr	$157	$582,887	$145,722	$728,608	**$728,608**
15.2	Gate Maintenance	0	EA/yr	$73,303	$0.00	$0	$0	
15.3	Pump Station Maintenance	0	EA/yr	$100,110	$0.00	$0	$0	
	Total Cost				**$26,913,190**	**$6,728,297**	**$33,641,487**	**$33,641,487**

1.3 NONSTRUCTURAL MEASURES: ELEVATION, FLOODPROOFING, AND ACQUISITION/RELOCATION

Nationally Significant Industries within the study area include oil and gas industry. While these assets are vital to the regional economy, it is expected that short-term disruptions of their productivity would be made up elsewhere in the nation over the long-run. Previous USACE projects have assessed the ability of other national centers to make up for temporary production loss locally and have shown this to be the case. Therefore, economic damages (project benefits) would be captured in the Regional Economic Development (RED) account. The regional significance to employment, production, and other factors has not been included in the economic appendix and would fall into the RED account. RED benefits will be further refined during feasibility level of design and incorporated into the final report.

It was determined through various sources that elevation of structures would not be feasible/recommended above 13 feet ground level. These sources included:

1) 2008 Shoring company interviews - the shoring companies only provided costs up to 13 feet due to constructability and other constraints.

2) FEMA P-550, pages 5-10, 5-11, which states you can elevate up to 10-15 feet (https://www.fema.gov/media-library-data/20130726-1517-20490-9361/fema_p550_rev3.pdf)

3) FEMA P-762 Chapter 2, references 10-15 feet

4) CPRA Master Plan, which states they support up to 14 feet

5) St. Mary's Parish Unified Development Ordinance, which references a max structure height of 35 feet (GSE to roof top).

6) International Building Code Chapter 5, references 2 story building with a 40 feet total height

Table M:1-22 provides average nonstructural acquisition/relocation cost estimates per building and Table M:1-23 provides average nonstructural elevation/commercial cost estimates per building. Additional information is contained in the Economics Appendix.

Table M:1-22. Nonstructural Acquisition/Relocation Average Cost Estimate Per Building

Residential Acquisiton/Relocation Cost		
Price Level:	2019	
Acquisition Costs		
Land Costs	2	sf
Acquisition Land Costs (Moving from)	$39,800	
Demolition, Deed, Legal, Regrading	$47,000	
Cultural Resources Arch Survey	$2,000	
Structure Value		
Total Acquisition Costs	$88,800	
Total Acquisition Costs w/ Contingency	$119,436	
Relocation Costs		
Relocation Costs	$38,000	
Relocation Land Value (Moving to)	$39,800	
Total Relocation Costs	$77,800	
Total Relocation Costs w/ Contingency	$104,641	

Non-Residential Acquisiton/Relocation Cost		
Price Level:	2019	
Acquisition Costs		
Land Costs	3	sf
Acquisition Land Costs (Moving from)	$300,000	
Demolition, Deed, Legal, Regrading	$141,000	
Cultural Resources Arch Survey	$2,000	
Structure Value		
Total Acquisition Costs	$443,000	
Total Acquisition Costs w/ Contingency	$595,835	
Relocation Costs		
Relocation Costs	$50,000	
Relocation Land Value (Moving to)	$300,000	
Total Relocation Costs	$350,000	
Total Relocation Costs w/ Contingency	$470,750	

*Land Costs include the cost of suitable land to relocate a new structure to and is computed for the entire parcel

*Average Land Costs for res computed by using the average parcel size for a 1,500 sq ft. house, which is 19,900 sq ft. lot

*Average Land Costs for non-res computed by using average parcel size for a COM structure, which is 100,000 sq ft. lot

*Relocation costs include moving costs and incidentals for residential structures. It includes Uniform Relocation Act

*Relocation costs include moving costs, searching expenses, and re-establishing costs for non-residential

*34.5% contingency added to depreciated replacement values

Sources:

Land Costs - USACE Real Estate Office

Land Value - USACE Real Estate Office

Cultural Survey - USACE Cultural Resources Office

Demo, et al - 2010 MVR Des Moines River Feasibility Study

Table M:1-23. Nonstructural Elevation/Commercial Average Cost Estimate Per Building

BASE COSTS (NO CONTINGENCY)

Residential Elevation Cost						Commercial Floodproofing Cost	
Source:	New Orleans District (2012 Donaldson to the Gulf Study)					Source: New Orleans District (2012 Donaldson to the Gulf St	
Price Level:	2019					Price Level:	2019
Height	1STY-PIER	1STY-SLAB	2STY-PIER	2STY-SLAB	MOBILE	Square Footage	Cost
[ft]	[$]	[$]	[$]	[$]	[$]	1,000	113,759
N/A	0	0	0	0	0	10,000	113,759
1	78	88	86	97	43	20,000	113,759
2	78	88	86	97	43	30,000	268,800
3	81	90	89	99	43	40,000	268,800
4	81	93	89	106	53	50,000	268,800
5	81	93	89	106	53	60,000	268,800
6	83	95	91	107	53	70,000	268,800
7	83	95	91	107	53	80,000	268,800
8	85	98	93	111	53	90,000	268,800
9	85	98	93	111	53	100,000	268,800
10	85	98	93	111	53	110,000	664,476
11	85	98	93	111	53	120,000	664,476
12	85	98	93	111	53	130,000	664,476
13	86	101	95	117	53	140,000	664,476
14	86	101	95	117	53	150,000	664,476
15	86	101	95	117	53		
16	86	101	95	117	53		

PROJECT COSTS (WITH CONTINGENCY, 34.5%)

Residential Elevation Cost						Commercial Floodproofing Cost	
Source:	New Orleans District (2012 Donaldson to the Gulf Study)					Source: New Orleans District (2012 Donaldson to the Gulf St	
Price Level:	2019					Price Level:	2019
Height	1STY-PIER	1STY-SLAB	2STY-PIER	2STY-SLAB	MOBILE	Square Footage	Cost
[ft]	[$]	[$]	[$]	[$]	[$]	1,000	153,006
N/A	0	0	0	0	0	10,000	153,006
1	105	118	116	130	58	20,000	153,006
2	105	118	116	130	58	30,000	361,536
3	109	121	120	133	58	40,000	361,536
4	109	125	120	143	71	50,000	361,536
5	109	125	120	143	71	60,000	361,536
6	112	128	122	144	71	70,000	361,536
7	112	128	122	144	71	80,000	361,536
8	114	132	125	149	71	90,000	361,536
9	114	132	125	149	71	100,000	361,536
10	114	132	125	149	71	110,000	893,720
11	114	132	125	149	71	120,000	893,720
12	114	132	125	149	71	130,000	893,720
13	116	136	128	157	71	140,000	893,720
14	116	136	128	157	71	150,000	893,720
15	116	136	128	157	71		
16	116	136	128	157	71		

Residential	W/O Conting	W/ Conting
Average Cost	$ 170,000	$ 228,650
Non-Residenti	W/O Conting	W/ Conting
Average Cost	$ 664,476	$ 893,720

*Costs were determined from the 2012 Donaldson to the Gulf Study and escalated to 2019 costs.
*34.5% contingency added to values

1.4 ALTERNATIVE 1 NONSTRUCTURAL MEASURES– RAISING, DRY FLOODPROOFING, WET FLOODPROOFING

The Recommended Plan is the alternative that maximized the National Economic Development NED account and includes implementation of non-structural (elevation and floodproofing) methods. The project cost estimates for the NED plan were developed in MCACES MII cost estimating software. Standard approaches for a feasibility estimates regarding labor, equipment, materials, crews, unit prices, quotes, sub- and prime contractor markups as required by ER 1110-2-1150. This philosophy was taken wherever practical within the time constraints. The project sponsor is), State of Louisiana CPRA. Cost estimates for wet floodproofing were informed by Roderick Scott, CFM, and Gerald Gesser, Architect, members of the Flood Mitigation Industry Association due to limited funds, COVID travel restrictions, and project schedule following 3x3x3 study guidance. Where possible, costs were supplemented with multiple estimating sources such as quotes, bid data, and A-E estimates. The intent was to provide or convey “fair and reasonable” estimates that depict the local market conditions. The estimates assume a typical application of subcontractors. Given the long time over which this project is to be constructed and the unknown economic status during that time, demands from non-governmental civil works projects were not considered to dampen the competition and increase prices.

1.4.1 Structure Estimation

The NED estimate was structured to develop the unit costs in MII representing the standard “achitype” non-structural work being performed. The MII unit cost for the average structure of each type were applied to the voluminous quantities of structures to be raised or floodproofed in an Excel summary spreadsheet that was transferred to the TPCS.

All work activities and corresponding levels of effort are based upon conversations with Davies Shoring, LLC and Orleans Shoring on 23 June 2015 and 24 June 2015, respectively.

Residential Elevation Projects were grouped according to these categories:

- Mobile Home, Low Lift - This includes manufactured homes raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate these are assumed to be 900 sq.ft. single-wide sectional trailers.
- Mobile Home, High Lift - This includes manufactured homes raised a minimum of 6'-6" and a maximum of 13'-0" above the lowest adjacent grade. For the purpose of this estimate these are assumed to be 900 sq.ft. single-wide sectional trailers.
- Pier-supported Frame House, Low Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 2'-6" and a maximum of 6'-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 1,866 sq.ft. and two-story homes are assumed to be 2,3239 sq.ft.; footprint square footage.
- Pier-supported Frame House, High Lift - This includes wood frame houses built on a pier and beam foundation raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate single story are

assumed to be 1,866 sq.ft. and two-story homes are assumed to be 2,239 sq.ft.; footprint square footage.

- Slab-supported Frame House, Low Lift - This includes wood frame houses built on a concrete slab raised a minimum of 2'-6" and a maximum of 6-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 1,866 sq.ft. and two-story homes are assumed to be 2,239 sq.ft.; footprint square footage.
- Slab-supported Frame House, High Lift - This includes wood frame houses built on a concrete slab raised a minimum of 6'-6" and a maximum of 13-0" above the lowest adjacent grade. For the purpose of this estimate single story are assumed to be 1,866 sq.ft. and two-story homes are assumed to be 2,239 sq.ft.; footprint square footage.

The work process for Mobile Homes and Pier-supported frame houses was as follows:

1. Individual homeowner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.
3. Contractor prepares and submits for approval Guide Plans and Specifications, and Estimate on individual structure
4. Government approves of guide plans, specification and estimate and approves for a start work.
5. Contractor obtains all necessary permits and Mobilize to the site.
6. Residents temporarily relocate.
7. Disconnect utilities.
8. Place Jacks and Cribbing.
9. Insert Steels.
10. Elevate Structure.
11. Install Piers.
12. Set Structure on Piers.
13. Anchor Structure.
14. For High Lifts, pour grade beams between piers and slab-on-grade.
15. Reconnect Utilities.
16. For Low Lifts, install Perimeter Enclosure.
17. Install elevated landings and stairs.
18. Demobilization and Closeout.

The work process for Slab-supported houses was:

1. Individual homeowner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.
3. Contractor prepares and submits for approval Guide Plans and Specifications, and Estimate on individual structure
4. Government approves of guide plans, specification and estimate and approves for a start work.

5. Contractor obtains all necessary permits and Mobilize to site.
6. Residents temporarily relocate.
7. Disconnect utilities.
8. Excavate at perimeter and tunnels under slab on 8' centers.
9. Place Jacks and Cribbing.
10. Push segmented piles to refusal.
11. Elevate Structure.
12. Install Piers.
13. Anchor Structure:
    For lower lifts, demo existing driveway and install new driveway adjusted to garage floor elevation.
14. For High Lifts, pour grade beams between piers and slab-on-grade.
15. Reconnect Utilities.
16. For Low Lifts, install Perimeter Enclosure.
17. Install elevated landings and stairs.
18. Demobilization and Closeout.

Commercial Floodproofing Projects were group according to the following categories:

- Commercial Dry Floodproofing – This includes protecting the lower 3' of the structure from floodwater inundation. The average square footage was estimated according to occupancy type and ranged from 2,885 SF for an auto repair facility to 9,597 SF for professional office space.
- Commercial Wet Floodproofing – This includes retrofitting the building so that water may enter the building without causing any major damage. The average square footage was assumed to be 18,043 SF. Work process is assumed to be the same for warehouse and fabrication commercial buildings.

The work process for dry floodproofing was as follows:

1. Individual homeowner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.
3. Contractor prepares and submits for approval Guide Plans and Specifications, and Estimate on individual structure
4. Government approves of guide plans, specification and estimate and approves for a start work.
5. Contractor obtains all necessary permits and Mobilize to site.
6. Demolition
7. Construct Flood Barrier
8. Construct Brick Veneer
9. Install Self Closing Flood Barriers for entrances

The work process for wet floodproofing was as follows:

1. Individual homeowner completes program application and USACE determines eligibility.
2. Government selects contractor and enters into design build agreement.
3. Contractor prepares and submits for approval Guide Plans and Specifications, and Estimate on individual structure
4. Government approves of guide plans, specification and estimate and approves for a start work.
5. Contractor obtains all necessary permits and Mobilize to site.
6. Electrical Work
7. Wet floodproofing
8. Protective coatings
9. Install flood vents

1.4.2 Quantity Development

Teams inspected digital photography of each structure based on x, y coordinates assigned to structures appearing with the National Structure Inventory 2.0 (see Appendix D Economics). The team estimated the number of square feet per total structure, along with other characteristics, such as one or two-story, slab or pier foundations, etc. An "average structure" was calculated for each type (one or two-story, slab or pier foundations, mobile homes) and this "average structure" was used to develop the structure elevation costs for each type in MII. Similar averages were used for non-residential structures for floodproofing and warehouses.

1.4.3 Bid Competition

It was assumed that there will not be an economically saturated market and that bidding competition will be present.

1.4.4 Contract Acquisition Strategy

The project will use the traditional method of implementation. The "traditional method" of implementation is generally described in publications of the USACE National Floodproofing Committee and Flood Risk Management Planning Center of Expertise. Under the traditional method, the USACE District utilizes a Federal procurement to obtain design and construction contractors for the various floodproofing and elevation measures. The Government will procure contracts that will allow a contractor to perform floodproofing work on multiple structures through a series of one or more task orders and who will be responsible for all work associated with flood risk mitigation approval of the engineering plans for each structure to final inspection. Additional implementation eligibility criteria and process descriptions are provided in Appendix K: Implementation Plan.

1.4.5 Labor Shortages

It was assumed there will be a normal labor market.

1.4.6 Labor Rates

Local labor market wages are above the local Davis-Bacon Wage Determination and actual rates have been used. This was based upon local information and payroll data received from the New Orleans District Construction Representatives and estimators with experiences in past years.

1.4.7 Materials

Cost quotes are used on major construction items when available, although quantities per site are small relatively speaking. The MII Costbook was also used for some materials. It was assumed that materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials. Prices include delivery of materials.

1.4.8 Equipment

Equipment rates used are primarily based from the latest USACE EP-1110-1-8, Region III. For specialty equipment required, industry practice was assumed and followed in the cost estimates. Example: structure jacking system quotes from Jahns Structure Jacking Systems Inc. were entered in USACE CheckRate spreadsheet to develop an hourly equipment rate for use in Mii.

1.4.9 Crews

Major crew and productivity rates were developed and studied by ARCADIS engineers in conjunction with local professionals familiar with the type of work. All of the work is typical to the Louisiana area. The crews and productivities were checked by local USACE senior cost engineers, discussions with contractors, and comparisons with historical cost data. Crew work hours are assumed to be 8 hours 5 days per week, which is typical to the area and type of work.

1.4.10 Relocation Cost

Not applicable.

1.4.11 Mobilization

Contractor mobilization and demobilization are based on the assumption that most of the contractors will be coming from within the Gulf Coast/Southern region. Minimal equipment is required for the NED non-structural work.

1.4.12 Field Office Overhead

Included in Mii cost estimates.

1.4.13 Home Office Overhead

Included in Mii cost estimates.

1.4.14 Taxes

Local taxes will be applied, using an average between the parishes that contain the work. Reference the LA parish tax rate website: http://www.laota.com/pta.htm

1.4.15 E&D and S&A

USACE costs to manage design (PED) and construction (S&A) are based on New Orleans District Programmatic Cost Estimate guidance. Assumptions for PED and S&A are identified in the following sections.

1.4.16 Planning, Engineering & Design (PED)

Itemized line item costs are included in the direct costs for specific implementation/administrative steps (Gov't and contractor) of each of the projects (non-Real Estate portion – Real Estate related costs covered under Acct 01). Additional PED costs have been included in the 30 Acct PED for more overall programmatic efforts such as Project Management, Planning & Environmental Compliance, Contracting, Planning during Construction, and Project Operations.

1.4.17 Supervision & Administration (S&A)

Itemized line item costs are included in the direct costs for specific implementation/administrative steps for the Government administration of each of the projects (non-Real Estate portion – Real Estate related costs covered under Acct 01). Additional more general S&A costs have been included in the 31 Acct S&A for more overall programmatic Construction Management efforts. It is anticipated that the government will utilize an IDIQ or MATOC contract mechanism and have multiple contractors responsible for multiple structures.

1.4.18 Contingencies

Contingencies were developed using the USACE Cost and Schedule Risk Analysis (CSRA) process and the Crystal Ball software that evaluates schedule and cost related risks. See summaries in Cost Schedule Risk Analysis (CSRA) section.

1.4.19 Escalation

Escalation used in the MII and TPCS was based upon the latest US Army Corps of Engineers Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS).

1.4.20 HTRW

The estimates include no costs for any potential Hazardous, Toxic, and Radioactive Waste (HTRW). HTRW issues are not expected and project features could be revised to avoid. HTRW will be avoided at all costs. Appendix K Implementation Plan describes the eligibility criteria, process, and responsibility related to HTRW concerns.

1.5 SUMMARY OF COST AND SCHEDULE RISK ANALYSIS (CSRA)

In an effort to identify the applicable cost and schedule risks inherent with execution of the Recommended Alternative, a Cost and Schedule Risk Analysis was prepared as per ER 1110-2-1302. This were implemented in an effort to determine a contingency cost required for cost estimating and based on the risk items associated with the project. The results of these analyses are determined by qualifying and quantifying all potential cost risks and running a Monte Carlo simulation to produce the frequency spectrum and probability range for the applied risk costs. The cost contingency is obtained from the 80-percent contingency as determined by this analysis.

The initial Risk Register considered 12 risk items. From the initial risk items, a total of 9 potential moderate and high risk items were cho3sen for modeling purposes for the Cost Risk Analysis and 3 risk items for the Schedule Risk Analysis. Assumptions were made for each risk item before running the Monte Carlo simulation. The result of the simulation for the Cost and Schedule Risk Analysis gave a rounded contingency of 31.7 percent at the 80-percent confidence level.

The contingency cost for this project was utilized for a Micro Computer Aided Cost Estimating System (MCACES) estimation of the costs associated with the South Central Coastal NED Non-Structural Plan. The potential cost risks developed during this analysis also serve as an indicator of how to avoid unforeseen escalation of project costs throughout project implementation and therefore, may be used as a valuable tool in all future aspect of the project study.

The major contributors to the resulting total project cost contingency for the Cost Estimate were:

- (PR-2) Participation Rate 10yr to 25yr – risk (positive) of having only a 65 percent participation rate instead of the 100 percent assumed in cost.
- (CON-1) Availability of Flood Proofing Contractors – risk of inflated prices due to large budgets and limited pool of contractors.
- (CA-1) Contract Acquisition – risk that contract acquisition methods chosen could cause increased levels of subcontracting and/or limit pool of contractors.

The major contributors to the resulting total project schedule contingency for the project schedule were:

- (PR-3) Intermittent Funding – risk of delays in schedule due to a lack of funding during the project.

- (CA-1) Contract Acquisition – risk of limited competition due to contract type delaying the schedule.
- (PPM-1) PED and S&A - risk of Federal Gov't having to set up a full system to engineer, design, and administer program to the lowest levels.

The corresponding Total Cost including contingency (cost & schedule) for the Cost Risk Analysis is presented on Table M:1-24.

Table M:1-24. Cost Contingency Analysis Table

Confidence Level	Value	Contingency
Most Likely Cost Estimate	**$622,200,000**	**0.00%**
5%	**$638,937,180**	**2.69%**
50%	**$752,488,680**	**20.94%**
80%	**$819,437,400**	**31.70%**
95%	**$884,270,640**	**42.12%**

The corresponding Total Schedule including contingency for the Project Schedule is presented on Table M6-24.

Table M:1-25. Schedule Contingency Analysis Table

Confidence Level	Value	Contingency
Most Likely Cost Estimate	**300.0 Months**	**0.00%**
5%	**316.4 Months**	**5.74%**
50%	**362.1 Months**	**20.02%**
80%	**397.6 Months**	**33.08%**
95%	**431.7 Months**	**44.43%**

The rounded contingency percentage for **Project Cost and Schedule (31.7%)** were transferred to the TPCS for final calculation of total contingency and cost. Lands and Damages cost and contingency are not included in the above.

1.6 RECOMMENDED PLAN FINAL COST ESTIMATE

The final cost estimate for the Recommended Plan is shown below.

See Appendix D: Economics for additional cost breakdowns, including interest during construction.

PROJECT: South Central Coastal Louisiana
PROJECT NO: P2 332135
LOCATION: South Central Louisiana

DISTRICT: MVN District
POC: CHIEF, COST ENGINEERING, John Petitbon P.E.

PREPARED: 2/25/2022

This Estimate reflects the scope and schedule in report: SCCL Feasibility Study - NED plan

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC):				2022					
						Effective Price Level Date:				1 OCT 21					
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-20 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
11	LEVEES & FLOODWALLS	$476,224	$150,963	31.7%	$627,187	7.4%	$511,282	$162,076	$673,358	$0	$673,358	48.8%	$760,897	$241,205	$1,002,102
18	CULTURAL RESOURCE PRESERVATION	$5,307	$1,682	31.7%	$6,989	13.3%	$6,011	$1,906	$7,917	$0	$7,917	48.8%	$8,946	$2,836	$11,782
18	CULTURAL RESOURCE PRESERVATION	$4,563	$1,446	31.7%	$6,009	13.3%	$5,168	$1,638	$6,806	$0	$6,806	4.0%	$5,374	$1,704	$7,077
	CONSTRUCTION ESTIMATE TOTALS:	$486,094	$154,092		$640,185	7.5%	$522,461	$165,620	$688,081	$0	$688,081	48.4%	$775,217	$245,744	$1,020,961
01	LANDS AND DAMAGES	$30,367	$7,592	25.0%	$37,959	8.4%	$32,916	$8,229	$41,145	$0	$41,145	48.8%	$48,986	$12,246	$61,232
30	PLANNING, ENGINEERING & DESIGN	$87,497	$27,737	31.7%	$115,233	2.4%	$89,577	$28,396	$117,972	$0	$117,972	36.4%	$122,203	$38,738	$160,941
31	CONSTRUCTION MANAGEMENT	$48,609	$15,409	31.7%	$64,019	2.4%	$49,765	$15,775	$65,540	$0	$65,540	39.3%	$69,308	$21,971	$91,278
	PROJECT COST TOTALS:	$652,567	$204,829	31.4%	$857,396		$694,718	$218,020	$912,739	$0	$912,739	46.2%	$1,015,714	$318,699	$1,334,413

ESTIMATED TOTAL PROJECT COST: $1,334,413

_____ CHIEF, COST ENGINEERING, John Petitbon P.E.

_____ PROJECT MANAGER, xxx

_____ CHIEF, REAL ESTATE, xxx

_____ CHIEF, PLANNING, xxx

_____ CHIEF, ENGINEERING, JSV

_____ CHIEF, OPERATIONS, xxx

_____ CHIEF, CONSTRUCTION, SSW

_____ CHIEF, CONTRACTING,xxx

_____ CHIEF, PM-PB, xxxx

_____ CHIEF, DPM, xxx

Section 2

Detailed Project Cost and Schedule Risk Analysis Report for NED (Recommended Plan)

Prepared for:

U.S. Army Corps of Engineers

Mississippi Valley Division

New Orleans District

_____

Prepared by:

New Orleans District

_____

Date: **02 Dec 2020**

2.1 COST AND SCHEDULE RISK SUMMARY

The U.S. Army Corps of Engineers prepared this feasibility report and Environmental Impact Statement for the Southwest Coastal Louisiana Feasibility study. The report includes input from the study sponsors, natural resource agencies and the public.

The study area (Figure M:2-1) includes three parishes along the Louisiana coast beginning near Morgan City, Louisiana and extending west to Delcambre, Louisiana. The coastal parishes are adjacent to the Gulf of Mexico and extend inland or north approximately 90 miles near Arnaudville, Louisiana. The area consists of St. Martin Parish, Iberia Parish, St. Mary Parish and the coastal boundary of the latter two parishes.

The eastern study boundary includes the western portion of the Atchafalaya Basin, beginning on the north near Arnaudville, Louisiana, and extending south to Morgan City,

Louisiana. The Atchafalaya Basin is the largest wetland and swamp in the United States. It includes the Lower Atchafalaya River, Wax Lake Outlet, Atchafalaya Bay, Atchafalaya River, and Bayous Chêne, Boeuf, and Black navigation channel. During the early 20th century, the Atchafalaya River Basin was designated as a spillway for floods of the Mississippi River. Numerous large access canals and pipeline canals were dredged through deep swamp areas, across bayous, and across the Atchafalaya River. The Atchafalaya Basin is bordered on the west by the West Atchafalaya Basin Protection Levee (WABPL), which separates the Atchafalaya Basin from primarily agricultural lands in the western part of the study area. The Atchafalaya Basin is bordered on the east by the East Atchafalaya Basin Protection Levee (EABPL), which represents the western boundary of the Atchafalaya Floodway.

The western part of the study area is dominated by Bayou Teche, a former main channel of the Mississippi River, and is primarily agricultural. Agriculture land use dominates the natural terraces adjacent to Bayou Teche that have developed from thousands of years of flood events. These natural terraces are characterized by fine grained soil deposits such as clays and silts, but can include some sands. They are traditionally rich in nutrients and are well suited for agriculture. Bayou Teche is bordered in the south by U.S. Hwy 90 and by the north and west study boundaries.

South of U.S. Hwy 90, the study area is characterized by coastal plains and marshes and influenced by tides and brackish waters. This area has significant oil and gas development and infrastructure. Salt domes and associated extraction industries are major occurrences along the Gulf of Mexico coast. Avery Island, Weeks Island, and Cote Blanche Island are domes located within the study area. The coastal plain area on the eastern study area boundary includes both the Atchafalaya River bay, where the Atchafalaya River meets the Gulf of Mexico, and the Wax Lake Outlet. Both the Atchafalaya River and the Wax Lake Outlet are outlets for the Atchafalaya Basin. It should be noted that due to the high sediment load, the Wax Lake Outlet and Atchafalaya River delta area are the only developing deltas along the Louisiana coast. Approaching from the east and south of U.S. Hwy 90, the Gulf Intracoastal Waterway (GIWW) intersects the study area just north of Avoca Island, near Morgan City, Louisiana. The GIWW continues west toward Texas; however, the western boundary of Iberia Parish serves as the boundary of the study area.

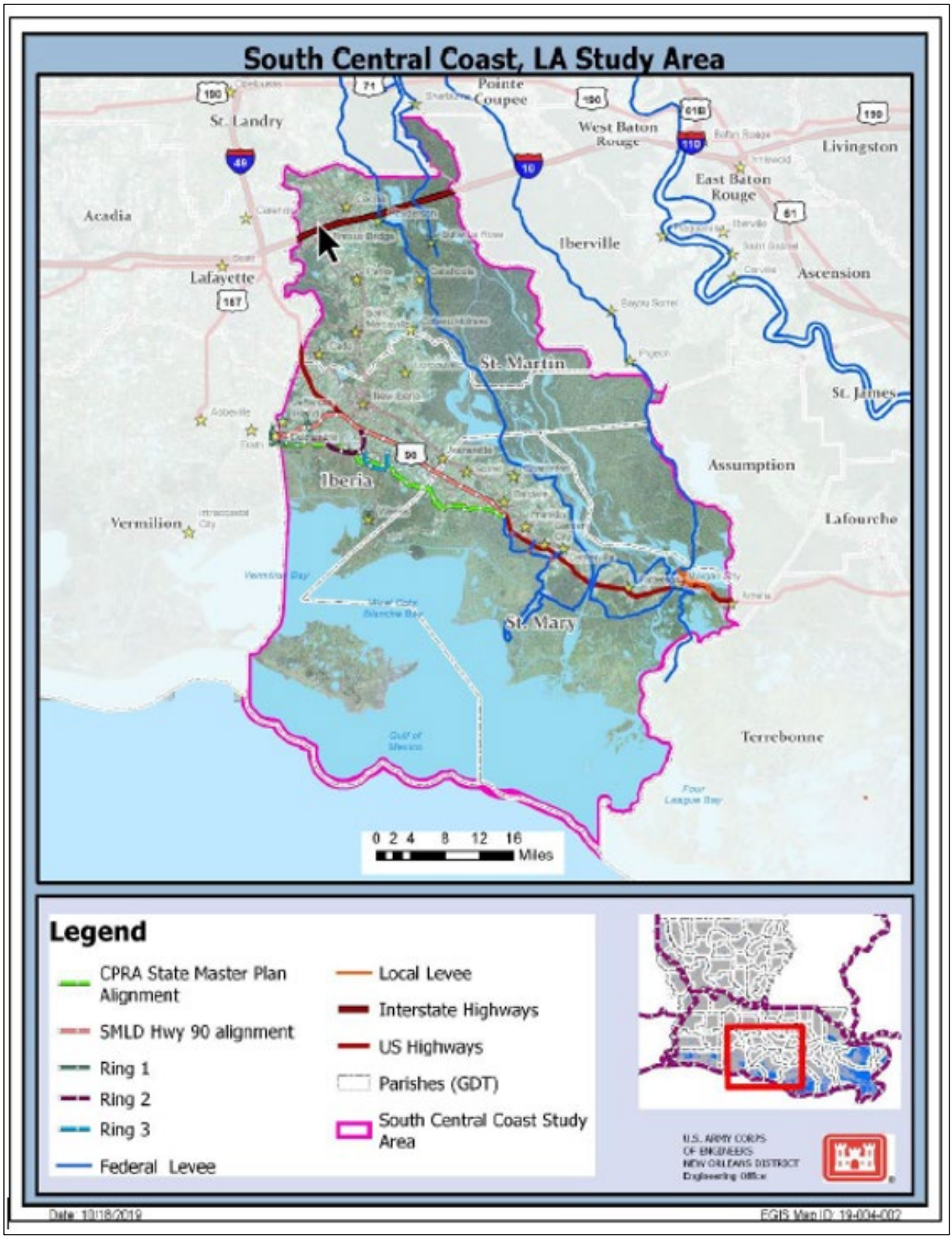

Figure M:2-1. South Central Coast Louisiana Study Area

The NED RP (Alternative 1 – Nonstructural) consists of nonstructural measures throughout the study area involving a variety of actions including:

1. Elevation of eligible residential structures. This measure requires lifting the entire structure to an elevation not greater than a maximum of 13 feet above ground level.
2. Dry flood proofing of eligible commercial and public structures (excluding large warehouses and industrial buildings) for flood depths not greater than three feet above the adjacent ground by methods such as sealing the walls of structures with waterproofing compounds, impermeable sheeting (veneer walls) and other materials and covers to protect openings from floodwaters.
3. Wet flood proofing of commercial warehouses and machine shops by raising utilities, installing flood vents to allow water to flow in and out without severely damaging the structure and adding protective water tight coatings.

Nonstructural plans were evaluated using approximately 100 hydrologic reaches that comprise the study area as the unit of analysis. As a result, benefits and costs were calculated on a reach-by-reach basis. Reaches were identified that contain structures falling within the defined floodplain. This report recommends implementing nonstructural measures for residential, non-residential, and warehouse properties in the 0-25 year (0-4% ACE) floodplain. Construction contingency results are shown in Table M:2-1.

Table M:2-1. Construction Contingency Results

Confidence Level	Base Cost	Contingency $	Contingency (%)
5%	$622,200,000	$16,737,180	2.69%
50%	$622,200,000	$130,288,680	20.94%
80%	$622,200,000	$197,237,400	31.70%
90%	$622,200,000	$232,640,580	37.39%

2.2 Key Findings/Observations Recommendations

The USACE worked through the risk register in November 2019 and August 2020, focusing on the construction and program assumption risks, real estate risks excluded. The study outcome identified key cost and schedule risks resulting in a rounded contingency of 31.7 percent of the costs studied.

Cost Risks: From the CSRA, the key or greater identified Cost Risks (– and +) include:

- (PR-2) Participation Rate 0yr to 25yr – risk (positive) of having only a 65 percent participation rate instead of the 100 percent assumed in cost.
- (CON-1) Availability of Floodproofing Contractors – risk of inflated prices due to large budgets and limited pool of contractors.
- (CA-1) Contract Acquisition – risk that contract acquisition methods chosen could cause increased levels of subcontracting and/or limit pool of contractors.

Schedule Risks: Schedule risks indicate a duration uncertainty which can also be translated into cost impacts. The greatest identified schedule risks include:

- (PR-3) Intermittent Funding – risk of delays in schedule due to a lack of funding during the project.
- (CA-1) Contract Acquisition – risk of limited competition due to contract type delaying the schedule.
- (PPM-1) PED and S&A - risk of Federal Gov't having to set up a full system to engineer, design, and administer the program to the lowest levels.

Recommendations: Further iterative project and risk study is important throughout the project life-cycle in order to efficiently manage and maintain a reasonable cost and schedule. Certain risks are outside the USACE control, while certain risks can be managed to lessen impact in cost and time. The more critical items that warrant attention are:

- Work to identify inefficiencies and limit administration by the federal government to higher levels so it does not require setting up robust planning, design, and administration programs.
- Publicize and encourage participation by construction contractors to ensure adequate supply and competition.
- Utilize budget conscious contracting acquisition methods.

2.3 REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both cost and schedule risks for all project features.

2.4 PROJECT SCOPE

The study area, which is characterized by low, flat terrain, is highly susceptible to flooding from the tidal surges associated with hurricanes and tropical storms due to its close proximity to the Gulf of Mexico. The apparent subsidence that is taking place along the coast of Louisiana and an increase in relative sea level rise is expected to increase the potential for coastal flooding in the future. As the level of the ground sinks relative to the levels of the Gulf of Mexico, the depth of potential flooding in the future will increase. The largest population centers are Morgan City and Bayou Vista in St. Mary Parish and New Iberia in Iberia Parish.

The structural alternatives were not found to be economically justified. However, the nonstructural alternatives of elevating residential structures, flood proofing non-residential structures, and constructing berms for warehouses in the 0-25 year floodplain was found to be economically justified and is the NED recommended plan.

This report includes the project technical scope, feasibility level estimates developed by the New Orleans District Cost Engineering. The program schedule was developed by New Orleans District Project Management and New Orleans District Cost Engineering performed an internal Quality Control Review of the work. Consequently, these documents serve as the basis for the risk analysis. In general terms, the scope consists of:

- Residential Structure elevating
- Non-Residential Structure floodproofing
- Industrial Warehouse wet floodproofing

2.4.1 USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering DX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of these documents and sources:

- ER 1110-2-1150, Engineering and Design for Civil Works Projects.
- ER 1110-2-1302, Civil Works Cost Engineering.
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering DX.
- Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
- Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

Section 3
Methodology/Process

The Project Delivery Team is composed of various USACE New Orleans District branches including Project Management, Economics, Real Estate, Planning, Contracting, Design, Hydrologic, Geotechnical, and Cost Engineering Offices and CPRA.

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering DX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

Section 4
Identify and Assess Risk Factors

Identifying the risk factors via the USACE are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire USACE is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the USACE and empirical data from similar projects is desirable and is considered.

USACE meetings were held in April 2020 and August 2020 for the purposes of identifying and assessing risk factors. The meeting included qualified representatives from multiple project team disciplines and functions, for example:

- Project/program managers.
- Planners
- Project Engineers
- Real Estate, Economist
- Cost engineers.

The meetings focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Subsequent meetings and phone conversations focused primarily on risk factor assessment and quantification.

4.1 QUANTIFY RISK FACTOR IMPACTS

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The following elements of each risk factor were discussed by the USACE to estimate the elements of each risk factor:

- Maximum possible value for the risk factor.
- Minimum possible value for the risk factor.
- Most likely value (the statistical mode), if applicable.
- Nature of the probability density function used to approximate risk factor uncertainty.
- Mathematical correlations between risk factors.
- Affected cost estimate and schedule elements.

The risk discussions focused on the various project features as presented within the USACE Civil Works Work Breakdown Structure for cost accounting purposes. It was recognized that the various features carry differing degrees of risk as related to cost, schedule, design complexity, and design progress. The example features under study are presented in Table M:4-1.

Table M:4-1. Work Breakdown Structure by Feature

01	LANDS AND DAMAGES
11	LEVEES & FLOODWALLS
30	PLANNING, ENGINEERING & DESIGN
31	CONSTRUCTION MANAGEMENT

The resulting product from the USACE discussions is captured within a risk register as presented in Appendix A for both cost and schedule risk concerns. Note that the risk register records the USACE's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.2 ANALYZE COST ESTIMATE AND SCHEDULE CONTINGENCY

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the USACE. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as

quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the “total project cost” for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering DX guidance, only critical path and near critical path tasks are considered to be uncertain for the purposes of contingency analysis.

Section 5
Key Assumptions

Key assumptions are those that are most likely to significantly affect the determinations and/or estimates of risk presented in the risk analysis. The key assumptions are important to help ensure that project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis, as well as any resultant limitations on the use of outcomes and results.

The following is an example of key assumptions for the risk analysis that could be identified by the USACE and risk analyst:

- Level of Design: The cost comparisons and risk analyses performed and reflected within this report are based upon design scope and estimates that are considered to be well developed and designed.
- Design Scope: The prescribed scope satisfies the requirements of this acquisition given that it is a re-authorization along the already approved alignment with minor adjustments.
- Operation and Maintenance: Operation and maintenance activities were not included in the cost estimate or schedules
- Contract Acquisition Strategy: Consistent with cost estimate and schedule assumptions, it is assumed that the contract acquisition strategy is predominately firm fixed price.
- Confidence Levels: The Walla Walla Cost Engineering Dx guidance generally focuses on the 80 percent level of confidence for cost contingency calculation. For this risk analysis, the 80 percent level of confidence was used. It should be noted that the use of 80 percent as a decision criteria is a moderate risk aversion approach, generally resulting in higher cost contingencies. However, the 80 percent level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to completely capture actual project costs.
- Only moderate and high risk levels were applied for the purposes of the CSRA analysis.

The following list identifies the key risk analysis assumptions and limitations within the context of the South Central Coastal Louisiana CSRA. For each item, the context is first provided and then followed by the key assumption or limitation.

- *Unknown Decisions or Decision Makers:* The CSRA was prepared using a framework to generate contingency information that is appropriate for use by State of Louisiana and USACE decision makers for scheduling, budgeting, and project control purposes. The framework may generate results that are appropriate for use by a wide variety of decision makers or stakeholders; however, the assumed

use of CSRA results is limited to scheduling, budgeting, and project control. Other uses by unknown decision makers may not be appropriate.

- *Dynamic Risks:* Risk events are dynamic, not static, and should be evaluated regularly through all phases of design, construction and O&M (if required). The CSRA is based on the identification and assessment of risks as of the date of this document. Reduced utility of current CSRA results should be assumed if the likelihood and impact of risks change over time.
- *Causal Relationships:* With the exception of risk events identified as correlated in the risk register, it is assumed that the impacts of risks are independent and that the realization of one risk does not cause the realization of another. Significant variance of the risk model results from actual project costs and schedules may be experienced if significant causal relationships exist between risks assumed to be independent.
- *Conservation of Market Pricing Risk:* The CSRA assumes that market pricing risks are not created or destroyed but can only be transferred or shared *at a price* as a result of various contract acquisition strategies. As an example, it is assumed that a contractor will add a level of contingency to a fixed price bid, relative to a cost reimbursable bid, that is reflective of the risk transferred contractually from the Government to the contractor. Other aspects of contract acquisition strategies not related to market pricing, such as the management cost of modifications or claims, are not included in this assumption. Any contract acquisition strategy that actually transfers market pricing risk to a contractor *at no cost* to the Government is not reflected in the CSRA.
- *Unknown Unknown* and *Unknowable Risks*: The Kinetin Framework describes decision-making contexts, in part, by characteristic types of uncertainty. Simple, complicated, complex and chaotic contexts within the framework are respectively associated with *known known*, *known unknown*, *unknown unknown* and *unknowable* uncertainties. The CSRA process focuses on *known known* and *known unknown* risks and is not intended to quantify the impacts of *unknown unknown* or *unknowable* risks. Significant variance of the risk model results from actual project costs and schedules may be experienced if *unknown unknowable* risks, as defined in the Cynefin Framework, are realized.

Section 6
Risk Analysis Results

The following sections discuss the risk register, cost risk analysis results, schedule risk analysis results, and the combined cost and schedule risk analysis results.

6.1 RISK REGISTER

A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. A summary risk register that includes typical risk events studied (high and moderate levels) should be presented in a table in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. A more detailed risk register would be provided in appendix A. The detailed risk registers of appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 COST RISK ANALYSIS - COST CONTINGENCY RESULTS

The cost risk model was run from selected items from the initial Risk Register's 13 risk items (as shown in Appendix A). There were a total of nine risks used in the modeling for the risk analyses which had a cost impact of moderate or high. The risk was analyzed using the low, most likely, and high estimates for each risk item and the items associated variance distribution. The analysis produced a sensitivity chart of the risk items and confidence levels from 0 to 100 percent and the associated contingency amount.

The cost sensitivity chart for the Project Cost is shown in Figure M:6-1. The sensitivity chart shows the influence of each risk items on the resulting cost contingency. The risk items are ranked according to their importance to the cost contingency. As shown in the Cost Sensitivity Charts, Owner Participation Rate (positive), Availability of Flood Proofing Contractors (negative), and Contract Acquisition (negative) have the greatest impact influence on the cost contingency.

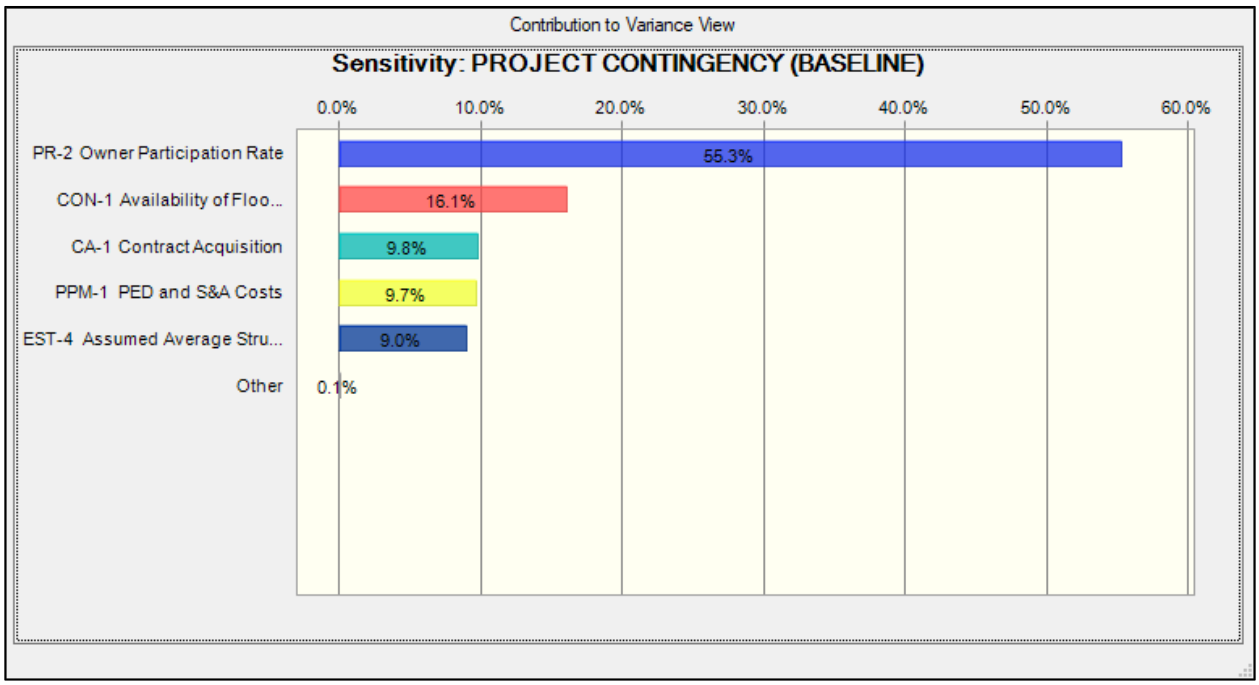

Figure M:6-1. Project Cost Sensitivity Chart

The cost risk analysis also produced a confidence table in 5 percent increments of project confidence associated with contingency dollars. Several key confidence levels are shown in Table M:6-1. The recommended cost contingency amount for the project is $197,237,400.

Table M:6-1. Project Cost Confidence

Confidence Level	Value	Contingency
Most Likely Cost Estimate	**$622,200,000**	**0.00%**
5%	**$638,937,180**	**2.69%**
50%	**$752,488,680**	**20.94%**
80%	**$819,437,400**	**31.70%**
95%	**$884,270,640**	**42.12%**

6.3 SCHEDULE RISK ANALYSIS - SCHEDULE CONTINGENCY RESULTS

A schedule risk analysis was conducted on three risks of the risk register, shown in Appendix A, which had a schedule impact of moderate or high. The project Risk Register originally considered 13 risk items but only 3 risks were determined to have an impact on the overall program schedule. The risk was analyzed using the low, most likely, and high estimates for each risk item and the items associated variance distribution. The analysis produced a sensitivity chart of the risk items and confidence levels from 0 to 100 percent and the associated contingency amount.

The schedule sensitivity chart is shown in Figure M:6-2. The sensitivity chart shows the influence of each risk items on the resulting schedule contingency. The risk items are ranked according to their importance to the schedule contingency. As shown in the Schedule Sensitivity Chart, Intermittent Funding (PR-3) item had the most influence on the schedule contingency. It is important to note that the schedule is more for a program rather than a single project and therefore few items significantly affect the overall schedule.

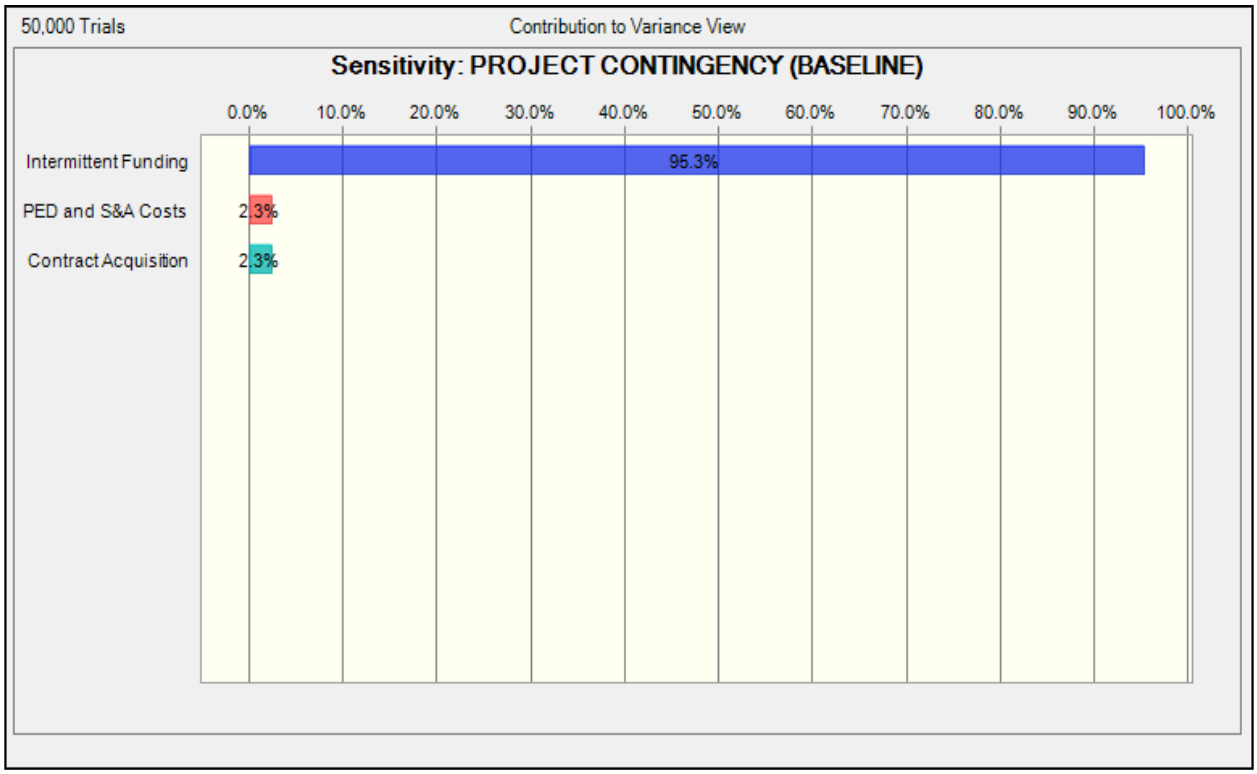

Figure M:6-2. Project Schedule Sensitivity Chart

The schedule risk analysis also produced a confidence table in 5 percent increments of project confidence associated with contingency months. The confidence table is shown in Table M:6-2. As seen in the table, all the associated contingency month amounts are positive. The contingency month amounts range from 0.5 months to over 180 months. The recommended schedule contingency amount is 99.2 months. Note that these results reflect only those contingencies established from the schedule risk analysis.

Table M:6-2. Project Schedule Confidence

Confidence Level	Value	Contingency
0%	**304.1 Months**	**0.15%**
5%	**316.4 Months**	**5.74%**
10%	**322.8 Months**	**7.69%**
15%	**327.9 Months**	**9.25%**
20%	**332.9 Months**	**10.70%**
25%	**336.8 Months**	**12.16%**
30%	**341.5 Months**	**13.57%**
35%	**346.4 Months**	**15.10%**
40%	**352.3 Months**	**16.67%**
45%	**356.9 Months**	**18.31%**
50%	**362.1 Months**	**20.02%**
55%	**368.6 Months**	**21.87%**
60%	**372.9 Months**	**23.77%**
65%	**379.2 Months**	**25.75%**
70%	**385.1 Months**	**27.96%**
75%	**390.8 Months**	**30.41%**
80%	**397.6 Months**	**33.08%**
85%	**407.6 Months**	**36.18%**
90%	**418.3 Months**	**39.76%**
95%	**431.7 Months**	**44.43%**
100%	**466.7 Months**	**60.17%**

6.4 COMBINED COST AND SCHEDULE CONTINGENCY RESULTS

To obtain 3an overall feature contingency, the cost risk analysis confidence table and the schedule risk analysis confidence table are combined. To obtain the final contingency dollar amount, the schedule contingency is converted into dollars by using the time value of money.

Section 7
Major Findings/Observations

The cost and schedule risk analysis resulted in a recommended combined cost contingency of $197,237,400 and a schedule recommended contingency of 97.6 months. The project construction costs for several confidence levels are shown below. Table M:7-1 presents construction costs, which include base cost plus cost and schedule contingencies. Lands and Damages cost and contingency are not included. The recommended contingency is 31.7 percent based on the 80 percent confidence level. These contingencies were applied to the detailed estimate for the recommended plan. Lands and Damages cost and contingency are not included in the above numbers. Note: The rounding of contingencies causes the totals on the TPCS to be slightly higher than and not add up to exactly the costs previously mentioned.

Table M:7-1. Project Contingencies (Base Cost Plus Cost and Schedule Contingencies)

Confidence Level	Base Cost	Contingency $	Contingency (%)
5%	$622,200,000	$16,737,180	2.69%
50%	$622,200,000	$130,288,680	20.94%
80%	$622,200,000	$197,237,400	31.70%
90%	$622,200,000	$232,640,580	37.39%

The major contributors to the resulting total project cost contingency were:

- (PR-2) Participation Rate 0yr to 25yr – risk (positive) of having only a 65 percent participation rate instead of the 100 percent assumed.
- (CON-1) Availability of Floodproofing Contractors – risk of inflated prices due to large budgets and limited pool of contractors.
- (CA-1) Contract Acquisition – risk that contract acquisition methods chosen could cause increased levels of subcontracting and/or limit pool of contractors.

The major contributor to the resulting total project contingency for the Schedule feature was:

- (PR-3) Intermittent Funding – risk of delays in schedule due to a lack of funding during the project.
- (CA-1) Contract Acquisition – risk of limited competition due to contract type delaying the schedule.
- (PPM-1) PED and S&A - risk of Federal Gov't having to set up a full system to engineer, design, and administer the program to the lowest levels.

Recommendations: Further iterative project and risk study is important throughout the project life-cycle in order to efficiently manage and maintain a reasonable cost and schedule. Certain risks are outside the USACE control, while certain risks can be managed to lessen impact in cost and time. The more critical items that warrant attention are:

- Work to identify inefficiencies and limit administration by the federal government to higher levels so it does not require setting up robust planning, design, and administration programs.
- Publicize and encourage participation by construction contractors to ensure adequate supply and competition.
- Utilize budget conscious contracting acquisition methods.

The above risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. These conclusions were reached by identifying and assessing risk items for use in the risk analysis. These quantitative impacts of these risk items are then analyzed using a combination of professional judgment, empirical data, and analytical techniques.

DETAILED RISK REGISTER

(Present the detailed Risk Register here, covering all risk events, regardless of low, medium, or high risk concerns)

Risk No.	Risk/Opportunity Event	Concerns	USACE Discussions	Project Cost			Project Schedule		
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the USACE's sphere of influence.)									
	PROJECT & PROGRAM MGMT								
PPM-1	PED and S&A Costs	Project assumes the Fed Gov't will perform high level administration. The USACE's concern is that the Fed Gov't may have to implement a more robust administration/ inspection/approval process for the program.	It is still unclear exactly how this program willl be implemented / administered; but it was assumed that the Federal Govt will administer at a high level. If the Govt has to implement a full administration plan to the lowest levels, it would add considerable administrative costs - PED and S&A.	Likely	Significant	HIGH		Likely	Marginal
PPM-2	Inventory of Eligible Structures	The USACE's concern is that the structure inventory could vary significantly from the current inventory. However, implementation of other similar projects has proven that the inventory generally reduces as a project moves from feasibility to implementation.	This risk item considers the accuracy of the inventory of structures eligible for the nonstructural program. The inventory, which is the basis for the nonstructural cost estimate, was developed in 2012 and considered conservative. The inventory done was a 100% windshield survey - drive by and visually looked at each structure noting characteristics and assumed height above ground. It is assumed structures constructed after this survey would not be eligible nor have a need for this project because they would have been built to the new code.	Very Unlikely	Marginal	LOW		Very Unlikely	Negligible
PPM-3	Scope Maturity	Concern that unanticipated items of work could be added as part of the program as it is developed.	This item is to address the concern that due to the early program development stage, extended period of completion, and political pressure of dealing directly with the public, there could be un-anticipated items of work that could be added/required.	Likely	Significant	HIGH		Likely	Negligible

	CONTRACT ACQUISITION RISKS								
CA-1	Contract Acquisition	limited competition during contract procurement could increase bid prices.	The base estimate assumes open and competitive bidding which is the traditionally employed contract procurement method. However, often competition will be limited due to certain small business objectives, using small groups of pre-approved contractors, or with the intent of improving overall quality of construction (best-value procurements). The house elevating costs are based on the limited pool available in the LA area, so some limited competition could be considered to already be built into the costs. There is a risk not knowing the exact implementation plan could cause increased levels of tiered subcontracting and/or limit the pool of contractors.	Likely	Significant	HIGH		Likely	Marginal
3	**TECHNICAL RISKS**								
TL-1	Technical / Design Changes	possible design changes/ technical requirements for implementation	This item is to address the concern that due to the extended period of completion, there could be future design / technical changes that would result in increased requirements and cost.	Unlikely	Marginal	LOW		Likely	Negligible
	CONSTRUCTION RISKS								
CON-1	Availability of Floodproof Contractors	The concern is that the contracting pool could not be sufficient to support this project thereby reducing production, quality, and competitive market.	The base estimate assumes that there is no issue in obtaining capable contractors to perform the construction associated with the nonstructural floodproofing efforts. There is the risk that if you were to flood the market with a robust budget in a given time period and had a limited pool of contractors you could greatly increase contractor prices.	Likely	Significant	HIGH		Likely	Marginal

CON-2	Unknown Cultural Resources	cultural resources might be encountered.	The cost of the needed surveys is pre-negotiated and the number of surveys needed are fixed so no contingency is needed for the survey costs. Work is on existing property/structures so the chances of finding artifacts that would need to be removed are low. If some are found, the number of structures affected would be low.	Unlikely	Significant	MODERATE		Unlikely	Significant
CON-3	Construction Contract Modifications	concern that construction contract modifications/claims could impact cost and schedule.	Dealing with the public, occupied structures, and unknown site conditions could result in increased risk of contract modifications/claims. Will impact costs, but little overall impact to larger project timeline.	Likely	Marginal	MODERATE		Likely	Negligible
	ESTIMATE AND SCHEDULE RISKS								
EST-2	Required Raise Height	The concern is that assumed ground elevations may not be accurate and could result in a higher "required" raise amount.	The existing ground elevation was taken from 2009 LIDAR which is considered to be reasonably accurate for this level of detail. A sampling of first floor elevation was conducted by ocular measurement and applied across the study area. The calculated "raise" height was rounded UP based on efficiencies in the cost estimate. The Std deviation is less than 1 ft based on the check surveys of LIDAR data. A one foot difference in elevation costs the same in many cases. Raise height calculations considered conservative.	Unlikely	Negligible	LOW		Unlikely	Negligible
EST-3	Temporary Relocation of Residents	temporary relocation assistance during residential house elevating is NOT currently allowed for homeowners.	Due to public outrage Gov't may be forced to provide relocation assistance during construction on residential structures. Based on available information, avg outage is approximately 45 days.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible

EST-4	Assumed Average Structure Size	concern that the "average" structure size by occupancy type used in the calculations may not truly represent the total of the actual sizes affected and therefore under-represent the project cost.	Due to large volume there is no way to estimate using individual dimensions, so they were averaged into an "average" structure for the various types. Accuracy of the size data method could result in variations from the actual sizes and cause the total cost to increase. Sizes were determined from aerial photographs but a field recon was also performed.	Likely	Marginal	MODERATE		Likely	Negligible
Programmatic Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the USACE's sphere of influence.)									
PR-2	Owner Participation Rate	This item is perceived by the USACE to potentially be a significant opportunity. Historical participation rates in other programs have varied widely from project to project (ex. LRH's nonstructural program ranging from a low of about 5% to a high of about 80 with an average of about 56%).	The nonstructural program involves voluntary participation on the part of individuals at risk due to flooding. A 100% participation rate has been conservatively assumed in the cost estimate. Therefore, no chance of cost increases, only cost decrease. This risk element is negative so it is likely to have a cost reduction effect.	Very Likely	Significant	HIGH		Very Likely	Negligible
PR-3	Intermittent Funding	Receiving inadequate Federal or State funds will result in inefficient effort and contract procurements. The overall implementation of the project could be affected, exposing the project to greater risk of inflation.	This is one of the most difficult risk to quantify and yet has the potential to negatively affect the project's final cost and schedule. The USACE has little or no influence over this risk item. The project is fully supported by the State. Intermittent funding could result in increased construction schedule resulting in construction cost escalation.	Very Likely	Marginal	MODERATE		Very Likely	Significant

Section 8
Construction Schedule

The construction period for this program/project is scheduled to begin in 2025 and end in 2050. There are 1,790 potential residential structures and 450 potential commercial structures for a total of 2,240 structures. The construction duration per structure is assumed to be three months. It is assumed that there will be around 25 contractors participating in this program. With a rate of approximately 100 structures per year, it would take 22.5 years to complete all structures. The team assumed a total of 25 years for full implementation as a reasonable project completion duration.

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