



# Amite River and Tributaries Study East of the Mississippi River, Louisiana (ART)



## Appendix B: Cost Engineering

November 2019

# CONTENTS

<b>Section 1–General</b> .....	<b>1</b>
1.1    Cost Estimate Development.....	1
1.2    Estimate Structure.....	1
1.3    Bid Competition.....	1
<b>Section 2–Contract Acquisition Strategy</b> .....	<b>2</b>
<b>Section 3–Labor Shortages</b> .....	<b>3</b>
<b>Section 4–Labor Rate</b> .....	<b>4</b>
<b>Section 5–Materials</b> .....	<b>5</b>
<b>Section 6–Quantities</b> .....	<b>6</b>
<b>Section 7–Equipment</b> .....	<b>7</b>
<b>Section 8–Severe Rates</b> .....	<b>8</b>
<b>Section 9–Fuels</b> .....	<b>9</b>
<b>Section 10–Crews</b> .....	<b>9</b>
<b>Section 11–Unit Prices</b> .....	<b>10</b>
<b>Section 12–Relocation Costs</b> .....	<b>11</b>
<b>Section 13–Mobilization</b> .....	<b>12</b>
<b>Section 14–Field Office Overhead</b> .....	<b>13</b>
<b>Section 15–Overhead Assumptions</b> .....	<b>14</b>
<b>Section 16–Home Office Overhead</b> .....	<b>15</b>
<b>Section 17–Taxes</b> .....	<b>16</b>
<b>Section 18–Bond</b> .....	<b>17</b>
<b>Section 19–Planning, Engineering &amp; Design (PED)</b> .....	<b>18</b>
<b>Section 20–Supervision &amp; Administration (S&amp;A)</b> .....	<b>19</b>
<b>Section 21–Contingencies</b> .....	<b>20</b>
<b>Section 22–Escalation</b> .....	<b>21</b>
<b>Section 23–Hazardous, Toxic, and Radioactive Waste</b> .....	<b>22</b>
<b>Section 24–Schedule</b> .....	<b>23</b>
<b>Section 25–Cost Estimate</b> .....	<b>24</b>

# LIST OF TABLES

Table B:25-1. Darlington Dam – Reduced Wet.....	<b>Error! Bookmark not defined.</b>
Table B:25-2. Darlington Dam – Dry.....	<b>Error! Bookmark not defined.</b>
Table B:25-3. Sandy Creek Dry Dam .....	<b>Error! Bookmark not defined.</b>
Table B:25-4. Three Tributary Dry Dams.....	<b>Error! Bookmark not defined.</b>



# Section 1

## General

### 1.1 COST ESTIMATE DEVELOPMENT

Cost estimates for Structural Alternatives were developed at a Class 4 Level of effort utilizing Parametric costs, Historical costs, or the latest MCACES MII cost estimating software. The cost estimates used the standard approaches for a feasibility estimate structure regarding labor, equipment, materials, crews, unit prices, quotes, and sub and prime contractor markups. This philosophy was taken wherever practical within the time constraints. It was supplemented with estimating information from other sources, where necessary, such as quotes, bid data, and Architect-Engineer (A-E) estimates. The intent was to provide or convey a “fair and reasonable” estimate that depicts the local market conditions. The estimates assume a typical application of tiered subcontractors. All of the construction work (e.g., dam structure, dredging, excavation, dewatering, pilings, rock, etc.) is common to the Gulf Coast region. The construction sites are accessible from land and access is easily provided from various local highways.

The cost estimates for the Non-Structural Alternatives were developed by the US Army Corps of Engineers, Mississippi Valley Division, New Orleans District (MVN) Economist, and are discussed in the Appendix: F Economics and Main Report.

### 1.2 ESTIMATE STRUCTURE

The estimates are structured to reflect the projects performed. The estimates have been subdivided by alternative and US Army Corps of Engineers (USACE) feature codes.

### 1.3 BID COMPETITION

It is assumed that there will not be an economically saturated market and that there will be bidding competition

## Section 2

# Contract Acquisition Strategy

There is no declared contract acquisition plan/types at this time. It is assumed that the contract acquisition strategy will be similar to past projects with large, unrestricted, design/bid/build contracts

## **Section 3**

# **Labor Shortages**

It is assumed there will be a normal labor market.

## **Section 4**

# **Labor Rate**

Local labor market wages are above the local Davis-Bacon Wage Determination, so actual rates have been used. Local payroll information was not available; therefore, regional gulf coast information was used from MVN construction representatives and estimators with experiences in past years.



## Section 5

# Materials

Cost quotes are used on major construction items when available. Recent cost quotes may include concrete, steel sheet piling, rock, gravel, and sand. The assumption is that materials will be purchased as part of the construction contract. The estimate does not anticipate government furnished materials, except for borrow materials. Prices include delivery of materials.

All borrow material is assumed government furnished. Specific sources for borrow material have not yet been established. The non-Federal local sponsor has assisted with researching possible sources and stated there is very likely acceptable borrow for random fill within a 5 mile radius of the project and within a 20 mile radius of the project for clay fill. An assumed average one-way haul distance of 5 miles was used for random fill and an average one way haul distance of 20 miles for clay fill was used, until a borrow source has been confirmed. Haul speeds are estimated using a 40 mph speed average, given the rural access roads and highways.

The borrow quantity calculations followed the MVN Geotechnical guidance:

Hauled Levee: 10 BCY (bank cubic yards) of borrow material = 12 LCY (loose cubic yards) hauled = 8 ECY (embankment cubic yards) compacted.

Soil compaction factors can vary considerably with soil material gradation and moisture content. As borrow data was not available at this time materials obtained for fill were assumed to mimic Bonnet Carre Spillway borrow materials.

## **Section 6**

# **Quantities**

Quantities for dam alternatives were provided by civil and structural designers for the various alternatives.

## Section 7

# Equipment

Rates used are based from the latest USACE Engineer Pamphlet (EP)-1110-1-8, Region III. Adjustments are made for fuel, filters, oil, and grease (FOG) prices and Facility Capital Cost of Money (FCCM). Judicious use of owned verses rental rates was considered based on typical contractor usage and local equipment availability. Only a few select pieces of marine/marsh equipment are considered rental. Full FCCM/Cost of Money rate is latest available; MII program takes the EP recommended discount, no other adjustments have been made to the FCCM. Equipment was chosen based on historical knowledge of similar projects.

## **Section 8**

# **Severe Rates**

Severe equipment rates were used, where applicable, for various pieces of equipment in the hydraulic dredging crews where they may come in contact with any harsh environment.

Rental rates were used, where applicable, for various pieces of marine and marsh equipment, where rental is typical, such as marsh backhoes.

## Section 9

# Fuels

Fuels (gasoline, on and off-road diesel) were based on local market averages for on-road and off-road for the Gulf Coast area. Historic data gathered in the Greater New Orleans area over the last 10 years shows fuel cost have risen and fallen at irregular rates; therefore, an average fuel cost was assumed.

## 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 the Gulf Coast area and MVN Cost Engineers. The crews and productivities were checked by local MVN estimators, discussions with contractors and comparisons with historical cost data. Major crews include haul, earthwork, piling, concrete, and hydraulic dredging.

Most crew work hours are assumed to be 10 hours, 6 days/week, which is typical to the area. Marine based bucket excavation/dredging operators are assumed to work two 12 hours shifts, 7 days/week.

A 10 percent markup on labor for weather delay is selectively applied to the labor in major earthwork placing detail items and associated items that would be affected by weather making it unsafe or difficult to place (trying to run dump trucks on a wet levee) or be detrimental/non-compliant to the work being done (trying to place/compact material in the rain). The 10 percent markup is to cover the common practice of paying for labor arriving to the job site and then being sent home due to minor weather, which is part of known average weather impacts as reflected within the standard contract specifications. The markup was not applied to small quantities where this can be scheduled around.

## **Section 10**

# **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.

## Section 11

# Relocation Costs

Relocation costs are defined as the relocation of public roads, bridges, railroads, and utilities required for project purposes. In cases where potential significant impacts were known, costs were included within the cost estimate.

## Section 12

# Mobilization

Contractor mobilization and demobilization (mob/demob) are based on the assumption that most of the contractors will be coming from within the Gulf Coast/Southern region. Mob/demob costs are based on historical studies of detailed Government estimate mob/demob, which are in the range of approximately 3 to 5 percent of the construction costs. With undefined acquisition strategies and assumed individual project limits, the estimate utilizes a slightly more comprehensive, approximate 4 percent value (min) applied at each contract rather than risking minimizing mob/demob costs by detailing costs based on an assumed number of contracts. This value also matches well with values previously prescribed by USACE Walla Walla District, which has studied historical rates.



## Section 13

# Field Office Overhead

The estimate used a field office overhead rate of 12 percent for the prime contractors at budget level development. Based on historical studies and experience, USACE Walla Walla District has recommended typical rates ranging from 9 percent to 11 percent for large civil works projects; however, the 9-11 percent rate does not consider possible incentives such as camps, allowances, travel trailers, meals, etc., which have been used previously to facilitate large or remote projects. With undefined acquisition strategies and assumed individual project limits, the estimate utilizes a more comprehensive percentage based approach applied at each contract rather than risking minimizing overhead costs by detailing costs based on an assumed number of contracts. The applied rates were previously discussed among numerous USACE Cost Engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans Districts.

## Section 14

# Overhead Assumptions

Overhead assumptions may 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, camp/facility/kitchen maintenance and utilities, 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.

## Section 15

# 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 percent 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 among numerous USACE Cost Engineers including Walla Walla, Vicksburg, Norfolk, Huntington, St. Paul, and New Orleans Districts.

## Section 16

# Taxes

Local taxes will be applied based on the parishes that contain the work. Reference the tax rate website for Louisiana: <http://www.salestaxstates.com>.

## **Section 17**

# **Bond**

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

## Section 18

# 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, a rate of approximately 12 percent for Engineering and Design (E&D) plus small percentages for other support features is applied against the estimated construction costs. Other USACE civil works districts such as St. Paul, Memphis, and St. Louis have reported values ranging from 10-15 percent for E&D. Additional support features might include project management, engineering, planning, designs, investigations, studies, reviews, and value engineering. An E&D rate of 12 percent was applied.

## Section 19

# Supervision & Administration (S&A)

Historically, a range from 5 percent to 15 percent, depending on project size and type, was applied against the estimated construction costs. 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. S&A costs are percentage based. An S&A rate of 11 percent was applied.

## Section 20

# Contingencies

Contingencies for the focused array of Structural Alternatives were developed using the USACE Abbreviated Cost Risk Analysis (ARA) program. An ARA is a qualitative approach used by PDT to address key risk concerns for major features of work and their impact to cost and schedule drivers such as Project Scope Growth, Acquisition Strategy, Construction Elements, Quantities, Specialty Fabrication or Equipment, Cost Estimate Assumptions, and External Project Risks. A separate ARA was prepared for each alternative to differentiate between the alternatives. Each alternative had very similar features of work and similar risk concerns, but the Sandy Creek Dry Dam and the three Tributary Dams had higher risk contingencies due of lack of geotechnical and Hydrological data and historical information in the area of these smaller dams and design scaled down some quantities of the larger Darlington Dam to minimize design effort at this phase.



## **Section 21**

# **Escalation**

Escalation used is based upon the latest version of the USACE Engineering Manual (EM) 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS).

## **Section 22**

# **Hazardous, Toxic, and Radioactive Waste**

The estimate does not include costs for any potential Hazardous, Toxic, and Radioactive Waste (HTRW). A Phase I Environmental Site Assessment will be conducted prior to the Final IFR and EIS. The final report will include any estimated costs to address potential HTRW.

## Section 23

# Schedule

The project schedule for each alternative was developed based on the construction line items for each feature of work.

For the Darlington Dam – Reduced Wet and Dry Dam Alternatives, it was assumed Engineering and Design (E&D), Cultural Resources Surveys and Cultural Mitigation, Environmental T&E Species and Habitat Mitigation, and Real Estate acquisition would start in 2021 and construction would begin in 2022. The construction duration for each alternative would be 4 years, with completion in 2026.

For Sandy Creek Dry Dam and the three Tributary Dry Dam Alternatives it was assumed E&D, Cultural Resources Surveys and Cultural Mitigation, Environmental T&E Species Investigation and Habitat Mitigation, and Real Estate acquisition would start in 2021 and construction would begin in 2024. The construction duration for each alternative would be for 2 years, with completion by 2026.

## Section 24

# Cost Estimate

Tables B:24-1 through B:24-4 show the baseline project cost for each focused array alternative.

*Table B:24-1. Darlington Dam – Reduced Wet*

<b>Feature</b>	<b>Cost</b>	<b>Contingency</b>	<b>Total</b>
01 Lands & Damages	\$133,490,000	\$30,785,000	\$164,275,000
02 Relocations	\$3,034,000	\$1,466,000	\$4,500,000
04 Dams	\$448,369,000	\$178,595,000	\$626,964,000
06 Fish & Wildlife Facilities	\$569,050,000	\$112,762,000	\$681,812,000
18 Cultural Resources Preservation	\$83,445,000	\$28,624,000	\$112,069,000
30 PED	\$92,538,000	\$36,912,000	\$129,450,000
31 Construction Management	\$49,654,000	\$19,807,000	\$69,461,000
<b>TOTAL</b>	<b>\$1,379,580,000</b>	<b>\$408,951,000</b>	<b>\$1,788,531,000</b>

*Table B:24-2. Darlington Dam - Dry*

<b>Feature</b>	<b>Cost</b>	<b>Contingency</b>	<b>Total</b>
01 Lands & Damages	\$133,299,000	\$30,722,000	\$164,021,000
02 Relocations	\$3,034,000	\$1,466,000	\$4,500,000
04 Dams	\$441,389,000	\$175,260,000	\$616,649,000
06 Fish & Wildlife Facilities	\$159,894,000	\$31,684,000	\$191,578,000
18 Cultural Resources Preservation	\$78,506,000	\$27,607,000	\$106,113,000
30 PED	\$91,107,000	\$36,229,000	\$127,336,000
31 Construction Management	\$48,887,000	\$19,439,000	\$68,326,000
<b>TOTAL</b>	<b>\$956,116,000</b>	<b>\$322,407,000</b>	<b>\$1,278,523,000</b>

*Table B:24-3. Sandy Creek Dry Dam*

<b>Feature</b>	<b>Cost</b>	<b>Contingency</b>	<b>Total</b>
01 Lands & Damages	\$12,568,000	\$3,395,000	\$15,963,000
02 Relocations	\$416,000	\$921,000	\$1,337,000
04 Dams	\$80,773,000	\$39,709,000	\$120,482,000
06 Fish & Wildlife Facilities	\$29,681,000	\$5,881,000	\$35,562,000
18 Cultural Resources Preservation	\$41,947,000	\$17,313,000	\$59,260,000
30 PED	\$16,644,000	\$8,329,000	\$24,973,000
31 Construction Management	\$8,931,000	\$4,469,000	\$13,400,000
<b>TOTAL</b>	<b>\$190,960,000</b>	<b>\$80,017,000</b>	<b>\$270,977,000</b>

*Table B:24-4. Three Tributary Dry Dams*

<b>Feature</b>	<b>Cost</b>	<b>Contingency</b>	<b>Total</b>
01 Lands & Damages	\$15,366,000	\$3,662,000	\$19,028,000
02 Relocations	\$7,720,000	\$4,257,000	\$11,977,000
04 Dams	\$99,105,000	\$47,604,000	\$146,709,000
06 Fish & Wildlife Facilities	\$33,696,000	\$6,677,000	\$40,373,000
18 Cultural Resources Preservation	\$57,464,000	\$24,443,000	\$81,907,000
30 PED	\$21,899,000	\$10,632,000	\$32,531,000
31 Construction Management	\$11,751,000	\$5,704,000	\$17,455,000
<b>TOTAL</b>	<b>\$247,001,000</b>	<b>\$102,979,000</b>	<b>\$349,980,000</b>

Additionally, there were two nonstructural alternatives that were included in the Focused Array of Alternatives which were assessments of all residential and non-residential structures located within the 0.04 and 0.02 AEP flood plains of the study area. The cost estimates for the 0.04 and 0.02 AEP nonstructural features were developed based on the cost of reducing risk of damage to the structures in the year 2026 respective flood plains. Details of these costs and their development are presented in Appendix F.

- Nonstructural 0.04 AEP Alternative - First Cost - \$1,335,282,000
- Nonstructural 0.02 AEP Alternative - First Cost - \$2,160,836,000

Based on the economic analysis of the focused array the National Economic Development (NED) plan is the Darlington Dry Dam, which is also the PDT's Tentatively Selected Plan (TSP). To further evaluate possible inclusion of nonstructural features into the TSP, Economics performed preliminary analysis of the flood risk that remains in the floodplain after the proposed alternative is implemented. This is known as the residual flood risk and nonstructural measures can be used to reduce the residual risk associated with the TSP. The preliminary analysis found a total of 3,252 residential structures and an additional 314 non-residential structures in the 0.04 AEP floodplain that were considered eligible for acquisition, elevation and flood proofing conditional to certain criteria as described in Appendix F. The baseline project cost for the TSP/NED

plan which includes the Darlington Dry Dam combined with the nonstructural measures is shown in Table 24-5.

*Table B:24-5. Darlington Dry Dam With 0.04 AEP Elevations & Floodproofing*

<b>Feature</b>	<b>Cost</b>	<b>Contingency</b>	<b>Total</b>
01 Lands & Damages	\$133,299,000	\$30,722,000	\$164,021,000
02 Relocations	\$3,034,000	\$1,466,000	\$4,500,000
04 Dams	\$441,389,000	\$175,260,000	\$616,649,000
06 Fish & Wildlife Facilities	\$159,894,000	\$31,684,000	\$191,578,000
18 Cultural Resources Preservation	\$78,506,000	\$27,607,000	\$106,113,000
30 PED	\$91,107,000	\$36,229,000	\$127,336,000
31 Construction Management	\$48,887,000	\$19,439,000	\$68,326,000
Nonstructural 0.04 AEP - First Cost	\$761,485,000	\$262,713,000	\$1,024,198,000
<b>TOTAL</b>	<b>\$1,717,601,000</b>	<b>\$585,120,000</b>	<b>\$2,302,721,000</b>

Further details of how the Nonstructural 0.04 AEP - First Cost was developed can be found in Appendix F.