

ST. JOHNS COUNTY, FLORIDA
South Ponte Vedra Beach, Vilano
Beach, and Summer Haven Reaches

COASTAL STORM RISK MANAGEMENT PROJECT
FINAL INTEGRATED FEASIBILITY STUDY AND
ENVIRONMENTAL ASSESSMENT

APPENDIX B
Cost Engineering and Risk Analysis

March 2017



**US Army Corps
of Engineers**
Jacksonville District

**U.S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT**

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ATTACHMENT TO APPENDIX B

ATTACHMENT A: CSRA EXECUTIVE SUMMARY

B. COST ESTIMATES

B1. GENERAL INFORMATION

Corps of Engineers cost estimates for planning purposes are prepared in accordance with the following guidance:

- Engineer Technical Letter (ETL) 1110-2-573, Construction Cost Estimating Guide for Civil Works, 30 September 2008
- Engineer Regulation (ER) 1110-1-1300, Cost Engineering Policy and General Requirements, 26 March 1993
- ER 1110-2-1302, Civil Works Cost Engineering, 15 September 2008
- ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999
- ER 1105-2-100, Planning Guidance Notebook, 22 April 2000, as amended
- Engineer Manual (EM) 1110-2-1304 (Tables Revised 31 March 2009), Civil Works Construction Cost Index System, 31 March 2000
- CECW-CP Memorandum for Distribution, Subject: Initiatives to Improve the Accuracy of Total Project Costs in Civil Works Feasibility Studies Requiring Congressional Authorization, 19 September 2007
- CECW-CE Memorandum for Distribution, Subject: Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs, 3 July 2007
- Cost and Schedule Risk Analysis Process, March 2008

The goal of the cost estimates for the St. Johns County Coastal Storm Risk Management Project Feasibility Study is to present a Total Project Cost (construction and non-construction costs) for the Recommended Plan(s) at the current price level to be used for project justification/authorization and to escalate costs for budgeting purposes. In addition, the costing efforts are intended to produce a final product (cost estimate) that is reliable and accurate, and that supports the definition of the Government's and the non-Federal sponsor's obligations.

The cost estimating effort for the study also yielded a series of alternative plan formulation cost estimates for decision making. The final set of plan formulation cost estimates used for plan selection rely on construction feature unit pricing and are prepared in Civil Works Work Breakdown Structure (CWWBS) format to the sub-feature level. The cost estimate supporting the National Economic Development (NED) plan (Recommended Plan/Locally Preferred Plan) is prepared in MCACES/MII format to the CWWBS sub-feature level. This estimate is supported by the preferred labor, equipment, materials and crew/production breakdown. A fully funded (escalated for inflation through project completion) cost estimate, the Baseline Cost Estimate or Total Project Cost Summary, has also been developed.

An abbreviated risk analysis was prepared that addresses project uncertainties and sets contingencies for the plan formulation cost estimates. A full cost and schedule risk analysis was performed to establish the project contingency for the Recommended Plan's cost items.

B.1.1 Plan Formulation Cost Estimates

For the plan formulation cost estimates, unit prices for dredging related work were developed in CEDEP and then entered into MCACES/MII. Unit prices for the remaining major

or variable construction elements were developed in MCACES/MII based on input from the PDT. Design details, information and assumptions were provided in the Engineering Appendix. Plan formulation alternatives were run through Beach-Fx for calculation of the Benefit-to-Cost Ratio (BCR). Cost Engineering provided estimates for the initial construction on all alternatives that were input into Beach-Fx. An abbreviated risk analysis was completed in order to establish the contingency for each of the alternatives. Non-construction costs were included as percentages of the total construction contract cost for this level of comparison and screening.

Refer to Economics Section in the main report for final plan formulation cost tables.

B.1.2 Recommended Plan

The Recommended Plan or NED plan was chosen by the Project Delivery Team (PDT) according to the plan formulation described above. The Economics Appendix fully describes the plan selection. The scope of work for the Recommended Plan is found in Appendix A, Engineering. The MCACES/MII cost estimate for the Recommended Plan (Section A3, below) is based on that scope and is formatted in the CWWBS. The notes provided in the body of the estimate detail the estimate parameters and assumptions. These include pricing at the Fiscal Year 2017 price level (1 October 2016-30 September 2017). For project justification purposes, the estimate costs are categorized under the appropriate CWWBS code and include both construction and non-construction costs.

The construction costs fall under the following feature codes:

- 17 Beach Replenishment

The non-construction costs fall under the following feature codes:

- 01 Lands and Damages
- 30 Planning, Engineering and Design
- 31 Construction Management

B.1.3 Construction Cost

For the construction costs, unit prices for dredging related work were developed in the Cost Engineering Dredge Estimating Program (CEDEP) and then entered into MCACES/MII. These costs include all major project components categorized under the appropriate CWWBS to the sub-feature level. The Total Project Cost Summary (TPCS) on the Recommended Plan contains contingencies as noted in the estimate (below) and were determined as a result of the risk analysis which is covered under another paragraph.

B.1.4 Non-construction Cost

Non-construction costs typically include Lands and Damages (Real Estate), Planning Engineering & Design (PED) and Construction Management Costs (Supervision & Administration, S&A). These costs were provided by the PDT either as a lump sum cost or as a percentage of the total Construction Contract Cost. Lands and Damages are provided by Real Estate and are best described in the Real Estate Appendix, Appendix D. PED costs are for the preparation of contract plans and specifications (P&S) and include itemized costs that were provided by the PDT, as well as costs for Post-Construction Monitoring costs and

percentages for Engineering During Construction (EDC) that were provided by the project manager. Construction Management costs are for the supervision and administration of a contract and include Project Management and Contract Admin costs. These costs were provided by the project manager and are included as a percentage of the total construction contract cost.

The main report details both cost allocation and cost apportionment for the Federal Government and the non-Federal Sponsor. Also included in the main report are the non-Federal Sponsor's obligations (items of local cooperation).

B.1.5 Construction Schedule

A construction schedule was prepared utilizing input from the PDT and reflects all project construction components. The schedule considers not only durations of individual components of construction, but also the timing of construction contracts based on funding and construction windows. The construction schedule was combined with the project schedule to create an overall schedule that was used for the generation of the TPCS. The construction schedule will change as the project moves through the various project lifecycle phases. The overall project schedule is provided below.

B.1.6 Total Project Cost Summary

The cost estimate for the Recommended Plan is prepared with an identified price level date and inflation factors are used to adjust the pricing to the project schedule. This estimate is known as the Fully Funded Cost Estimate or Total Project Cost Summary. It includes all Federal and non-Federal costs: Lands, Easements, Rights of Way and Relocations; construction features; Planning Engineering and Design; Construction Management; Contingency; and Inflation.

B2. PLAN FORMULATION COST ESTIMATES

There were several alternatives the PDT evaluated during plan formulation in order to identify the Recommended Plan. All alternatives that were evaluated at various stages in the study can be found in the Economics Appendix and are also outlined in the Main Report.

All dredging unit costs were calculated in CEDEP and transferred to MII to determine the total initial construction costs for each alternative. Real estate provided costs for the Lands and Damages by reach. The Planning, Engineering and Design (PED) costs, Engineering During Construction (EDC) costs and Supervision & Administration (S&A) costs were provided as a percentage of the total construction contract cost per the Project Manager.

A contingency was applied to each alternative. The contingencies for the construction and non-construction costs were developed using an Abbreviated Risk Analysis. All major risk components were the same for each reach and alternative. Fluctuations in contingencies were mostly as a result of varying total initial construction costs. Site access, staging areas and dune crossovers were all identified as risk items that would require further consideration and refinement in the cost estimate.

Once the total initial construction costs for each alternative were developed in MII, the costs were broken down into a spreadsheet so that the PDT could input the cost information into BeachFx. The table listed the Mobilization & Demobilization costs separately and a Total Cost/Cubic Yard that consisted of the Dredging Cost, plus the non-Construction Costs (minus the Real Estate) since these were the two main cost inputs for BeachFx. The cost of the dune plantings and the Real Estate costs were listed separately and were added to the total project cost outside of BeachFx.

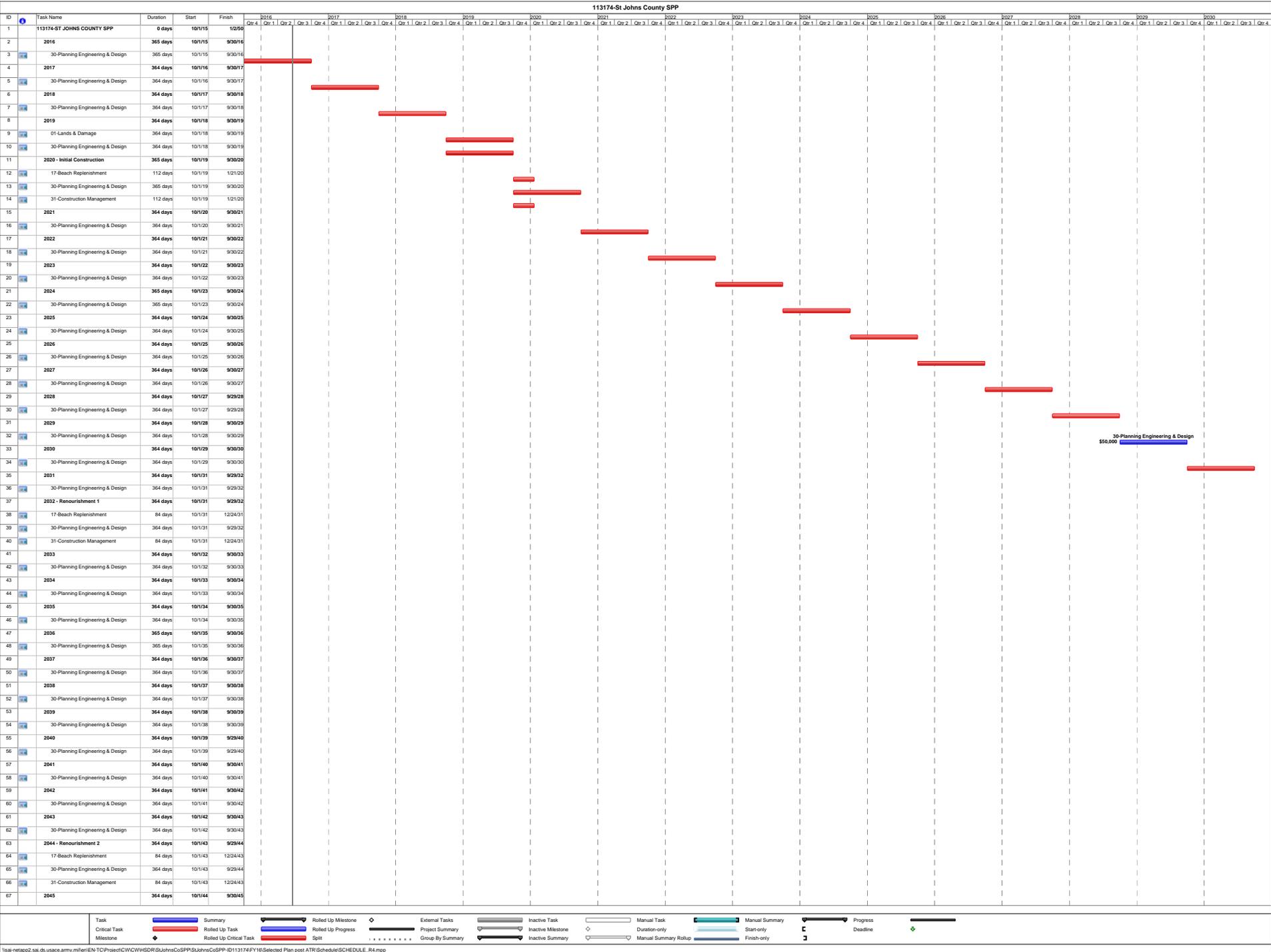
B3. RECOMMENDED PLAN (NED) COST ESTIMATE

The recommended design covers approximately 2.6 miles of the study area extending from R-103.5 to R-116.5 with tapers extending approximately 1000 ft north of R-103.5 and approximately 1000ft south of R-116.5. The construction template consists of a 60 foot wide berm extension plus nourishment of the dune where necessary to maintain the existing (2015) dune profile.

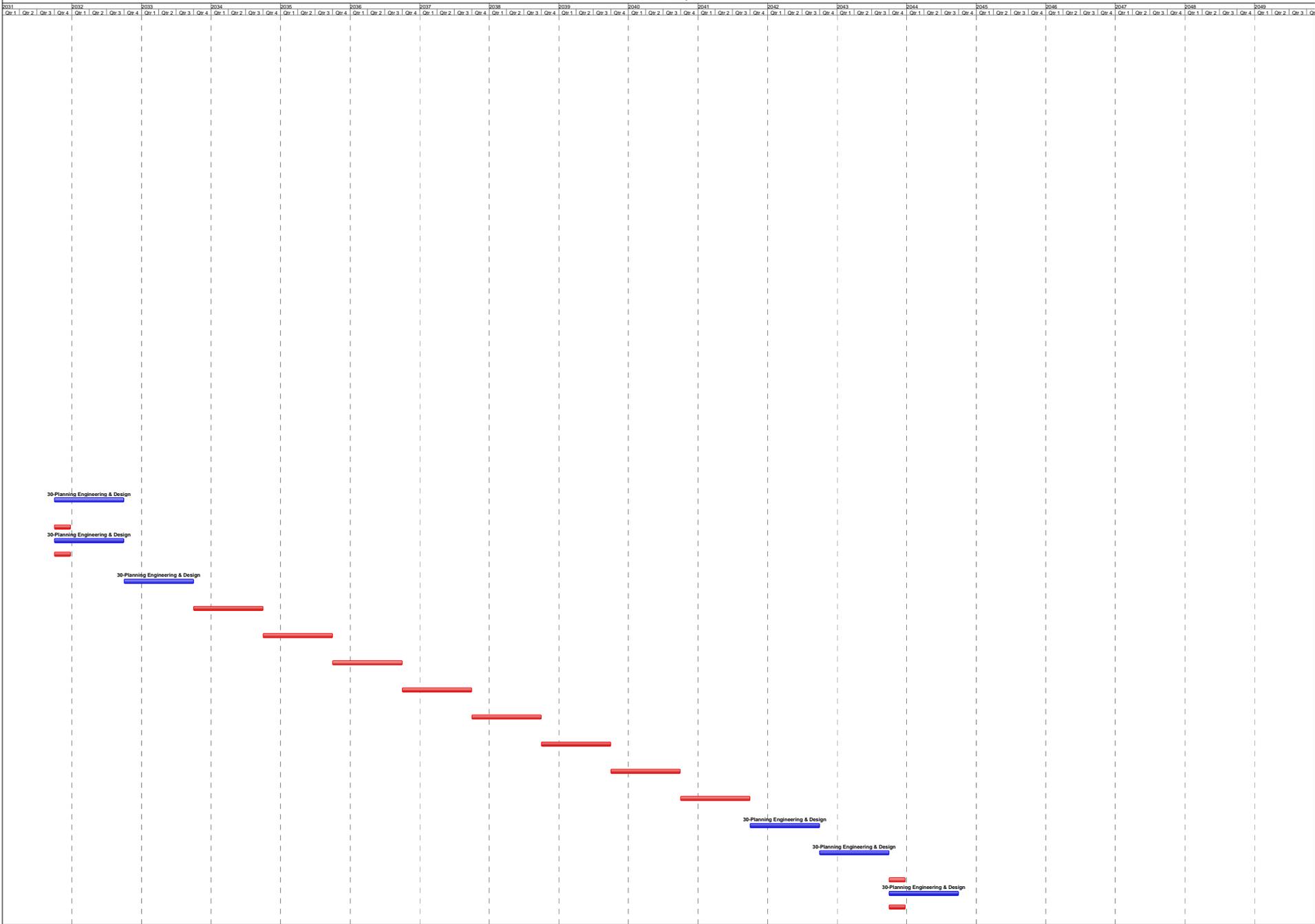
The Recommended Plan estimate was prepared for the Total Project Cost, not just the initial construction costs.

B4. SCHEDULE

The project schedule covers the lifecycle phases of the Recommended Plan (Planning Phase, Preconstruction, Engineering and Design (PED) Phase and the Construction Phase). Refer to the Schedule on the next page.

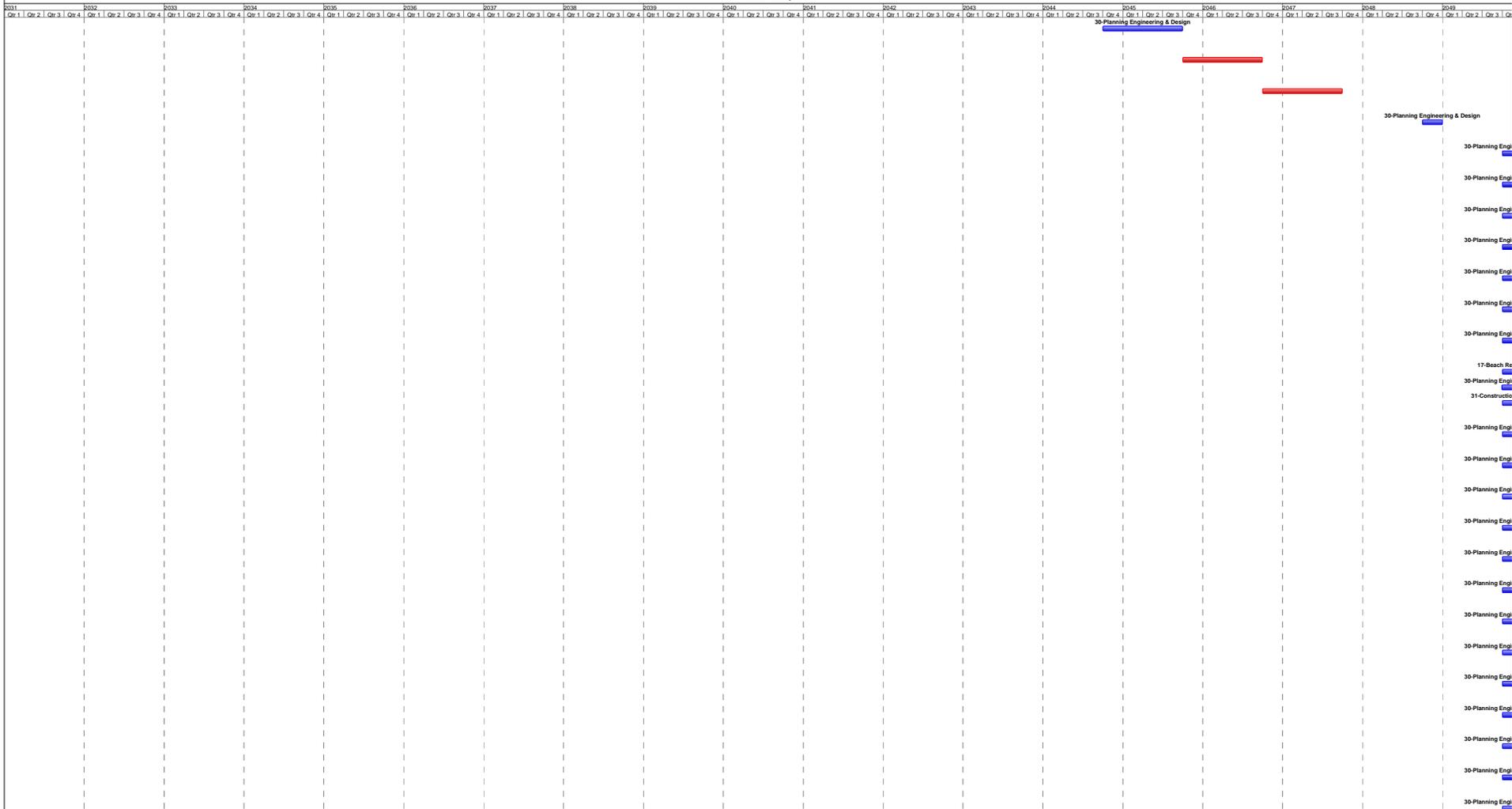


113174-St Johns County SPP



Task	Summary	Rolled Up Milestone	External Tasks	Inactive Task	Manual Task	Manual Summary	Progress
Critical Task	Rolled Up Task	Rolled Up Progress	Project Summary	Inactive Milestone	Duration-only	Start-only	Deadline
Milestone	Rolled Up Critical Task	Split	Group By Summary	Inactive Summary	Manual Summary Rollup	Finish-only	

113174-St Johns County SPP



B5. RISK AND UNCERTAINTY ANALYSIS

A Cost and Schedule Risk Analysis was conducted according to the procedures outlined in the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008.
- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

B.5.1 Risk Analysis Methods

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 the desired level of cost confidence.

The entire PDT participated in a risk analysis brainstorming session to identify risks associated with the Recommended Plan. The risks were listed in the risk register, which is a tool commonly used in project planning and risk analysis, and evaluated by the PDT. The actual Risk Register is provided in Attachment A. Assumptions were made as to the likelihood and impact of each risk item, as well as the probability of occurrence and magnitude of the impact if it were to occur. A risk model was then developed by Walla Walla in order to establish contingencies to apply to the project cost. Risks were evaluated for the following features of work:

- 01 Lands and Damages

- 17 Beach Replenishment
 - Mob, Demob & Preparatory Work
 - Hopper Dredging
 - Dune Planting
- 30 Planning, Engineering and Design
- 31 Construction Management

After the model was run, the results were reviewed and all parameters were re-evaluated by the PDT as a sanity check of assumptions and inputs. Adjustments were made to the analysis accordingly and the final contingency was established. The contingency was applied to the Recommended Plan estimate in the Total Project Cost Summary in order to obtain the Fully Funded Cost.

B.5.2 Risk Analysis Results

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.

Based on the risks that were assessed for the project, the resultant contingency was 28%. The complete breakdown of results can be viewed in the Cost and Schedule Risk Analysis report provided in Attachment A.

B6. TOTAL PROJECT COST SUMMARY

The Total Project Cost Summary (TPCS) addresses inflation through project completion (accomplished by escalation to mid-point of construction per ER 1110-2-1302, Appendix C, Page C-2). It is based on the scope of the Recommended Plan and the official project schedule. The TPCS includes Federal and non-Federal costs for Lands and Damages, all construction features, PED, S&A, along with the appropriate contingencies and escalation associated with each of these activities. The TPCS is formatted according to the CWWBS and uses Civil Works Construction Cost Indexing System (CWCCIS) factors for escalation (EM 1110-2-1304) of construction costs and Office of Management and Budget (EC 11-2-18X, 20 Feb 2008) factors for escalation of PED and S&A costs.

The Total Project Cost Summary was prepared using the MCACES/MII cost estimate on the Recommended Plan, as well as the contingencies set by the risk analysis and the official project schedule.

B.6.1 Total Project Cost Summary Spreadsheet

Refer to the Total Project Cost Summary Spreadsheet on the next page.

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: St Johns County Coastal Storm Risk Management Project
PROJECT NO: P2 113174
LOCATION: St Johns County, FL

DISTRICT: Jacksonville District
POC: CHIEF, COST ENGINEERING, Matthew Cunningham

PREPARED: 2/14/2017

This Estimate reflects the scope and schedule in report; St Johns County CSRMP Feasibility Report December 2015

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)					TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Spent Thru: 10/1/2016 (\$K)	TOTAL FIRST COST (\$K)	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
17	Initial BEACH REPLENISHMENT 2020 Renourishments	\$14,233	\$3,985	28.0%	\$18,218	1.4%	\$14,425	\$4,039	\$18,464	\$0	\$18,464	3.3%	\$14,908	\$4,174	\$19,082
17	BEACH REPLENISHMENT	\$33,457	\$9,368	28.0%	\$42,825	1.4%	\$33,910	\$9,495	\$43,405	\$0	\$43,405	61.8%	\$54,866	\$15,362	\$70,229
CONSTRUCTION ESTIMATE TOTALS:		\$47,689	\$13,353		\$61,042	1.4%	\$48,335	\$13,534	\$61,869	\$0	\$61,869	44.4%	\$69,774	\$19,537	\$89,311
01	Initial LANDS AND DAMAGES Renourishments	\$2,480	\$694	28.0%	\$3,174	1.4%	\$2,514	\$704	\$3,217	\$0	\$3,217	3.3%	\$2,598	\$727	\$3,325
01	LANDS AND DAMAGES	\$0	\$0		\$0	-	\$0	\$0	\$0	\$0	\$0		\$0	\$0	\$0
30	Initial PLANNING, ENGINEERING & DESIGN Renourishments	\$1,331	\$373	28.0%	\$1,703	2.7%	\$1,367	\$383	\$1,749	\$0	\$1,749	6.6%	\$1,457	\$408	\$1,865
30	PLANNING, ENGINEERING & DESIGN	\$5,236	\$1,466	28.0%	\$6,702	2.7%	\$5,377	\$1,506	\$6,883	\$0	\$6,883	322.4%	\$22,715	\$6,360	\$29,075
31	Initial CONSTRUCTION MANAGEMENT Renourishments	\$1,067	\$299	28.0%	\$1,366	2.7%	\$1,096	\$307	\$1,403	\$0	\$1,403	6.6%	\$1,169	\$327	\$1,496
31	CONSTRUCTION MANAGEMENT	\$2,507	\$702	28.0%	\$3,209	2.7%	\$2,575	\$721	\$3,296	\$0	\$3,296	217.6%	\$8,178	\$2,290	\$10,467
PROJECT COST TOTALS:		\$60,310	\$16,887	28.0%	\$77,197		\$61,263	\$17,154	\$78,417	\$0	\$78,417	72.8%	\$105,890	\$29,649	\$135,540

CHIEF, COST ENGINEERING, Matthew Cunningham

PROJECT MANAGER, Jason Harrah

CHIEF, REAL ESTATE, Audrey Omerod

CHIEF, PLANNING, Eric Summa

CHIEF, ENGINEERING, Laurenn Borocharner

CHIEF, OPERATIONS, Carol Bernstein

CHIEF, CONSTRUCTION, Steve Duba

CHIEF, CONTRACTING, Tim Black

CHIEF, PM-PB, Karen Smith

CHIEF, DPM, Tim Murphy

TOTAL PROJECT COST INITIAL: \$25,769
TOTAL PROJECT COST RENOURISHMENTS: \$109,771
ESTIMATED TOTAL PROJECT COST: \$135,540

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: St Johns County Coastal Storm Risk Management Project
 LOCATION: St Johns County, FL
 This Estimate reflects the scope and schedule in report; St Johns County CSRMP Feasibility Report December 2015

DISTRICT: Jacksonville District
 POC: CHIEF, COST ENGINEERING, Matthew Cunningham
 PREPARED: 2/14/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 20-Jun-16		Program Year (Budget EC): 2017		Effective Price Level: 1-Oct-15		Effective Price Level Date: 1 OCT 16						
WBS NUMBER	Civil Works Feature & Sub-Feature Description	RISK BASED			ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)	
		COST (\$K)	CNTG (\$K)	CNTG (%)										TOTAL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
17	INITITAL CONSTRUCTION-2020 BEACH REPLENISHMENT	\$14,233	\$3,985	28.0%	\$18,218	1.4%	\$14,425	\$4,039	\$18,464	2018Q4	3.3%	\$14,908	\$4,174	\$19,082
CONSTRUCTION ESTIMATE TOTALS:		\$14,233	\$3,985	28.0%	\$18,218		\$14,425	\$4,039	\$18,464			\$14,908	\$4,174	\$19,082
01	LANDS AND DAMAGES	\$2,480	\$694	28.0%	\$3,174	1.4%	\$2,514	\$704	\$3,217	2018Q4	3.3%	\$2,598	\$727	\$3,325
30	PLANNING, ENGINEERING & DESIGN													
1.4%	Project Management	\$205	\$57	28.0%	\$262	2.7%	\$211	\$59	\$269	2018Q4	6.6%	\$224	\$63	\$287
0.6%	Planning & Environmental Compliance	\$80	\$22	28.0%	\$102	2.7%	\$82	\$23	\$105	2018Q4	6.6%	\$88	\$25	\$112
2.8%	Engineering & Design	\$400	\$112	28.0%	\$512	2.7%	\$411	\$115	\$526	2018Q4	6.6%	\$438	\$123	\$561
0.3%	Contracting & Reprographics	\$40	\$11	28.0%	\$51	2.7%	\$41	\$12	\$53	2018Q4	6.6%	\$44	\$12	\$56
0.6%	Life Cycle Updates	\$90	\$25	28.0%	\$115	2.7%	\$92	\$26	\$118	2018Q4	6.6%	\$99	\$28	\$126
2.5%	Engineering During Construction	\$356	\$100	28.0%	\$455	2.7%	\$365	\$102	\$468	2018Q4	6.6%	\$390	\$109	\$499
1.1%	Physical Monitoring	\$150	\$42	28.0%	\$192	2.7%	\$154	\$43	\$197	2018Q4	6.6%	\$164	\$46	\$210
0.1%	Environmental Monitoring	\$10	\$3	28.0%	\$13	2.7%	\$10	\$3	\$13	2018Q4	6.6%	\$11	\$3	\$14
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	\$1,067	\$299	28.0%	\$1,366	2.7%	\$1,096	\$307	\$1,403	2018Q4	6.6%	\$1,169	\$327	\$1,496
CONTRACT COST TOTALS:		\$19,111	\$5,351		\$24,462		\$19,402	\$5,432	\$24,834			\$20,132	\$5,637	\$25,769

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: St Johns County Coastal Storm Risk Management Project
 LOCATION: St Johns County, FL
 This Estimate reflects the scope and schedule in report; St Johns County CSRMP Feasibility Report December 2015

DISTRICT: Jacksonville District
 POC: CHIEF, COST ENGINEERING, Matthew Cunningham
 PREPARED: 2/14/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	Estimate Prepared: Effective Price Level:		20-Jun-16 1-Oct-15	TOTAL (\$K) F	Program Year (Budget EC): Effective Price Level Date:		2017 1 OCT 16	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
		COST (\$K) C	CNTG (\$K) D	CNTG (%) E		ESC (%) G	COST (\$K) H	CNTG (\$K) I						
17	RENOURISHMENT 1-2032 BEACH REPLENISHMENT	\$10,780	\$3,018	28.0%	\$13,799	1.4%	\$10,926	\$3,059	\$13,985	2028Q1	24.2%	\$13,570	\$3,800	\$17,369
CONSTRUCTION ESTIMATE TOTALS:		\$10,780	\$3,018	28.0%	\$13,799		\$10,926	\$3,059	\$13,985			\$13,570	\$3,800	\$17,369
01	LANDS AND DAMAGES	\$0	\$0	28.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
30	PLANNING, ENGINEERING & DESIGN													
3.1%	Project Management	\$330	\$92	28.0%	\$422	2.7%	\$339	\$95	\$434	2028Q1	54.4%	\$523	\$146	\$670
0.7%	Planning & Environmental Compliance	\$80	\$22	28.0%	\$102	2.7%	\$82	\$23	\$105	2028Q1	54.4%	\$127	\$36	\$162
3.7%	Engineering & Design	\$400	\$112	28.0%	\$512	2.7%	\$411	\$115	\$526	2028Q1	54.4%	\$634	\$178	\$812
0.4%	Contracting & Reprographics	\$40	\$11	28.0%	\$51	2.7%	\$41	\$12	\$53	2028Q1	54.4%	\$63	\$18	\$81
1.4%	Life Cycle Updates	\$150	\$42	28.0%	\$192	2.7%	\$154	\$43	\$197	2028Q1	54.4%	\$238	\$67	\$304
2.5%	Engineering During Construction	\$269	\$75	28.0%	\$345	2.7%	\$277	\$77	\$354	2028Q1	54.4%	\$427	\$120	\$546
1.4%	Physical Monitoring	\$150	\$42	28.0%	\$192	2.7%	\$154	\$43	\$197	2028Q1	54.4%	\$238	\$67	\$304
0.1%	Environmental Monitoring	\$10	\$3	28.0%	\$13	2.7%	\$10	\$3	\$13	2028Q1	54.4%	\$16	\$4	\$20
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	\$808	\$226	28.0%	\$1,034	2.7%	\$830	\$232	\$1,062	2028Q1	54.4%	\$1,281	\$359	\$1,639
CONTRACT COST TOTALS:		\$13,017	\$3,645		\$16,662		\$13,224	\$3,703	\$16,926			\$17,116	\$4,793	\$21,909

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: St Johns County Coastal Storm Risk Management Project
 LOCATION: St Johns County, FL
 This Estimate reflects the scope and schedule in report; St Johns County CSRMP Feasibility Report December 2015

DISTRICT: Jacksonville District
 POC: CHIEF, COST ENGINEERING, Matthew Cunningham
 PREPARED: 2/14/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 20-Jun-16		Effective Price Level: 1-Oct-15		Program Year (Budget EC): 2017		Effective Price Level Date: 1 OCT 16						
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
17	RENOURISHMENT 2-2044 BEACH REPLENISHMENT	\$10,780	\$3,018	28.0%	\$13,799	1.4%	\$10,926	\$3,059	\$13,985	2040Q1	57.5%	\$17,210	\$4,819	\$22,029
CONSTRUCTION ESTIMATE TOTALS:		\$10,780	\$3,018	28.0%	\$13,799		\$10,926	\$3,059	\$13,985			\$17,210	\$4,819	\$22,029
01	LANDS AND DAMAGES	\$0	\$0	28.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
30	PLANNING, ENGINEERING & DESIGN													
3.1%	Project Management	\$330	\$92	28.0%	\$422	2.7%	\$339	\$95	\$434	2040Q1	174.6%	\$931	\$261	\$1,191
0.7%	Planning & Environmental Compliance	\$80	\$22	28.0%	\$102	2.7%	\$82	\$23	\$105	2040Q1	174.6%	\$226	\$63	\$289
3.7%	Engineering & Design	\$400	\$112	28.0%	\$512	2.7%	\$411	\$115	\$526	2040Q1	174.6%	\$1,128	\$316	\$1,444
0.4%	Contracting & Reprographics	\$40	\$11	28.0%	\$51	2.7%	\$41	\$12	\$53	2040Q1	174.6%	\$113	\$32	\$144
1.4%	Life Cycle Updates	\$150	\$42	28.0%	\$192	2.7%	\$154	\$43	\$197	2040Q1	174.6%	\$423	\$118	\$541
2.5%	Engineering During Construction	\$269	\$75	28.0%	\$345	2.7%	\$277	\$77	\$354	2040Q1	174.6%	\$759	\$213	\$972
1.4%	Physical Monitoring	\$150	\$42	28.0%	\$192	2.7%	\$154	\$43	\$197	2040Q1	174.6%	\$423	\$118	\$541
0.1%	Environmental Monitoring	\$10	\$3	28.0%	\$13	2.7%	\$10	\$3	\$13	2040Q1	174.6%	\$28	\$8	\$36
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	\$808	\$226	28.0%	\$1,034	2.7%	\$830	\$232	\$1,062	2040Q1	174.6%	\$2,278	\$638	\$2,916
CONTRACT COST TOTALS:		\$13,017	\$3,645		\$16,662		\$13,224	\$3,703	\$16,926			\$23,518	\$6,585	\$30,103

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: St Johns County Coastal Storm Risk Management Project
 LOCATION: St Johns County, FL
 This Estimate reflects the scope and schedule in report; St Johns County CSRMP Feasibility Report December 2015

DISTRICT: Jacksonville District
 POC: CHIEF, COST ENGINEERING, Matthew Cunningham
 PREPARED: 2/14/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	Estimate Prepared: Effective Price Level:		20-Jun-16 1-Oct-15	Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16				FULLY FUNDED PROJECT ESTIMATE					
		COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
17	RENOURISHMENT 3-2056 BEACH REPLENISHMENT	\$11,896	\$3,331	28.0%	\$15,227	1.4%	\$12,058	\$3,376	\$15,434	2052Q1	99.8%	\$24,086	\$6,744	\$30,831
CONSTRUCTION ESTIMATE TOTALS:		\$11,896	\$3,331	28.0%	\$15,227		\$12,058	\$3,376	\$15,434			\$24,086	\$6,744	\$30,831
01	LANDS AND DAMAGES	\$0	\$0	28.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
30	PLANNING, ENGINEERING & DESIGN													
2.8%	Project Management	\$330	\$92	28.0%	\$422	2.7%	\$339	\$95	\$434	2052Q1	404.5%	\$1,710	\$479	\$2,189
0.7%	Planning & Environmental Compliance	\$80	\$22	28.0%	\$102	2.7%	\$82	\$23	\$105	2052Q1	404.5%	\$415	\$116	\$531
3.4%	Engineering & Design	\$400	\$112	28.0%	\$512	2.7%	\$411	\$115	\$526	2052Q1	404.5%	\$2,073	\$580	\$2,653
0.3%	Contracting & Reprographics	\$40	\$11	28.0%	\$51	2.7%	\$41	\$12	\$53	2052Q1	404.5%	\$207	\$58	\$265
1.3%	Life Cycle Updates	\$150	\$42	28.0%	\$192	2.7%	\$154	\$43	\$197	2052Q1	404.5%	\$777	\$218	\$995
2.5%	Engineering During Construction	\$297	\$83	28.0%	\$380	2.7%	\$305	\$85	\$391	2052Q1	404.5%	\$1,540	\$431	\$1,971
1.3%	Physical Monitoring	\$150	\$42	28.0%	\$192	2.7%	\$154	\$43	\$197	2052Q1	404.5%	\$777	\$218	\$995
0.1%	Environmental Monitoring	\$10	\$3	28.0%	\$13	2.7%	\$10	\$3	\$13	2052Q1	404.5%	\$52	\$15	\$66
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	\$891	\$250	28.0%	\$1,141	2.7%	\$916	\$256	\$1,172	2052Q1	404.5%	\$4,619	\$1,293	\$5,912
CONTRACT COST TOTALS:		\$14,245	\$3,989		\$18,234		\$14,470	\$4,051	\$18,521			\$36,256	\$10,152	\$46,407

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: St Johns County Coastal Storm Risk Management Project
 LOCATION: St Johns County, FL
 This Estimate reflects the scope and schedule in report; St Johns County CSRMP Feasibility Report December 2015

DISTRICT: Jacksonville District
 POC: CHIEF, COST ENGINEERING, Matthew Cunningham
 PREPARED: 2/14/2017

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	Estimate Prepared: Effective Price Level:		20-Jun-16 1-Oct-15	Program Year (Budget EC): 2017 Effective Price Level Date: 1 OCT 16				FULLY FUNDED PROJECT ESTIMATE					
		COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
17	RENOURISHMENT 3-Project End BEACH REPLENISHMENT	\$0	\$0	28.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$0	\$0	0.0%	\$0		\$0	\$0	\$0			\$0	\$0	\$0
01	LANDS AND DAMAGES	\$0	\$0	28.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	\$340	\$95	28.0%	\$435	2.7%	\$349	\$98	\$447	2064Q2	838.6%	\$3,277	\$918	\$4,195
	Planning & Environmental Compliance	\$50	\$14	28.0%	\$64	2.7%	\$51	\$14	\$66	2064Q2	838.6%	\$482	\$135	\$617
	Engineering & Design	\$400	\$112	28.0%	\$512	2.7%	\$411	\$115	\$526	2064Q2	838.6%	\$3,856	\$1,080	\$4,935
	Contracting & Reprographics	\$40	\$11	28.0%	\$51	2.7%	\$41	\$12	\$53	2064Q2	838.6%	\$386	\$108	\$494
	Life Cycle Updates	\$30	\$8	28.0%	\$38	2.7%	\$31	\$9	\$39	2064Q2	838.6%	\$289	\$81	\$370
	Engineering During Construction	\$0	\$0	28.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	Physical Monitoring	\$50	\$14	28.0%	\$64	2.7%	\$51	\$14	\$66	2064Q2	838.6%	\$482	\$135	\$617
	Environmental Monitoring	\$10	\$3	28.0%	\$13	2.7%	\$10	\$3	\$13	2064Q2	838.6%	\$96	\$27	\$123
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$0	\$0	28.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONTRACT COST TOTALS:		\$920	\$258		\$1,178		\$945	\$265	\$1,209			\$8,868	\$2,483	\$11,351

B7. COST MCX TPCS CERTIFICATION

The Recommended Plan estimate, formal cost and schedule risk analysis and total project cost summary spreadsheet underwent cost review and certification by the Walla Walla Mandatory Center of Expertise.

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

**SAJ - PN 113174
St Johns County, FL
Coastal Storm Risk Management Project**

The St John County, FL Coastal Storm Risk Management Project, as presented by the Jacksonville District, has undergone a successful update for the Cost Agency Technical Review (Cost ATR) of remaining costs, performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the cost products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of February 15, 2017, the Cost MCX certifies the estimated total project cost:

FY17 Project First Cost: \$ 78,417,000
Fully Funded Costs: \$135,540,000

Note: Cost ATR was devoted to remaining work. It did not review spent costs, which requires an audit process. It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through Federal interest of the project.



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ou=DoD, ou=PKI, ou=USA,
cn=CALLAN.KIM.C.1231558221
Date: 2017.02.15 12:46:58 -08'00'

Kim C. Callan, PE, CCE, PM
Chief, Cost Engineering MCX
Walla Walla District

ATTACHMENT A
CSRA REPORT EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The CSRA was developed by CESAJ-ENTC with support by the Cost Engineering Mandatory Center of Expertise (MCX) for Civil Works. The CSRA was reviewed by the MCX during Agency Technical Review (ATR) and during subsequent coordination between the MCX and Jacksonville District Cost Engineering. This report presents a recommendation for the total project cost and schedule contingencies for the St. Johns County Coastal Storm Risk Management (CSRSM) Project Feasibility Report. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis study was conducted for the development of contingency on the total project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated total project cost.

Specific to the St. Johns County CSRSM project, the most likely total project cost (at current price level) is approximately \$78.4 Million. Based on the results of the analysis, the Jacksonville District recommends a contingency value of \$16.9 Million, or 28%. This contingency includes \$16.3 Million (27%) for risks related to cost and \$0.7 Million (1%) for the effect of schedule delay on overall project costs.

The Jacksonville District performed the risk analysis using the *Monte Carlo* technique, producing the aforementioned contingencies and identifying key risk drivers. This has been reviewed, as required, by the MCX, Walla Walla District.

The following table portrays the development of contingencies (28% overall). The contingency is based on an 80% confidence level, as per USACE Civil Works guidance.

Table ES-1. Contingency Analysis Table

Base Cost Estimate	\$60,310,000	
Confidence Level	Value (\$\$)	Contingency (%)
5%	\$68,600,300	14%
50%	\$73,605,100	23%
80%	\$77,313,700	28%
95%	\$79,906,100	32%

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The key cost risk drivers identified through sensitivity analysis are PR5 (Fuel Prices), PR1 (Bidding Climate), PR9 (Sea Level Rise), CA1 (Acquisition Strategy), and which together contribute over 90% of the statistical cost variance.

- Fuel Prices captures the risk that fluctuation in fuel costs could impact the contract cost.
- Bidding Climate captures the risk that severe economic swings could increase / decrease the number of potential bidders and affect cost and schedule.
- Sea Level Rise captures the risk that sea level rise could impact the scope and schedule.
- Acquisition Strategy captures the risk possibility that multiple contracts could increase the cost.

Additional moderate cost risks that should be closely monitored are PM1 (Scope Definition), TL3 (Availability of Sand), TL4 (Character of Materials), REG1 (Environmental Impacts), ET4 (Subcontracting Plan), ET5 (Dredge Size/Type), and PR2 (Bid Protests).

- Scope Definition captures the risk that poorly defined scope could lead to higher costs and impacts to the schedule.
- Availability of Sand captures the risk that there could be a shortage in the amount of borrow material available for the life of the project.
- Character of Materials captures the risk that a lack of geotech investigations or the presence of rock leads to uncertainty regarding the yield of suitable material from the borrow site.
- Environmental Impacts captures the risk to cost caused by impacts to cultural resources at the project site or borrow area which would require additional investigation, coordination and permitting.

- Subcontracting Plan captures the risk that a subcontracting plan different than the assumed could affect cost and schedule.
- Dredge Size/Type captures the risk that the equipment used in the estimate, including the dredge type, might not be similar to what contractors offer.
- Bid Protests captures the risk that there is the inherent risk of protests from the industry.

The key schedule risk drivers identified through sensitivity analysis are PM2 (Funding Stream), REG1 (Environmental Impacts), REG3 (Environmental Restrictions), and PR1 (Bidding Climate) which together contribute over 70% of the statistical schedule variance.

- Funding Stream captures the impacts to the schedule of not receiving funding in a timely manner.
- Environmental Impacts captures the impacts to the schedule associated with the possibility of cultural resources at the project site or borrow area which would require additional investigation, coordination and permitting.
- Environmental Restrictions captures the impacts to the schedule associated with required dredging windows and environmental restrictions.
- Bidding Climate captures the impacts that severe economic swings could increase / decrease number of potential bidders and affect cost and schedule.

Additional moderate schedule risks that should be closely monitored are PM1 (Scope Definition), ET2 (Quantity Estimates), and PR2 (Bid Protests).

- Bid Protests captures the risk to the schedule due to the risk of protests from the industry.
- Quantity Estimates captures the risk to the schedule of quantity changes due to severe weather, sea level rise, changes in erosion rates, etc. The greater quantity variance risks would likely be in the out years.
- Scope Definition captures the risk to the schedule of a poorly defined scope.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project lifecycle, potential mitigation throughout the PED phase, and proactive monitoring and control of risk identified in this study.