P2-370840 - BRAZOS ISLAND HARBOR, TEXAS CHANNEL IMPROVEMENT PROJECT
FEASIBILITY STUDY
COST ANALYSIS SUMMARY

LOCATION AND DESCRIPTION:
Port of Brownsville is located on the south Texas coast near the border of U.S. and Mexico. The study area encompasses the entire Brownsville Ship Channel and surrounding region. The entrance channel is located offshore of Cameron County, Texas, in the Gulf of Mexico, and ends at Port of Brownsville Main Harbor. Brownsville Ship Channel provides deep draft access from the Gulf of Mexico through a jetty entrance channel to Brownsville, and a side channel, authorized to 36-feet, and a shallow draft Fishing Boat Harbor near Port Isabel. The primary purpose of the study is navigation, which consists of enlarging the existing Brownsville Ship Channel by deepening the entrance channel, jetty channel, the lower section of the main channel, the upper section of the main channel, and turning basin.

The MII is developed using October 2013 price levels and the latest labor rates for Galveston District. The estimate is divided into seven (7) contracts. Each contract is organized in accordance with a work breakdown structure. Midpoint dates for the construction contracts are developed in conjunction with the project manager for developing the fully-funded costs. The estimate is prepared in accordance with ER 1110-2-1302 Civil Works Cost Engineering, dated 15 Sep 08. The costs are escalated in accordance with the above Engineering Regulation and EM 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS), dated 31 Mar 2013. All data is input into the Total Project Cost Sheet (TPCS).

Marine fuel price is averaged, locked in at $3.30/gallon (October 2013). Diesel fuel price is locked in at $4.00/gallon (October 2013). There are no impacts to utilities anticipated. There are no Hazardous, Toxic, and Radioactive Wastes anticipated. The Operation and Maintenance estimate is dated October 2013, with an effective pricing date of October 2013. A formal Cost Risk Analyses is performed with the cooperation of the PDT and Cost Engineering Directory of Expertise (DX) of the Walla Walla District (October 2013). The risks are quantified and a cost risk model developed to determine a contingency at 80% Confidence Level (CL). An ATR Certification of Cost Estimate is provided by Walla Walla District.

CONTRACT 01:
This contract is for hopper dredging -17+000 to 00+000 and delivery to New Work Ocean Dredged Material Placement Area (offshore). The stationing listed is located on the Gulf of Mexico side of the jetties (entrance channel) and is unsuitable for a pipeline dredge due to wave action. The approximate duration is seven (7) months.

CONTRACT 02:
This contract is for dike raising and rehabilitation of Placement Area 4B and Placement Area 5A. The approximate duration is 15 months. Associated Costs provided by Department of Engineering Services of the Brownsville Navigation District (21 Oct 2013).

CONTRACT 03:
This contract is for dike raising and rehabilitation of Placement Area 7 and Placement Area 8. The approximate duration is seven (7) months. In addition, this contract is for pipeline dredging 70+000 to 82+000 and 82+000 to 89+500 and delivery to Placement Area 7 and Placement Area 8, respectively. The stationing listed is located in the upper section of the main channel and turning basin. The approximate duration is 10 months. The approximate duration of the total contract is 13 months as dike raising and rehabilitation can occur, in some instances, concurrently with pipeline dredging.

CONTRACT 04:
This contract is for pipeline dredging 25+000 to 50+000 and delivery to Placement Area 5A. The stationing listed is located in the middle section of the main channel. The approximate duration is 16 months.

CONTRACT 05:
This contract is for dike raising and rehabilitation of Placement Area 2. The approximate duration is three (3) months. In addition, this contract is for pipeline dredging 00+000 to 07+000 and delivery to Placement Area 2. The stationing listed is located in the lower section of the main channel near the jetties (entrance channel). The approximate duration is three (3) months.

CONTRACT 06:
This contract is for pipeline dredging 07+000 to 25+000 and delivery to Placement Area 4B. The stationing listed is located in the middle section of the main channel. The approximate duration is 11 months.

CONTRACT 07:
This contract is for dike raising and rehabilitation of Placement Area 5B. The approximate duration is three (3) months. In addition, this contract is for pipeline dredging 50+000 to 70+000 and delivery to Placement Area 5B. The stationing listed is located in the upper section of the main channel near the turning basin. The approximate duration is nine (9) months.

ACCOUNT CODE 12 - NAVIGATION PORTS AND HARBORS:
Dredge quantities are developed by SWG, Engineering Division, General Engineering (EC-EG). One (1) large hopper dredge is to be used for Contract 01 with offshore placement (with an option for the Contractor to bid Contract 05 as pump-out to PA 2 based on durations and schedules). The remainder of the channel is to be dredged with 30" pipeline dredges, with the material discharged into various, existing placement areas located along the waterway (PA 2, 4B, 5A, 5B, 7, and 8). Dredging costs are developed using Cost Engineering Dredge Estimating Program (CEDEP). Dredge production rates and losses are reduced to account for Resident Management System (RMS) historical effective working times and stiffer "new work" materials. Cost for mobilization and demobilization are developed using CEDEP, assuming the dredges are based in New Orleans, Louisiana. Dredge estimates are based on standard operation practices for the Galveston District, which assume conventional contracting practices of large business IFBs. For estimation purposes and contractor capabilities (derived from current Sabine-Neches Waterway dredging project, which includes four pipeline dredges working simultaneously), no more than three (3) dredges will be underway at any given time. In addition, dredges will be located no less than one (1) mile apart due to Coast Guard regulations; for estimate purposes, the dredges have been strategically spaced at stations so as not to impede dredging workflow.

The cost for Sea Turtle Protection is associated with hopper dredging and includes: 1) cost for two (2) trawlers per hopper; 2) a sea turtle protection device fitted to the hopper; and 3) 24-hour monitoring survey.

The cost for raising placement areas is included under this code of account. Part of the cost for raising a placement area includes clearing, grubbing, and stripping the area; seeding the outside of the dikes is not considered. Labor rates and overhead costs are adjusted to reflect Galveston District, Region 6. The placement area dikes are built using 3-CY dragline buckets, with an optimal production rate of 125-CY/HR, respectively. A total of three (3) draglines are working at the same time. For estimate purposes, dike works are lumped by perimeter and training dikes, locations, and bucket sizes. Articulated concrete block is to be placed approximately 22+000 to 34+000. Production assumed at 50-CY/HR in addition to transport of material from Central Texas via railcars, then trucks, then barges, and finally to the site. Material characteristics are provided by SWG, Engineering Division, Geotechnical and Structural Section (EC-ES).

ACCOUNT CODE 30 - ENGINEERING AND DESGIN:
The cost for this account are developed using the guidelines provided in the TPCS, with the agreement of the cost engineer and the project manager.

ACCOUNT CODE 31 - CONSTRUCTION MANAGEMENT:

The cost for this account are developed using the guidelines provided in the TPCS, with the agreement of the cost engineer and the project manager.

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 370840

SWG – Brazos Island Harbor, TX
Channel Improvement

The Brazos Island Harbor Channel Improvement project, as presented by Galveston District, has undergone a successful Cost Agency Technical Review (Cost ATR), 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 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 3, 2014, the Cost MCX certifies the estimated total project cost of:

FY 2015 Price Level: $257,211,000
Fully Funded Amount: $279,817,000

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 throughout the life of the project.

NEUBAUER.JAMES.GERARD.1153289898

Digitally signed by NEUBAUER.JAMES.GERARD.1153289898
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=NEUBAUER.JAMES.GERARD.1153289898
Date: 2014.02.03 13:34:46 -08'00'

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

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

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2015								
						Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-13 ($K)	L	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	K		M	N	O
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$95,019	$19,384	20%	$114,403	1.8%	$96,763	$19,740	$116,503	$0		$104,711	$21,361	$126,072
12	Federal	$85,367	$17,415	20%	$102,782	1.8%	$86,935	$17,735	$104,669	$0		$93,627	$19,100	$112,727
	CONSTRUCTION ESTIMATE TOTALS:	$180,386	$36,799		$217,185	1.8%	$183,698	$37,474	$221,172	$0		$198,338	$40,461	$238,798
01	LANDS AND DAMAGES													
01	non-Federal	$4	$1	25%	$5	1.8%	$4	$1	$5	$0		$4	$1	$5
01	Federal	$9	$2	25%	$11	1.8%	$9	$2	$11	$0		$10	$2	$12
22	FEASIBILITY STUDY (non-CAP)									$0		$0	$0	$0
	non-Federal									$0		$0	$0	$0
	Federal									$0		$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN	$18,039	$3,680	20%	$21,719	3.7%	$18,699	$3,815	$22,513	$0		$20,874	$4,258	$25,133
31	CONSTRUCTION MANAGEMENT	$10,824	$2,208	20%	$13,032	3.7%	$11,220	$2,289	$13,509	$0		$13,180	$2,689	$15,869
	PROJECT COST TOTALS:	$209,262	$42,690	20%	$251,952		$213,630	$43,581	$257,211	$0		$232,406	$47,411	$279,817

CHIEF, COST ENGINEERING, Willie Honza

PROJECT MANAGER, Byron Williams

CHIEF, REAL ESTATE, Terry Rupe

CHIEF, PLANNING, Dolan Dunn

CHIEF, ENGINEERING, Joe King

CHIEF, OPERATIONS, Joe Hrametz

CHIEF, CONSTRUCTION, Don Carelock

CHIEF, CONTRACTING, Curtis Cole

CHIEF, PM-PB, Valerie Miller

CHIEF, DPM, [redacted] EDMOND RUSSO

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

****** CONTRACT COST SUMMARY ******

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas
This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1/9/2014 Effective Price Level: 1-Oct-2013				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				FULLY FUNDED PROJECT ESTIMATE				
				RISK BASED										
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*
	PHASE 1 or CONTRACT 1													
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$5,570	$1,136	20%	$6,706	1.8%	$5,672	$1,157	$6,829	2018Q2	6.3%	$6,030	$1,230	$7,260
12	Federal	$8,334	$1,700	20%	$10,035	1.8%	$8,487	$1,731	$10,219	2018Q2	6.3%	$9,023	$1,841	$10,864
12	Navigation Aids (Federal)	$90	$18	20%	$108	1.8%	$92 $0	$19	$110	2018Q3	6.8%	$98	$20	$118
	CONSTRUCTION ESTIMATE TOTALS:	$13,994	$2,855	20%	**$16,849**		$14,251	$2,907	$17,158			$15,151	$3,091	$18,242
01	LANDS AND DAMAGES													
01	non-Federal	$4	$1	25%	$5	1.8%	$4	$1	$5	2017Q1	3.8%	$4	$1	$5
01	Federal	$9	$2	25%	$11	1.8%	$9	$2	$11	2017Q1	3.8%	$10	$2	$12
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$70	$14	20%	$84	3.7%	$73	$15	$87	2017Q1	8.7%	$79	$16	$95
1.0%	Planning & Environmental Compliance	$140	$29	20%	$169	3.7%	$145	$30	$175	2017Q1	8.7%	$158	$32	$190
5.0%	Engineering & Design	$700	$143	20%	$843	3.7%	$726	$148	$874	2017Q1	8.7%	$788	$161	$949
0.7%	Reviews, ATRs, IEPRs, VE	$98	$20	20%	$118	3.7%	$102	$21	$122	2017Q1	8.7%	$110	$23	$133
0.5%	Life Cycle Updates (cost, schedule, risks)	$70	$14	20%	$84	3.7%	$73	$15	$87	2017Q1	8.7%	$79	$16	$95
0.8%	Contracting & Reprographics	$112	$23	20%	$135	3.7%	$116	$24	$140	2017Q1	8.7%	$126	$26	$152
1.5%	Engineering During Construction	$210	$43	20%	$253	3.7%	$218	$44	$262	2018Q2	14.5%	$249	$51	$300
0.0%	Planning During Construction	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$700	$143	20%	$843	3.7%	$726	$148	$874	2018Q2	14.5%	$831	$169	$1,000
0.5%	Project Operation:	$70	$14	20%	$84	3.7%	$73	$15	$87	2018Q2	14.5%	$83	$17	$100
0.5%	Project Management	$70	$14	20%	$84	3.7%	$73	$15	$87	2018Q2	14.5%	$83	$17	$100
	CONTRACT COST TOTALS:	$16,247	$3,315		**$19,562**		$16,586	$3,384	$19,970			$17,752	$3,622	**$21,374**

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

****** CONTRACT COST SUMMARY ******

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas
This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1/9/2014				Program Year (Budget EC): 2015				FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level: 1-Oct-2013				Effective Price Level Date: 1 OCT 14								
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*
	PHASE 2 or CONTRACT 2													
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$2,285	$466	20%	$2,751	1.8%	$2,327	$475	$2,802	2018Q3	6.8%	$2,486	$507	$2,993
12	Federal	$6,856	$1,399	20%	$8,254	1.8%	$6,982	$1,424	$8,406	2018Q3	6.8%	$7,458	$1,521	$8,979
12	Associated Costs (non-Federal)	$39,250	$8,007	20%	$47,257	1.8%	$39,971	$8,154	$48,125	2019Q3	8.9%	$43,508	$8,876	$52,384
							$0							
	CONSTRUCTION ESTIMATE TOTALS:	$48,391	$9,872	20%	**$58,263**		$49,279	$10,053	$59,332			$53,452	$10,904	$64,356
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$242	$49	20%	$291	3.7%	$251	$51	$302	2017Q1	8.7%	$273	$56	$328
1.0%	Planning & Environmental Compliance	$484	$99	20%	$583	3.7%	$502	$102	$604	2017Q1	8.7%	$545	$111	$656
5.0%	Engineering & Design	$2,420	$494	20%	$2,914	3.7%	$2,509	$512	$3,020	2017Q1	8.7%	$2,726	$556	$3,282
0.7%	Reviews, ATRs, IEPRs, VE	$339	$69	20%	$408	3.7%	$351	$72	$423	2017Q1	8.7%	$382	$78	$460
0.5%	Life Cycle Updates (cost, schedule, risks)	$242	$49	20%	$291	3.7%	$251	$51	$302	2017Q1	8.7%	$273	$56	$328
0.8%	Contracting & Reprographics	$387	$79	20%	$466	3.7%	$401	$82	$483	2017Q1	8.7%	$436	$89	$525
1.5%	Engineering During Construction	$726	$148	20%	$874	3.7%	$753	$154	$906	2018Q3	15.7%	$871	$178	$1,049
0.0%	Planning During Construction	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$2,420	$494	20%	$2,914	3.7%	$2,509	$512	$3,020	2018Q3	15.7%	$2,903	$592	$3,496
0.5%	Project Operation:	$242	$49	20%	$291	3.7%	$251	$51	$302	2018Q3	15.7%	$290	$59	$350
0.5%	Project Management	$242	$49	20%	$291	3.7%	$251	$51	$302	2018Q3	15.7%	$290	$59	$350
	CONTRACT COST TOTALS:	$56,135	$11,452		**$67,587**		$57,307	$11,691	$68,997			$62,441	$12,738	**$75,179**

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

**** CONTRACT COST SUMMARY ****

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas
This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1/9/2014 Effective Price Level: 1-Oct-2013				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				FULLY FUNDED PROJECT ESTIMATE				
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*
	PHASE 3 or CONTRACT 3													
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$8,317	$1,697	20%	$10,014	1.8%	$8,470	$1,728	$10,198	2018Q3	6.8%	$9,048	$1,846	$10,894
12	Federal	$13,463	$2,746	20%	$16,209	1.8%	$13,710 $0	$2,797	$16,506	2018Q3	6.8%	$14,645	$2,988	$17,632
	CONSTRUCTION ESTIMATE TOTALS:	$21,780	$4,443	20%	**$26,223**		$22,180	$4,525	$26,704			$23,693	$4,833	$28,526
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$109	$22	20%	$131	3.7%	$113	$23	$136	2017Q1	8.7%	$123	$25	$148
1.0%	Planning & Environmental Compliance	$218	$44	20%	$262	3.7%	$226	$46	$272	2017Q1	8.7%	$246	$50	$296
5.0%	Engineering & Design	$1,089	$222	20%	$1,311	3.7%	$1,129	$230	$1,359	2017Q1	8.7%	$1,227	$250	$1,477
0.7%	Reviews, ATRs, IEPRs, VE	$152	$31	20%	$183	3.7%	$158	$32	$190	2017Q1	8.7%	$171	$35	$206
0.5%	Life Cycle Updates (cost, schedule, risks)	$109	$22	20%	$131	3.7%	$113	$23	$136	2017Q1	8.7%	$123	$25	$148
0.8%	Contracting & Reprographics	$174	$35	20%	$209	3.7%	$180	$37	$217	2017Q1	8.7%	$196	$40	$236
1.5%	Engineering During Construction	$327	$67	20%	$394	3.7%	$339	$69	$408	2018Q3	15.7%	$392	$80	$472
0.0%	Planning During Construction	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,089	$222	20%	$1,311	3.7%	$1,129	$230	$1,359	2018Q3	15.7%	$1,307	$267	$1,573
0.5%	Project Operation:	$109	$22	20%	$131	3.7%	$113	$23	$136	2018Q3	15.7%	$131	$27	$157
0.5%	Project Management	$109	$22	20%	$131	3.7%	$113	$23	$136	2018Q3	15.7%	$131	$27	$157
	CONTRACT COST TOTALS:	$25,265	$5,154		**$30,419**		$25,792	$5,262	$31,054			$27,738	$5,659	**$33,396**

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

**** CONTRACT COST SUMMARY ****

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas
This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1/9/2014				Program Year (Budget EC): 2015								
		Effective Price Level: 1-Oct-2013				Effective Price Level Date: 1 OCT 14				FULLY FUNDED PROJECT ESTIMATE				
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*
	PHASE 4 or CONTRACT 4													
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$15,667	$3,196	20%	$18,864	1.8%	$15,955	$3,255	$19,210	2018Q4	7.3%	$17,124	$3,493	$20,617
12	Federal	$21,543	$4,395	20%	$25,938	1.8%	$21,939	$4,475	$26,414	2018Q4	7.3%	$23,546	$4,803	$28,349
							$0							
	CONSTRUCTION ESTIMATE TOTALS:	$37,210	$7,591	20%	**$44,801**		$37,894	$7,730	$45,624			$40,670	$8,297	$48,967
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$186	$38	20%	$224	3.7%	$193	$39	$232	2017Q2	9.8%	$212	$43	$255
1.0%	Planning & Environmental Compliance	$372	$76	20%	$448	3.7%	$386	$79	$464	2017Q2	9.8%	$423	$86	$510
5.0%	Engineering & Design	$1,861	$380	20%	$2,241	3.7%	$1,929	$394	$2,323	2017Q2	9.8%	$2,118	$432	$2,550
0.7%	Reviews, ATRs, IEPRs, VE	$260	$53	20%	$313	3.7%	$270	$55	$324	2017Q2	9.8%	$296	$60	$356
0.5%	Life Cycle Updates (cost, schedule, risks)	$186	$38	20%	$224	3.7%	$193	$39	$232	2017Q2	9.8%	$212	$43	$255
0.8%	Contracting & Reprographics	$298	$61	20%	$359	3.7%	$309	$63	$372	2017Q2	9.8%	$339	$69	$408
1.5%	Engineering During Construction	$558	$114	20%	$672	3.7%	$578	$118	$696	2018Q4	17.0%	$677	$138	$815
0.0%	Planning During Construction	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,861	$380	20%	$2,241	3.7%	$1,929	$394	$2,323	2018Q4	17.0%	$2,256	$460	$2,717
0.5%	Project Operation:	$186	$38	20%	$224	3.7%	$193	$39	$232	2018Q4	17.0%	$226	$46	$272
0.5%	Project Management	$186	$38	20%	$224	3.7%	$193	$39	$232	2018Q4	17.0%	$226	$46	$272
	CONTRACT COST TOTALS:	$43,164	$8,806		**$51,970**		$44,065	$8,989	$53,055			$47,654	$9,721	**$57,375**

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

**** CONTRACT COST SUMMARY ****

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas
This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1/9/2014 Effective Price Level: 1-Oct-2013				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14				FULLY FUNDED PROJECT ESTIMATE				
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*
	PHASE 5 or CONTRACT 5													
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$2,769	$565	20%	$3,334	1.8%	$2,820	$575	$3,395	2018Q3	6.8%	$3,012	$615	$3,627
12	Federal	$4,850	$989	20%	$5,839	1.8%	$4,939 $0	$1,008	$5,947	2018Q3	6.8%	$5,276	$1,076	$6,352
	CONSTRUCTION ESTIMATE TOTALS:	$7,619	$1,554	20%	**$9,173**		$7,759	$1,583	$9,342			$8,288	$1,691	$9,979
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$38	$8	20%	$46	3.7%	$39	$8	$47	2017Q2	9.8%	$43	$9	$52
1.0%	Planning & Environmental Compliance	$76	$16	20%	$92	3.7%	$79	$16	$95	2017Q2	9.8%	$86	$18	$104
5.0%	Engineering & Design	$381	$78	20%	$459	3.7%	$395	$81	$476	2017Q2	9.8%	$434	$88	$522
0.7%	Reviews, ATRs, IEPRs, VE	$53	$11	20%	$64	3.7%	$55	$11	$66	2017Q2	9.8%	$60	$12	$73
0.5%	Life Cycle Updates (cost, schedule, risks)	$38	$8	20%	$46	3.7%	$39	$8	$47	2017Q2	9.8%	$43	$9	$52
0.8%	Contracting & Reprographics	$61	$12	20%	$73	3.7%	$63	$13	$76	2017Q2	9.8%	$69	$14	$84
1.5%	Engineering During Construction	$114	$23	20%	$137	3.7%	$118	$24	$142	2018Q3	15.7%	$137	$28	$165
0.0%	Planning During Construction	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$381	$78	20%	$459	3.7%	$395	$81	$476	2018Q3	15.7%	$457	$93	$550
0.5%	Project Operation:	$38	$8	20%	$46	3.7%	$39	$8	$47	2018Q3	15.7%	$46	$9	$55
0.5%	Project Management	$38	$8	20%	$46	3.7%	$39	$8	$47	2018Q3	15.7%	$46	$9	$55
	CONTRACT COST TOTALS:	$8,837	$1,803		**$10,640**		$9,021	$1,840	$10,862			$9,709	$1,981	**$11,690**

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

**** CONTRACT COST SUMMARY ****

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas
This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			1/9/2014	Program Year (Budget EC):			2015					
		Effective Price Level:			1-Oct-2013	Effective Price Level Date:			1 OCT 14	FULLY FUNDED PROJECT ESTIMATE				
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
	PHASE 6 or CONTRACT 6													
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$12,305	$2,510	20%	$14,815	1.8%	$12,531	$2,556	$15,087	2019Q3	8.9%	$13,640	$2,783	$16,423
12	Federal	$17,002	$3,468	20%	$20,471	1.8%	$17,314	$3,532	$20,846	2019Q3	8.9%	$18,847	$3,845	$22,691
							$0							
	CONSTRUCTION ESTIMATE TOTALS:	$29,307	$5,979	20%	**$35,286**		$29,845	$6,088	$35,934			$32,487	$6,627	$39,114
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$147	$30	20%	$177	3.7%	$152	$31	$183	2018Q2	14.5%	$174	$36	$210
1.0%	Planning & Environmental Compliance	$293	$60	20%	$353	3.7%	$304	$62	$366	2018Q2	14.5%	$348	$71	$419
5.0%	Engineering & Design	$1,465	$299	20%	$1,764	3.7%	$1,519	$310	$1,828	2018Q2	14.5%	$1,739	$355	$2,094
0.7%	Reviews, ATRs, IEPRs, VE	$205	$42	20%	$247	3.7%	$212	$43	$256	2018Q2	14.5%	$243	$50	$293
0.5%	Life Cycle Updates (cost, schedule, risks)	$147	$30	20%	$177	3.7%	$152	$31	$183	2018Q2	14.5%	$174	$36	$210
0.8%	Contracting & Reprographics	$234	$48	20%	$282	3.7%	$243	$49	$292	2018Q2	14.5%	$278	$57	$334
1.5%	Engineering During Construction	$440	$90	20%	$530	3.7%	$456	$93	$549	2019Q3	20.7%	$551	$112	$663
0.0%	Planning During Construction	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,465	$299	20%	$1,764	3.7%	$1,519	$310	$1,828	2019Q3	20.7%	$1,833	$374	$2,207
0.5%	Project Operation:	$147	$30	20%	$177	3.7%	$152	$31	$183	2019Q3	20.7%	$184	$38	$221
0.5%	Project Management	$147	$30	20%	$177	3.7%	$152	$31	$183	2019Q3	20.7%	$184	$38	$221
	CONTRACT COST TOTALS:	$33,997	$6,935		**$40,933**		$34,707	$7,080	$41,787			$38,195	$7,792	**$45,987**

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

**** CONTRACT COST SUMMARY ****

PROJECT: P2-370840 Brazos Island Harbor, Texas, Channel Improvement Project
LOCATION: Cameron County, Texas
This Estimate reflects the scope and schedule in report: BIH Engineering Appendix 2014

DISTRICT: SWG Galveston District PREPARED: 1/21/2014
POC: CHIEF, COST ENGINEERING, Willie Honza

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 1/9/2014				Program Year (Budget EC): 2015				FULLY FUNDED PROJECT ESTIMATE				
		Effective Price Level: 1-Oct-2013				Effective Price Level Date: 1 OCT 14								
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
	PHASE 7 or CONTRACT 7													
12	NAVIGATION PORTS & HARBORS													
12	non-Federal	$8,855	$1,806	20%	$10,661	1.8%	$9,018	$1,840	$10,857	2019Q4	9.4%	$9,862	$2,012	$11,874
12	Federal	$13,230	$2,699	20%	$15,928	1.8%	$13,472	$2,748	$16,221	2019Q4	9.4%	$14,734	$3,006	$17,740
							$0							
	CONSTRUCTION ESTIMATE TOTALS:	$22,085	$4,505	20%	**$26,590**		$22,490	$4,588	$27,078			$24,597	$5,018	$29,614
30	PLANNING, ENGINEERING & DESIGN													
0.5%	Project Management	$110	$22	20%	$132	3.7%	$114	$23	$137	2018Q2	14.5%	$131	$27	$157
1.0%	Planning & Environmental Compliance	$221	$45	20%	$266	3.7%	$229	$47	$276	2018Q2	14.5%	$262	$54	$316
5.0%	Engineering & Design	$1,104	$225	20%	$1,329	3.7%	$1,144	$233	$1,378	2018Q2	14.5%	$1,310	$267	$1,578
0.7%	Reviews, ATRs, IEPRs, VE	$155	$32	20%	$187	3.7%	$161	$33	$193	2018Q2	14.5%	$184	$38	$222
0.5%	Life Cycle Updates (cost, schedule, risks)	$110	$22	20%	$132	3.7%	$114	$23	$137	2018Q2	14.5%	$131	$27	$157
0.8%	Contracting & Reprographics	$177	$36	20%	$213	3.7%	$183	$37	$221	2018Q2	14.5%	$210	$43	$253
1.5%	Engineering During Construction	$331	$68	20%	$399	3.7%	$343	$70	$413	2019Q4	22.0%	$419	$85	$504
0.0%	Planning During Construction	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	20%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,104	$225	20%	$1,329	3.7%	$1,144	$233	$1,378	2019Q4	22.0%	$1,396	$285	$1,681
0.5%	Project Operation:	$110	$22	20%	$132	3.7%	$114	$23	$137	2019Q4	22.0%	$139	$28	$167
0.5%	Project Management	$110	$22	20%	$132	3.7%	$114	$23	$137	2019Q4	22.0%	$139	$28	$167
	CONTRACT COST TOTALS:	$25,617	$5,226		**$30,842**		$26,151	$5,335	$31,486			$28,917	$5,899	**$34,817**

US Army Corps of Engineers®

P2-370840

Brazos Island Harbor, Texas, Channel Improvement Project Feasibility Study
Project Cost and Schedule Risk Analysis Report

Prepared by:

U.S. Army Corps of Engineers,
Galveston District

Reviewed by:

U.S. Army Corps of Engineers
Cost Engineering Directory of Expertise, Walla Walla

February 2014

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The US Army Corps of Engineers (USACE), Galveston District, presents this cost and schedule risk analysis (CSRA) report regarding the risk findings and recommended contingencies for Brazos Island Harbor (BIH), Texas, Channel Improvement Project. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated September 15, 2008, a formal risk analysis, *Monte-Carlo* based-study was conducted by the Project Development Team (PDT) on remaining costs. The purpose of this risk analysis study is to present the cost and schedule risks considered, those determined and respective project contingencies at a recommend 80% confidence level of successful execution to project completion.

Port of Brownsville is located on the south Texas coast near the border of U.S. and Mexico. The study area encompasses the entire Brownsville Ship Channel and surrounding region. The entrance channel is located offshore of Cameron County, Texas, in the Gulf of Mexico, and ends at Port of Brownsville Main Harbor. Brownsville Ship Channel provides deep draft access from the Gulf of Mexico through a jetty entrance channel to Brownsville, and a side channel, authorized to 36-feet, and a shallow draft Fishing Boat Harbor near Port Isabel. The primary purpose of the study is navigation, which consists of enlarging the existing Brownsville Ship Channel by deepening the entrance channel, jetty channel, the lower section of the main channel, the upper section of the main channel, and turning basin.

Specific to the BIH, Texas, Channel Improvement Project, the current fully funded estimate approximates $280M. The estimated base project cost for the work approximates $209M. This CSRA study excludes spent costs and is expressed in FY 2014 dollars. Since the Real Estate office provided a separate 25% contingency for its real estate requirements, SWG performed the study on the estimated construction costs. Since the Port of Brownsville provided Associated Costs, the developed construction contingency was applied to the Associated Costs. Based on the results of the analysis, the Galveston District (preparer) and the Cost Engineering Mandatory Center of Expertise for Civil Works (MCX located in Walla Walla District) (reviewer) recommend a contingency value of $42.6M or approximately 20.4% of base project cost.

Galveston District performed a risk analysis using the *Monte Carlo* technique for the estimated construction costs, supported by District PDT input. The following table, ES-1, portrays the development of the construction contingencies (20.4%). The contingency is based on an 80% confidence level, as per USACE Civil Works guidance.

Table ES-1. Construction Contingency Results

Base Case Construction Cost Estimate	**209,248,193**	
Confidence Level	**Construction Value ($$)**	**Contingency (%)**
5%	$222,142,395	6.2%
50%	$240,194,321	14.8%
80%	**$251,852,693**	**20.4%**
90%	$256,888,586	22.8%

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The PDT worked through the risk register on 18 Jun 2013, in addition to follow-on e-mails and discussions. That period of time allowed improved project scope definition, investigations, design and cost information, and resulted in reduced risks in certain project areas. The key risk drivers identified through sensitivity analysis suggest a cost contingency of $24.8M and schedule risks adding another potential of $17.8, both at an 80% confidence level.

Cost Risks: From the CSRA, the key or greater Cost Risk items include:

- Q-5: Quantities for Current Scope: Pipeline Dredging – Surveys are required during PED. New surveys may indicate high shoaling (or eroding) areas not previously accounted for in modeling, which increase (or decrease) quantities (required depth) for current scope. Hopper could be used for reach adjacent to entrance channel (with pump-out), which could decrease cost by removing one mobilization and demobilization from project costs. Any changes in quantities due to storms during construction are found in “Programmatic Risks.” Any changes in quantities due to storms after construction are handled in OM.
- CT-5: Estimate and Schedule Risks: Pipeline Dredging – On dredging projects, fuel is a major cost driver for equipment. Fuel has fluctuated in FY13, e.g. minimum ($3.09), maximum ($3.64), and average ($3.30). An upswing in fuel cost is anticipated.

Moderate risks, when combined, can also become a cost impact.

- EX-5: Programmatic Risks: Pipeline Dredging – There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated. A recurrence interval of 25-years (4% chance of occurrence in any given year) over three-year project duration was assumed, which resulted in 11.5 probability of occurrence.

- AS-3: Contract Acquisition Strategy Risks: Mobilization and Demobilization – Dredges are limited in quantity. It is unknown how competitive the market will be at time of award. The schedule is organized to encourage dredges working on one contract to finish on time in order to bid on the next contract, which could be recognized as cost savings to the Government via reduction in mobilization and demobilization costs. These potential (but not guaranteed) savings are not included in the estimate.
- CE-6: Construction Risks: Containment Dikes – There is minimal access to placement area sites, only one-way-in and one-way-out accessibility, in most cases. For PA2, access is assumed by water due to low beach access and piping plover wintering season at nine (9) months. Water access may prove difficult should depth of water not be adequate for tug to ground barge near PA.
- Q-4: Quantities for Current Scope: Hopper Dredging – Surveys are required during PED. New surveys may indicate high shoaling (or eroding) areas not previously accounted for in modeling, which increase (or decrease) quantities (required depth) for current scope. Any changes in quantities due to storms during construction are found in "Programmatic Risks." Any changes in quantities due to storms after construction are handled in OM.
- Q-6: Quantities for Current Scope: Containment Dikes – Quantities are neat line. That is, quantities are based on old survey data (one typical section along the edge of work defines the volume), densities are assumed in the areas based on historical practices, and take-offs do not include contingencies. Any changes in quantities due to storms during construction are found in "Programmatic Risks."

Schedule Risks: The high value of schedule risk indicates a significant uncertainty of key risk items, time duration growth that can translate into added costs. Over time, risks increase on those out-year contracts where there is greater potential for change in new scope requirements, uncertain market conditions, and unexpected high inflation. The greatest risks are the following:

- EX-10: Programmatic Risks: Congressional Funding – It is uncertain whether all needed Congressional funding for PED will be made available in a timely manner. Construction is assumed multiple contracts (7) to account for an uneven construction funding stream, i.e. each contract is approximately one (1) year in duration. Delays in funding may result in additional PED expenses as well as escalation in schedule growth. If authorization has already been received, even if the construction funding is delayed, the funding will add the OMB escalation onto the funding request.
- CE-5: Construction Risks: Pipeline Dredging – Project is likely to experience boat traffic issues due to long pipeline lengths and one-way traffic. There is minimal access to placement area sites, only one-way-in and one-way-out accessibility, in most cases. For estimate purposes and contractor capabilities, no more than three (3) dredges will be underway at any given time. In addition, dredges will be

located no less than one (1) mile apart due to Coast Guard regulations; for estimate purposes, the dredges have been strategically spaced at stations so as not to impede dredging workflow.

Moderate risks, when combined, can also become a time and (resulting) cost impact.

- AS-3: Contract Acquisition Strategy Risks: Mobilization and Demobilization – Dredges are limited in quantity. It is unknown how competitive the market will be at time of award. The schedule is organized to encourage dredges working on one contract to finish on time in order to bid on the next contract, which could be recognized as cost savings to the Government via reduction in mobilization and demobilization costs. These potential (but not guaranteed) savings are not included in the estimate.

Recommendations: The PDT must include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life-cycle is important in support of the remaining project work within an approved budget and appropriation.

MAIN REPORT

1.0 PURPOSE

Under the auspices of the US Army Corps of Engineers (USACE), Galveston District, this report presents a recommendation for the total project cost and schedule contingencies for Brazos Island Harbor (BIH), Texas, Channel Improvement Project: Feasibility Study.

2.0 BACKGROUND

Port of Brownsville is located on the south Texas coast near the border of U.S. and Mexico. The study area encompasses the entire Brownsville Ship Channel and surrounding region. The entrance channel is located offshore of Cameron County, Texas, in the Gulf of Mexico, and ends at Port of Brownsville Main Harbor. Brownsville Ship Channel provides deep draft access from the Gulf of Mexico through a jetty entrance channel to Brownsville, and a side channel, authorized to 36-feet, and a shallow draft Fishing Boat Harbor near Port Isabel. The primary purpose of the study is navigation, which consists of enlarging the existing Brownsville Ship Channel by deepening the entrance channel, jetty channel, the lower section of the main channel, the upper section of the main channel, and turning basin.

Galveston District is preparing the Project Cost and Schedule Risk Analysis (CSRA) Report. As a part of this effort, Galveston District requested that the USACE Cost Engineering Technical Center of Expertise for Civil Works (Cost Engineering MCX) provide an Agency Technical Review (ATR) of the cost estimate and schedule.

3.0 REPORT SCOPE

The scope of the risk analysis report is to identify cost and schedule risks with a resulting recommendation for 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 cost risks for construction features. The CSRA excludes Real Estate costs and does not include consideration for life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the Micro Computer Aided Cost Estimating System (MCACES) cost estimate, project schedule, and funding profiles using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) Construction Cost Estimating Guide for Civil Works, dated September 30, 2008.

The project technical scope, estimates and schedules were developed and presented by the Galveston District. Consequently, these documents serve as the basis for the risk analysis.

The scope of this study addresses the identification of concerns, needs, opportunities and potential solutions that are viable from an economic, environmental, and engineering viewpoint.

3.2 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering MCX. The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. 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 to 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 analysis 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, this risk analysis was performed to meet the requirements and recommendations of 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.

4.0 METHODOLOGY / PROCESS

The Galveston District performed the Cost and Schedule Risk Analysis. The Cost Engineer facilitated a risk identification meeting with the Project Delivery Team (PDT) on 18 June 2013. The initial risk identification meeting also included qualitative analysis to produce a risk register that served as the framework for the risk analysis. The PDT held sanity checks of the risk analysis, and additional analysis between the dates of 18 June 2013 thru (a final risk register date of) 09 January 2014. This time period included a preliminary ATR of the project documents, which necessitated changes to both the cost estimate and the Cost and Schedule Risk Analysis.

Participants in the risk identification meeting of 18 June 2013, in addition to follow-on e-mails and discussions, included:

Name	Organization	Title
Byron Williams	USACE - SWG	Project Manager
Sheridan Willey	USACE - SWG	Planning Lead
Brenda Hayden	USACE - SWG	Engineering Lead
Janelle Stokes	USACE - SWG	Environmental Lead
Kathleen Williams	USACE - SWG	Regional Economist
Kimberly Jackson	USACE – SWT	Real Estate Specialist
Sarah Xie-DeSoto	USACE – SWG	Structures, Geotechnical Engineer
Eric Wood	USACE – SWG	Hydrology, Hydraulics Engineer
Eduardo Irigoyen	USACE - SWG	Construction Manager
Alicia Rea	USACE - SWG	Operations Manager
Martin Regner	USACE - SWG	Contracting Officer Representative
Martin Regner	USACE - SWG	Cost Engineer | Risk Facilitator

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. Per regulation and guidance, the P80 confidence level (80% confidence level) is the normal and accepted cost confidence level. District Management has the prerogative to select different confidence levels, pending approval from Headquarters, USACE.

In simple terms, contingency is an amount added to an estimate 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 MCX 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 averse 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 selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's District and/or Division management.

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. 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 are provided in Section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative 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.

A formal PDT meeting was held with the Galveston District office for the purposes of identifying and assessing risk factors. The meeting (conducted 18 June 2013) included capable and qualified representatives from multiple project team disciplines and functions, including project management, cost engineering, design, environmental compliance, and real estate

The initial formal 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. Additionally, numerous conference calls, informal meetings, and e-mails were conducted and/or traded throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment. The finalization of the risk register, CSRA model, findings, and results occurred 09 January 2014.

4.2 Quantify Risk Factor Impacts

The quantitative impacts (putting it to numbers of cost and time) of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were 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 involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following 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 resulting product from the PDT discussions is captured within a risk register as presented in Section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 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 PDT.

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 baseline 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.

5.0 PROJECT ASSUMPTIONS

The following data sources and assumptions were used in quantifying the costs associated with the BIH, Texas, Channel Improvement Project.

a. Galveston District MII MCACES (Micro-Computer Aided Cost Estimating Software) files were the basis for the cost and schedule risk analyses.

b. The cost comparisons and risk analyses performed and reflected within this report are based on design scope and estimates that are at the feasibility level.

c. Schedules are analyzed for impact to the project cost in terms of both uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs, and/or languishing federal administration costs incurred throughout delay. Specific to BIH, the schedule was analyzed only for impacts due to residual fixed costs.

d. Per the CWCCIS Historical State Adjustment Factors in EM 1110-2-1304, State Adjustment Factor for the State of Texas is 0.87, meaning that the average inflation for the project area is assumed to be 13% lower than the national average for inflation. Therefore, it is assumed that the project inflations experienced are similar (or better) to OMB inflation factors for future construction. Thus, the risk analyses accounted for no escalation over and above the national average.

e. Per the data in the estimate, the Job Office Overhead (JOOH) percentage for the Prime Contractor is 15%. Thus, the assumed residual fixed cost rate for this project is 15%. For the P80 schedule, this comprises approximately 15% of the total contingency due to the accrual of residual fixed costs associated with delay.

f. The Cost MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk averse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to capture actual project costs.

g. Only high and moderate risk level impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. If model results implied that a moderate risk was in fact a low level risk (or vice versa), then the risk was reclassified (but not removed from the model). Low level risk impacts should be maintained in project management documentation and reviewed at each project milestone to determine if they should be placed on the risk "watch list."

h. Real estate costs and contingencies (25%) were developed and provided by District Real Estate Division. As a result, the PDT did not perform risk identification on Real Estate unless it had a construction cost potential, e.g. PS-1: Project Scope Growth: Relocations (low risk).

i. The Associated Costs were developed and provided by the Port of Brownsville. As a result, the PDT did not perform risk identification on the Associated Costs. The recommended contingency value for construction costs was applied to the Associated Costs in order to capture potential, unidentified risks.

j. Potential weather damages and delays were captured via a recurrence interval of 25-years (4% chance of occurrence in any given year) over three-year project duration, which resulted in 11.5% probability of occurrence (yes-no assumption).

6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Appendix A. The complete risk register includes low level risks, as well as additional information regarding the 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 feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 Cost Contingency and Sensitivity Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P5, P50 and P90 confidence levels are also provided for illustrative purposes only.

Cost contingency for the Construction risks (including schedule impacts converted to dollars) was quantified as approximately $42.6 Million at the P80 confidence level (20.4% of the baseline construction cost estimate).

Table 1. Construction Cost Contingency Summary

Base Case Construction Cost Estimate	**209,248,193**	
Confidence Level	**Construction Value ($$)**	**Contingency (%)**
5%	$222,142,395	6.2%
50%	$240,194,321	14.8%
80%	**$251,852,693**	**20.4%**
90%	$256,888,586	22.8%

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers and the respective value variance are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost.

Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register. Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high level schedule risks identified in the risk register.

Figure 1. Cost Sensitivity Analysis

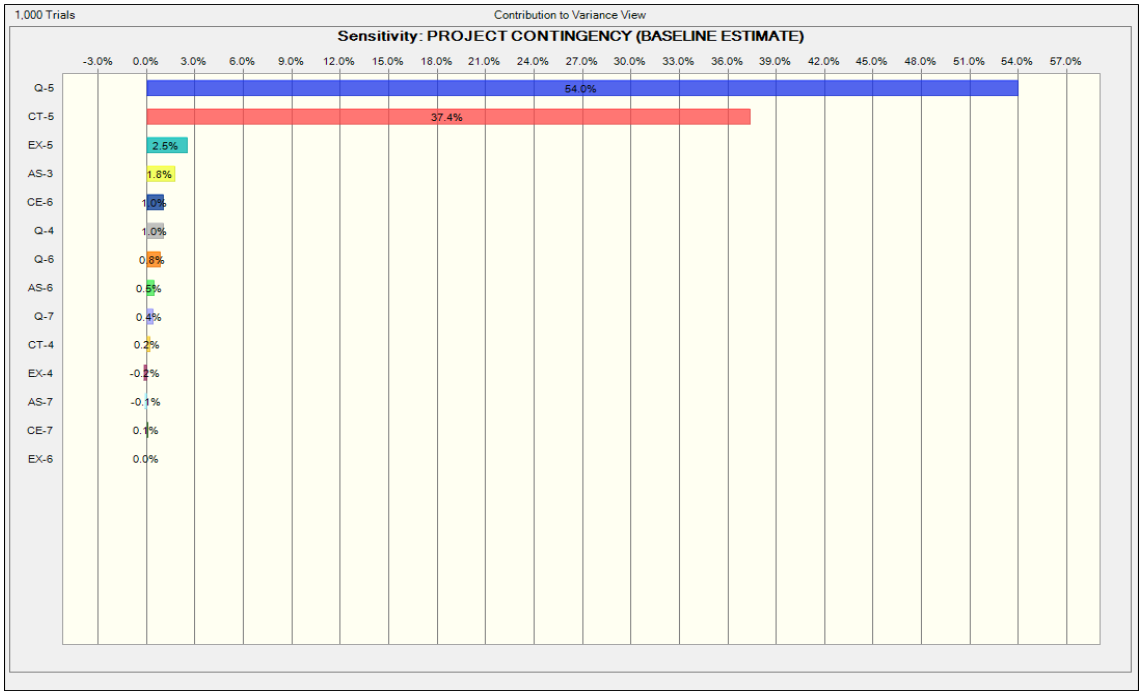

Figure 1. Key		
NO.	CATEGORY	EVENT
AS-3	Contract Acquisition Strategy Risks	Mobilization and Demobilization
AS-6	Contract Acquisition Strategy Risks	Containment Dikes
AS-7	Contract Acquisition Strategy Risks	Shoreline Stabilization
Q-4	Quantities for Current Scope	Hopper Dredging
Q-5	Quantities for Current Scope	Pipeline Dredging
Q-6	Quantities for Current Scope	Containment Dikes
Q-7	Quantities for Current Scope	Shoreline Stabilization
CE-6	Construction Risks	Containment Dikes
CE-7	Construction Risks	Shoreline Stabilization
CT-4	Estimate and Schedule Risks	Hopper Dredging
CT-5	Estimate and Schedule Risks	Pipeline Dredging
EX-4	Programmatic Risks	Hopper Dredging
EX-5	Programmatic Risks	Pipeline Dredging
EX-6	Programmatic Risks	Containment Dikes

6.3 Schedule and Contingency Risk Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P90 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 17.7 months based on the P80 level of confidence. These contingencies were used to calculate the projected residual fixed cost impact of project delays that are included in the Table 1 presentation of total cost contingency. The schedule contingencies were calculated by applying the high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

The schedule was not resource loaded and contained open-ended tasks and non-zero lags (gaps in the logic between tasks) that limit the overall utility of the schedule risk analysis. These issues should be considered as limitations in the utility of the schedule contingency data presented. Schedule contingency impacts presented in this analysis are based solely on projected residual fixed costs.

Table 2. Schedule Duration Contingency Summary

Risk Analysis Forecast	Schedule Duration (months)	Contingency[1] (months)
50% Confidence Level		
Project Duration	42.3	13.3
80% Confidence Level		
Project Duration	46.7	17.7
90% Confidence Level		
Project Duration	49.2	20.2

Figure 2. Schedule Sensitivity Analysis

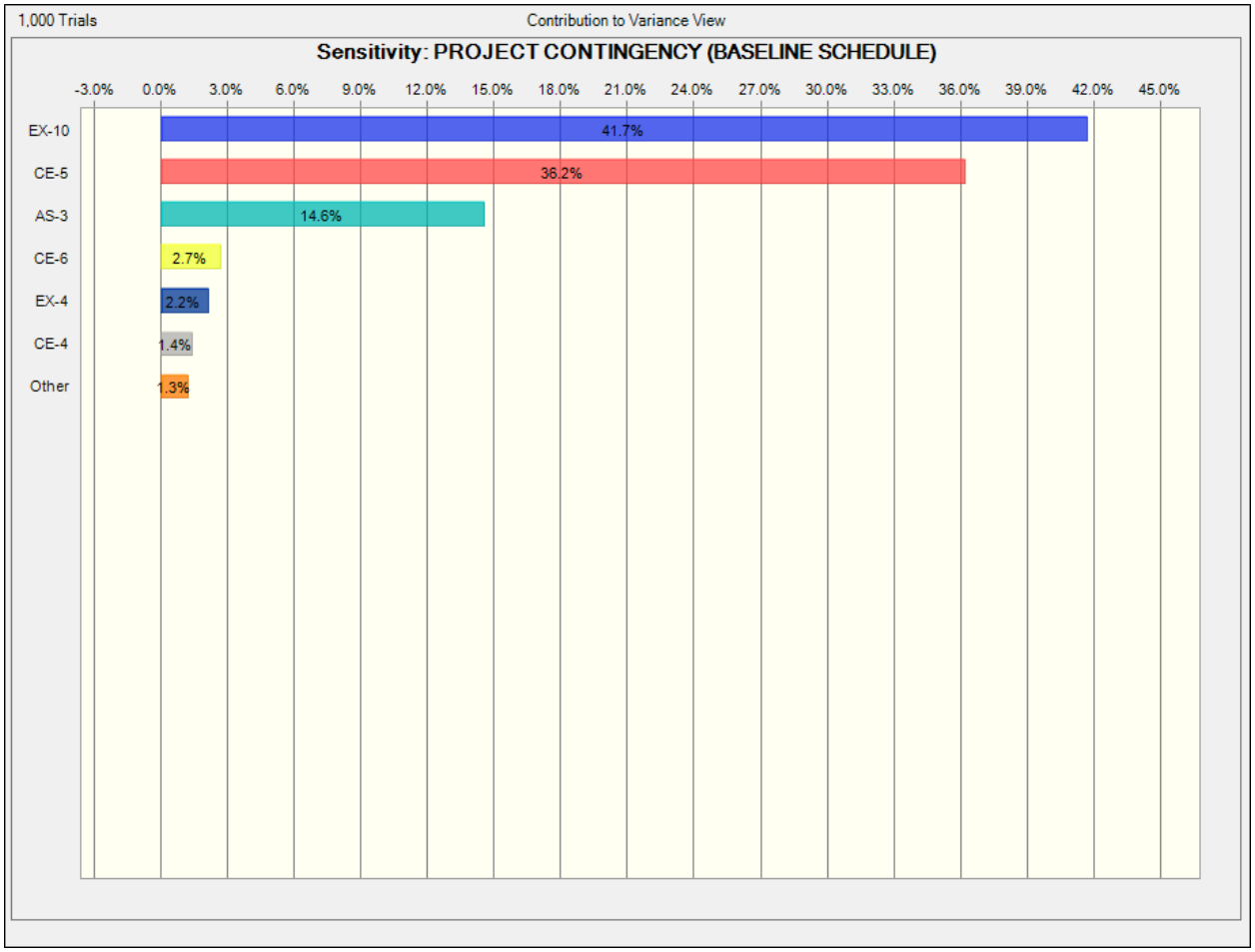

Figure 2. Key		
NO.	CATEGORY	EVENT
AS-3	Contract Acquisition Strategy Risks	Mobilization and Demobilization
CE-4	Construction Risks	Hopper Dredging
CE-5	Construction Risks	Pipeline Dredging
CE-6	Construction Risks	Containment Dikes
EX-4	Programmatic Risks	Hopper Dredging
EX-10	Programmatic Risks	Congressional Funding

7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. 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. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

7.1 Major Findings/Observations

Project cost and schedule comparison summaries are provided in Table 3 and Table 4 respectively. Additional major findings and observations of the risk analysis are listed below.

The PDT worked through the risk register on 18 Jun 2013, in addition to follow-on e-mails and discussions. That period of time allowed improved project scope definition, investigations, design and cost information, and resulted in reduced risks in certain project areas. The key risk drivers identified through sensitivity analysis suggest a cost contingency of $24.8M and schedule risks adding another potential of $17.8, both at an 80% confidence level.

Cost Risks: From the CSRA, the key or greater Cost Risk items include:

- Q-5: Quantities for Current Scope: Pipeline Dredging – Surveys are required during PED. New surveys may indicate high shoaling (or eroding) areas not previously accounted for in modeling, which increase (or decrease) quantities (required depth) for current scope. Hopper could be used for reach adjacent to entrance channel (with pump-out), which could decrease cost by removing one mobilization and demobilization from project costs. Any changes in quantities due to storms during construction are found in “Programmatic Risks.” Any changes in quantities due to storms after construction are handled in OM.
- CT-5: Estimate and Schedule Risks: Pipeline Dredging – On dredging projects, fuel is a major cost driver for equipment. Fuel has fluctuated in FY13, e.g. minimum ($3.09), maximum ($3.64), and average ($3.30). An upswing in fuel cost is anticipated.

Moderate risks, when combined, can also become a cost impact.

- EX-5: Programmatic Risks: Pipeline Dredging – There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project

construction occur during hurricane season, which is anticipated. A recurrence interval of 25-years (4% chance of occurrence in any given year) over three-year project duration was assumed, which resulted in 11.5 probability of occurrence.

- AS-3: Contract Acquisition Strategy Risks: Mobilization and Demobilization – Dredges are limited in quantity. It is unknown how competitive the market will be at time of award. The schedule is organized to encourage dredges working on one contract to finish on time in order to bid on the next contract, which could be recognized as cost savings to the Government via reduction in mobilization and demobilization costs. These potential (but not guaranteed) savings are not included in the estimate.
- CE-6: Construction Risks: Containment Dikes – There is minimal access to placement area sites, only one-way-in and one-way-out accessibility, in most cases. For PA2, access is assumed by water due to low beach access and piping plover wintering season at nine (9) months. Water access may prove difficult should depth of water not be adequate for tug to ground barge near PA.
- Q-4: Quantities for Current Scope: Hopper Dredging – Surveys are required during PED. New surveys may indicate high shoaling (or eroding) areas not previously accounted for in modeling, which increase (or decrease) quantities (required depth) for current scope. Any changes in quantities due to storms during construction are found in "Programmatic Risks." Any changes in quantities due to storms after construction are handled in OM.
- Q-6: Quantities for Current Scope: Containment Dikes – Quantities are neat line. That is, quantities are based on old survey data (one typical section along the edge of work defines the volume), densities are assumed in the areas based on historical practices, and take-offs do not include contingencies. Any changes in quantities due to storms during construction are found in "Programmatic Risks."

Schedule Risks: The high value of schedule risk indicates a significant uncertainty of key risk items, time duration growth that can translate into added costs. Over time, risks increase on those out-year contracts where there is greater potential for change in new scope requirements, uncertain market conditions, and unexpected high inflation. The greatest risks are the following:

- EX-10: Programmatic Risks: Congressional Funding – It is uncertain whether all needed Congressional funding for PED will be made available in a timely manner. Construction is assumed multiple contracts (7) to account for an uneven construction funding stream, i.e. each contract is approximately one (1) year in duration. Delays in funding may result in additional PED expenses as well as escalation in schedule growth. If authorization has already been received, even if the construction funding is delayed, the funding will add the OMB escalation onto the funding request.
- CE-5: Construction Risks: Pipeline Dredging – Project is likely to experience boat traffic issues due to long pipeline lengths and one-way traffic. There is minimal

access to placement area sites, only one-way-in and one-way-out accessibility, in most cases. For estimate purposes and contractor capabilities, no more than three (3) dredges will be underway at any given time. In addition, dredges will be located no less than one (1) mile apart due to Coast Guard regulations; for estimate purposes, the dredges have been strategically spaced at stations so as not to impede dredging workflow.

Moderate risks, when combined, can also become a time and (resulting) cost impact.

- AS-3: Contract Acquisition Strategy Risks: Mobilization and Demobilization – Dredges are limited in quantity. It is unknown how competitive the market will be at time of award. The schedule is organized to encourage dredges working on one contract to finish on time in order to bid on the next contract, which could be recognized as cost savings to the Government via reduction in mobilization and demobilization costs. These potential (but not guaranteed) savings are not included in the estimate.

Table 3. Construction Cost Comparison Summary (Uncertainty Analysis)

Most Likely Cost Estimate	$209,248,193		
Confidence Level	**Project Cost**	**Contingency**	**Contingency %**
5%	**$222,142,395**	**$12,894,203**	**6.16%**
10%	**$225,324,490**	**$16,076,298**	**7.68%**
15%	**$227,523,368**	**$18,275,176**	**8.73%**
20%	**$230,000,579**	**$20,752,386**	**9.92%**
25%	**$231,941,712**	**$22,693,520**	**10.85%**
30%	**$233,802,588**	**$24,554,396**	**11.73%**
35%	**$235,412,364**	**$26,164,171**	**12.50%**
40%	**$237,273,328**	**$28,025,136**	**13.39%**
45%	**$238,994,249**	**$29,746,056**	**14.22%**
50%	**$240,194,321**	**$30,946,128**	**14.79%**
55%	**$241,716,684**	**$32,468,491**	**15.52%**
60%	**$243,453,265**	**$34,205,072**	**16.35%**
65%	**$245,438,471**	**$36,190,278**	**17.30%**
70%	**$247,608,714**	**$38,360,521**	**18.33%**
75%	**$249,514,593**	**$40,266,401**	**19.24%**
80%	**$251,852,693**	**$42,604,500**	**20.36%**
85%	**$254,060,736**	**$44,812,543**	**21.42%**
90%	**$256,888,586**	**$47,640,394**	**22.77%**
95%	**$262,696,263**	**$53,448,070**	**25.54%**

Table 4. Construction Schedule Comparison Summary (Uncertainty Analysis)

Most Likely Schedule Duration	29.0 Months		
Confidence Level	**Project Duration**	**Contingency**	**Contingency %**
5%	**34.8 Months**	**5.8 Months**	**20.01%**
10%	**36.1 Months**	**7.1 Months**	**24.59%**
15%	**37.2 Months**	**8.2 Months**	**28.13%**
20%	**38.0 Months**	**9.0 Months**	**31.17%**
25%	**39.0 Months**	**10.0 Months**	**34.45%**
30%	**39.7 Months**	**10.7 Months**	**36.98%**
35%	**40.3 Months**	**11.3 Months**	**39.08%**
40%	**40.9 Months**	**11.9 Months**	**41.12%**
45%	**41.6 Months**	**12.6 Months**	**43.57%**
50%	**42.3 Months**	**13.3 Months**	**45.75%**
55%	**42.8 Months**	**13.8 Months**	**47.68%**
60%	**43.4 Months**	**14.4 Months**	**49.74%**
65%	**44.3 Months**	**15.3 Months**	**52.76%**
70%	**45.1 Months**	**16.1 Months**	**55.47%**
75%	**45.9 Months**	**16.9 Months**	**58.22%**
80%	**46.7 Months**	**17.7 Months**	**60.93%**
85%	**47.9 Months**	**18.9 Months**	**65.23%**
90%	**49.2 Months**	**20.2 Months**	**69.57%**
95%	**51.7 Months**	**22.7 Months**	**78.45%**

7.2 Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, *4th edition*, states that "project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project." Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

The CSRA study serves as a "road map" towards project improvements and reduced risks over time. The PDT must include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life-cycle is important in support of remaining within an approved budget and appropriation.

Risk Management: Project leadership should use the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measures, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions & Conclusions	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 PDT's sphere of influence.)								
	PROJECT SCOPE GROWTH								
PS-1	Relocations	potential for scope growth, added features, or changes in quantities; investigations not complete to fully support design assumptions	There is a possibility (but unlikely) inclusion of two (2) pipelines, i.e. current status indicates one (1) pipeline at 70-FT depth (per plans) / 90-FT depth (per Port) and one (1) pipeline at 50-FT depth outside of and parallel to the project footprint. The Real Estate Plan is complete and reports no impact.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
PS-2	Environmental Mitigation	change in site conditions	There is a possibility (but unlikely) inclusion of seagrass mitigation near channel banks, i.e. current status indicates no environmental impact for 52-FT depth, no widening plan.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
PS-3	Mobilization and Demobilization	dredge size and productivity	CEDEP produces an error (or greater unit price) for smaller dredge sizes, likely due to the long haul routes (hopper dredge) and/or pipeline pumps; therefore, the large hopper dredge and/or 30-Inch pipeline are the best (and least-cost) selections. RMS data for W912HY-10-C-0009 reflects EWT at 46.1% (pipeline), which is similar to 50% assumed in CEDEP (complete data not available for W912HY-12-C-0017 and W912HY-11-C-0003). Therefore, no "Project Scope Growth" is anticipated with regard to changes in hopper and/or pipeline assumptions.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
PS-4	Hopper Dredging	dredge size and productivity	CEDEP produces an error (or greater unit price) for smaller dredge sizes, likely due to the long haul routes (hopper dredge) and/or pipeline pumps; therefore, the large hopper dredge and/or 30-Inch pipeline are the best (and least-cost) selections. RMS data for W912HY-10-C-0009 reflects EWT at 46.1% (pipeline), which is similar to 50% assumed in CEDEP (complete data not available for W912HY-12-C-0017 and W912HY-11-C-0003). Therefore, no "Project Scope Growth" is anticipated with regard to changes in hopper and/or pipeline assumptions.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
PS-5	Pipeline Dredging	dredge size and productivity	CEDEP produces an error (or greater unit price) for smaller dredge sizes, likely due to the long haul routes (hopper dredge) and/or pipeline pumps; therefore, the large hopper dredge and/or 30-Inch pipeline are the best (and least-cost) selections. RMS data for W912HY-10-C-0009 reflects EWT at 46.1% (pipeline), which is similar to 50% assumed in CEDEP (complete data not available for W912HY-12-C-0017 and W912HY-11-C-0003). Therefore, no "Project Scope Growth" is anticipated with regard to changes in hopper and/or pipeline assumptions.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
PS-8	Planning, Engineering, & Design	adequate PDT resources	The District feels that there is District support and team development for future efforts.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
PS-9	Construction Management	construction duration expectation	Construction duration (expectation) is less than three (3) years. The estimate choice for assumed equipment establishes the duration. Opportunities may exist within the contract solicitation package or further estimate study to decrease the schedule and resulting costs. Historically, three (3) to five (5) dredges have been available based on market conditions, e.g. SNWW. The construction estimate assumes no more than three (3) large-sized dredges at any given time; however, in most cases, the construction estimate assumes two (2) large-sized dredges at any given time. Hopper with pump-out could be used adjacent to hopper entrance channel. Market study and contract development could result in market opportunities.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
	CONTRACT ACQUISITION STRATEGY RISKS								

AS-3	Mobilization and Demobilization	market conditions and competing projects may impact bid competition	Dredges are limited in quantity. It is unknown how competitive the market will be at time of award, but it is anticipated that bid competition will be high. The contract acquisition strategy is not unreasonable based on past projects, e.g. Sabine-Neches Waterway dredging project (employed four (4) pipeline dredges working simultaneously). The max dredges at anytime for proposed project areas is three (3), one (1) being a hopper dredge. The schedule is organized to encourage dredges working on one contract to finish on time in order to bid on the next contract, which could be recognized as cost savings to the Government via reduction in mobilization and demobilization costs. These potential (but not guaranteed) savings are not included in the estimate.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE
AS-6	Containment Dikes	contracting plan not firmly established; 8a or small business likely due to a requirement for subcontracting; limited bid competition anticipated	Containment dike construction would likely require small business subcontracts (by large dredge company), which would reduce efficiency. In addition, drop outlet structures would likely require a specialized small business company.	Likely	Negligible	LOW	Unlikely	Marginal	LOW
AS-7	Shoreline Stabilization	contracting plan not firmly established; 8a or small business likely due to a requirement for subcontracting; limited bid competition anticipated	Shoreline stabilization construction would likely require small business subcontracts (by large dredge company), which would reduce efficiency.	Likely	Negligible	LOW	Unlikely	Marginal	LOW
AS-9	Construction Management	contracting plan not firmly established; 8a or small business likely due to a requirement for subcontracting; limited bid competition anticipated	Additional contractor oversight is anticipated for small businesses.	Likely	Negligible	LOW	Unlikely	Negligible	LOW
	QUANTITIES FOR CURRENT SCOPE									
Q-4	Hopper Dredging	possibility for changes in quantities	Surveys are required during PED. New surveys may indicate high shoaling (or eroding) areas not previously accounted for in modeling, which increase (or decrease) quantities for current scope. Approved quantity method is to assume independence of “maintenance material” from “new work material.” That is, “new work material” quantities are calculated based on existing versus proposed authorized channel depths, i.e. quantities do not include “maintenance material” and the channel is assumed freshly dredged at existing authorized channel depth. “Maintenance material” - including potential quantity increases due to storms prior to start of construction – is handled under OM and no mixing of “maintenance material” and “new work material” is considered during construction. Any changes in quantities due to storms during construction are found in “Programmatic Risks.” Any changes in quantities due to storms after construction are handled in OM.	Likely	Marginal	MODERATE	Unlikely	Marginal	LOW
Q-5	Pipeline Dredging	possibility for changes in quantities	Surveys are required during PED. New surveys may indicate high shoaling (or eroding) areas not previously accounted for in modeling, which increase (or decrease) quantities for current scope. Hopper could be used for reach adjacent to entrance channel (with pumpout), which could decrease cost by removing one mobilization and demobilization from project costs. Approved quantity method is to assume independence of “maintenance material” from “new work material.” That is, “new work material” quantities are calculated based on existing versus proposed authorized channel depths, i.e. quantities do not include “maintenance material” and the channel is assumed freshly dredged at existing authorized channel depth. “Maintenance material” - including potential quantity increases due to storms prior to start of construction – is handled under OM and no mixing of “maintenance material” and “new work material” is considered during construction. Any changes in quantities due to storms during construction are found in “Programmatic Risks.” Any changes in quantities due to storms after construction are handled in OM.	Likely	Significant	HIGH	Unlikely	Marginal	LOW
Q-6	Containment Dikes	possibility for changes in quantities	Quantities do not include contingencies, i.e. quantities are neatline. Densities are assumed. Any changes in quantities due to storms during construction are found in “Programmatic Risks.”	Likely	Marginal	MODERATE	Unlikely	Marginal	LOW

Q-7	Shoreline Stabilization	possibility for changes in quantities	Quantities do not include contingencies, i.e. quantities are neatline. Densities are assumed. Any changes in quantities due to storms during construction are found in “Programmatic Risks.”	Likely	Negligible	LOW	Unlikely	Marginal	LOW
Q-8	Planning, Engineering, & Design	possibility for changes in quantities	Significant changes in quantities may lead to increased PED expenditures of time and money.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
	TECHNICAL RISKS								
TL-4	Hopper Dredging	potential for scope growth, added features, or changes in quantities	Soil characterization is not complete through entire channel reach; material assumed stiff clay due to limited sample data.	Very Unlikely	Significant	LOW	Very Unlikely	Significant	LOW
TL-5	Pipeline Dredging	potential for scope growth, added features, or changes in quantities	Soil characterization is not complete through entire channel reach; material assumed stiff clay due to limited sample data.	Very Unlikely	Significant	LOW	Very Unlikely	Significant	LOW
	LANDS AND DAMAGES RISKS								
LD-8	Planning, Engineering, & Design	easements for placement areas	Easements for all placement areas are with the Port. The District and the Port are in the process of extending the easements (to perpetual). No issues are anticipated with the District or the Port.	Very Unlikely	Negligible	LOW	Very Unlikely	Negligible	LOW
	REGULATORY AND ENVIRONMENTAL RISKS								
RE-4	Hopper Dredging	wildlife windows and/or species protection	Possibility exists for unaccounted for wildlife to be discovered in the area and/or nesting, which may delay project schedule. Unanticipated discoveries could lead to cost increases in order to account for environmental oversight.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
RE-5	Pipeline Dredging	wildlife windows and/or species protection	Possibility exists for unaccounted for wildlife to be discovered in the area and/or nesting, which may delay project schedule. Unanticipated discoveries could lead to cost increases in order to account for environmental oversight.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
RE-6	Containment Dikes	wildlife windows and/or species protection	Possibility exists for unaccounted wildlife to be discovered in the area and/or nesting, which may delay project schedule. For example, the piping plover (endangered) wintering season is nine (9) months. This impact is only anticipated for PA2 via land access. Estimate assumes access by water. Costs may increase to account for environmental oversight and/or non-violent "bird chasing" techniques, e.g. people, trained hawk-keepers, etc.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
RE-7	Shoreline Stabilization	wildlife windows and/or species protection	Possibility exists for unaccounted for wildlife to be discovered in the area and/or nesting, which may delay project schedule. Unanticipated discoveries could lead to cost increases in order to account for environmental oversight.	Unlikely	Marginal	LOW	Unlikely	Marginal	LOW
	CONSTRUCTION RISKS								
CE-4	Hopper Dredging	site accessibility, transportation delays, congestion	Project is likely to experience boat traffic issues due to one-way traffic. For estimate purposes and contractor capabilities, no more than three (3) dredges will be underway at any given time. In addition, dredges will be located no less than one (1) mile apart due to Coast Guard regulations; for estimate purposes, the dredges have been strategically spaced at stations so as not to impede dredging workflow.	Unlikely	Marginal	LOW	Likely	Negligible	LOW
CE-5	Pipeline Dredging	site accessibility, transportation delays, congestion	Project is likely to experience boat traffic issues due to long pipeline lengths and one-way traffic. There is minimal access to placement area sites, only one-way-in and one-way-out accessibility, in most cases. For estimate purposes and contractor capabilities, no more than three (3) dredges will be underway at any given time. In addition, dredges will be located no less than one (1) mile apart due to Coast Guard regulations; for estimate purposes, the dredges have been strategically spaced at stations so as not to impede dredging workflow.	Unlikely	Marginal	LOW	Likely	Significant	HIGH
CE-6	Containment Dikes	site accessibility, transportation delays, congestion	There is minimal access to placement area sites, only one-way-in and one-way-out accessibility, in most cases. For PA2, access is assumed by water due to low beach access and piping plover wintering season at nine (9) months.	Likely	Marginal	MODERATE	Likely	Marginal	MODERATE

CE-7	Shoreline Stabilization	site accessibility, transportation delays, congestion	There is minimal access to placement area sites, only one-way-in and one-way-out accessibility, in most cases. Access is predominately by water.	Likely	Negligible	LOW	Likely	Negligible	LOW
	ESTIMATE AND SCHEDULE RISKS								
CT-3	Mobilization and Demobilization	dredging liability insurance	Liability insurance has historically been high for areas south of Corpus Christi. Costs for mobilization/demobilization take this into account via reviews of historical bid openings.	Likely	Negligible	LOW	Unlikely	Negligible	LOW
CT-4	Hopper Dredging	fuel fluctuations can impact dredging costs	On dredging projects, fuel is a major cost driver for equipment. Fuel has fluctuated in FY13, e.g. minimum ($3.09), maximum ($3.64), and average ($3.30). An upswing in fuel cost is anticipated. CSRA to assume maximum fuel rate of $4.37/GAL, which results in total cost increase (per CEDEP) of $1.3M (hopper) and $21.5M (pipeline); CSRA does not assume a minimum fuel rate. Study should be for time of funding date estimate.	Likely	Negligible	LOW	Unlikely	Negligible	LOW
CT-5	Pipeline Dredging	fuel fluctuations can impact dredging costs	On dredging projects, fuel is a major cost driver for equipment. Fuel has fluctuated in FY13, e.g. minimum ($3.09), maximum ($3.64), and average ($3.30). An upswing in fuel cost is anticipated. CSRA to assume maximum fuel rate of $4.37/GAL, which results in total cost increase (per CEDEP) of $1.3M (hopper) and $21.5M (pipeline); CSRA does not assume a minimum fuel rate. Study should be for time of funding date estimate.	Likely	Significant	HIGH	Unlikely	Negligible	LOW
CT-6	Containment Dikes	settlement period	A settlement period is assumed for "new" placement areas. Since all placement areas "exist" and are only being raised with side-cast material, a settlement period is not assumed in the schedule. Adding a three (3) month settlement period would marginally impact contract schedules should it be determined that side-cast material is unsuitable.	Very Unlikely	Negligible	LOW	Unlikely	Marginal	LOW
	Programmatic Risks	(External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)							
EX-3	Mobilization and Demobilization	political influences, lack of support, obstacles; potential for severe adverse weather	There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated.	Likely	Negligible	LOW	Likely	Negligible	LOW
EX-4	Hopper Dredging	political influences, lack of support, obstacles; potential for severe adverse weather	There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated.	Likely	Negligible	LOW	Likely	Marginal	MODERATE
EX-5	Pipeline Dredging	political influences, lack of support, obstacles; potential for severe adverse weather	There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated.	Likely	Marginal	MODERATE	Likely	Negligible	LOW
EX-6	Containment Dikes	political influences, lack of support, obstacles; potential for severe adverse weather	There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated.	Likely	Negligible	LOW	Likely	Negligible	LOW
EX-7	Shoreline Stabilization	political influences, lack of support, obstacles; potential for severe adverse weather	There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated.	Likely	Negligible	LOW	Likely	Negligible	LOW
EX-8	Planning, Engineering, & Design	political influences, lack of support, obstacles; potential for severe adverse weather	There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated. Damages may result in additional project growth.	Likely	Negligible	LOW	Likely	Negligible	LOW
EX-9	Construction Management	political influences, lack of support, obstacles; potential for severe adverse weather	There is a potential for weather damages and delays, e.g. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated. Damages may result in additional project oversight.	Likely	Negligible	LOW	Likely	Negligible	LOW

EX-10	Congressional Funding	funding for PED is uncertain, post feasibility; funding for construction is uncertain, e.g. funding is incremental per FY and can be impacted by budget delays such as continuing resolutions	It is uncertain whether all needed Congressional funding for PED will be made available in a timely manner. Construction is assumed multiple contracts (7) to account for an uneven construction funding stream, i.e. each contract is approximately one (1) year in duration. Delays in funding may result in additional PED expenses as well as escalation in schedule growth. If authorization has already been received, even if the construction funding is delayed, the funding will add the OMB escalation onto the funding request.	Unlikely	Marginal	LOW	Likely	Significant	HIGH
EX-11	Stakeholder Funding	1 sponsor; has adequate funding support for their shares	Costs for deepening between 42 and 45 feet (and mobilization/demobilization and containment dike construction) are cost shared at 25 percent non-Federal and 75 percent Federal; costs for deepening between 45 and 52 feet are cost shared at 50 percent non-Federal and 50 percent Federal. Sponsor feels confident that their budget shares are not a critical constraint and that the Federal shares and funding are a greater concern.	Unlikely	Negligible	LOW	Unlikely	Negligible	LOW

Estimated by	USACE SWG EC PS
Designed by	USACE SWG EC
Prepared by	USACE SWG EC PS
Preparation Date	10/10/2013
Effective Date of Pricing	10/10/2013
Estimated Construction Time	812 Days

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Library Properties
Designed by
USACE SWG EC
Estimated by
USACE SWG EC PS
Prepared by
USACE SWG EC PS

Design Document	PLANNING STUDY
Document Date	10/10/2013
District	USACE SWG
Contact	MARTIN REGNER, 409.766.3923
Budget Year	2014
UOM System	Original

Direct Costs
LaborCost
EQCost
MatlCost
SubBidCost
CEDEP: MOBS
CEDEP: RATES
PA: MOBS
DROP OUTLET
STONE

Timeline/Currency

Preparation Date	10/10/2013
Escalation Date	10/10/2013
Eff. Pricing Date	10/10/2013
Estimated Duration	812 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB12EB-b: MII English Cost Book 2012-b

Labor SWG2012: Galveston District Labor Library - 2012

Note: http://www.wdol.gov is the website for current Davis Bacon & Service Labor Rates. Fringes paid to the laborers are taxable. In a non-union job the whole fringes are taxable. In a union job, the vacation pay fringe taxal

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP11R06: MII Equipment 2011 Region 06

06 SOUTHWEST

Sales Tax	8.10
Working Hours per Year	1,590
Labor Adjustment Factor	0.87
Cost of Money	2.50
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.082
Gas	3.420
Diesel Off-Road	3.570
Diesel On-Road	4.000

Shipping Rates

Over 0 CWT	17.56
Over 240 CWT	16.39
Over 300 CWT	14.76
Over 400 CWT	13.26
Over 500 CWT	7.25
Over 700 CWT	6.67
Over 800 CWT	5.18

Labor ID: SWG2012 EQ ID: EP11R06 Currency in US dollars TRACES MII Version 4.2

Date	Author	Note

Project Notes
1/10/2014 1:57:35 PM REGNER

P2-370840 - BRAZOS ISLAND HARBOR, TEXAS CHANNEL IMPROVEMENT PROJECT
FEASIBILITY STUDY

LOCATION AND DESCRIPTION:
Port of Brownsville is located on the south Texas coast near the border of U.S. and Mexico. The study area encompasses the entire Brownsville Ship Channel and surrounding region. The entrance channel is located offshore of Cameron County, Texas, in the Gulf of Mexico, and ends at Port of Brownsville Main Harbor. Brownsville Ship Channel provides deep draft access from the Gulf of Mexico through a jetty entrance channel to Brownsville, and a side channel, authorized to 36-feet, and a shallow draft Fishing Boat Harbor near Port Isabel. The primary purpose of the study is navigation, which consists of enlarging the existing Brownsville Ship Channel by deepening the entrance channel, jetty channel, the lower section of the main channel, the upper section of the main channel, and turning basin.

The MII is developed using October 2013 price levels and the latest labor rates for Galveston District. The estimate is divided into seven (7) contracts. Each contract is organized in accordance with a work breakdown structure. Midpoint dates for the construction contracts are developed in conjunction with the project manager for developing the fully-funded costs. The estimate is prepared in accordance with ER 1110-2-1302 Civil Works Cost Engineering, dated 15 Sep 08. The costs are escalated in accordance with the above Engineering Regulation and EM 1110-2-1304 Civil Works Construction Cost Index System (CWCCIS), dated 31 Mar 2013. All data is input into the Total Project Cost Sheet (TPCS).

Marine fuel price is averaged, locked in at $3.30/gallon (October 2013). Diesel fuel price is locked in at $4.00/gallon (October 2013). There are no impacts to utilities anticipated. There are no Hazardous, Toxic, and Radioactive Wastes anticipated. The Operation and Maintenance estimate is dated October 2013, with an effective pricing date of October 2013. A formal Cost Risk Analyses is performed with the cooperation of the PDT and Cost Engineering Directory of Expertise (DX) of the Walla Walla District (October 2013). The risks are quantified and a cost risk model developed to determine a contingency at 80% Confidence Level (CL). An ATR Certification of Cost Estimate is provided by Walla Walla District.

CONTRACT 01:
This contract is for hopper dredging -17+000 to 00+000 and delivery to New Work Ocean Dredged Material Placement Area (offshore). The stationing listed is located on the Gulf of Mexico side of the jetties (entrance channel) and is unsuitable for a pipeline dredge due to wave action. The approximate duration is seven (7) months.

CONTRACT 02:
This contract is for dike raising and rehabilitation of Placement Area 4B and Placement Area 5A. The approximate duration is 15 months. Associated Costs provided by Department of Engineering Services of the Brownsville Navigation District (21 Oct 2013).

CONTRACT 03:
This contract is for dike raising and rehabilitation of Placement Area 7 and Placement Area 8. The approximate duration is seven (7) months. In addition, this contract is for pipeline dredging 70+000 to 82+000 and 82+000 to 89+500 and delivery to Placement Area 7 and Placement Area 8, respectively. The stationing listed is located in the upper section of the main channel and turning basin. The approximate duration is 10 months. The approximate duration of the total contract is 13 months as dike raising and rehabilitation can occur, in some instances, concurrently with pipeline dredging.

CONTRACT 04:
This contract is for pipeline dredging 25+000 to 50+000 and delivery to Placement Area 5A. The stationing listed is located in the middle section of the main channel. The approximate duration is 16 months.

CONTRACT 05:
This contract is for dike raising and rehabilitation of Placement Area 2. The approximate duration is three (3) months. In addition, this contract is for pipeline dredging 00+000 to 07+000 and delivery to Placement Area 2. The stationing listed is located in the lower section of the main channel near the jetties (entrance channel). The approximate duration is three (3) months.

CONTRACT 06:
This contract is for pipeline dredging 07+000 to 25+000 and delivery to Placement Area 4B. The stationing listed is located in the middle section of the main channel. The approximate duration is 11 months.

CONTRACT 07:
This contract is for dike raising and rehabilitation of Placement Area 5B. The approximate duration is three (3) months. In addition, this contract is for pipeline dredging 50+000 to 70+000 and delivery to Placement Area 5B. The stationing listed is located in the upper section of the main channel near the turning basin. The approximate duration is nine (9) months.

ACCOUNT CODE 12 - NAVIGATION PORTS AND HARBORS:
Dredge quantities are developed by SWG, Engineering Division, General Engineering (EC-EG). One (1) large hopper dredge is to be used for Contract 01 with offshore placement (with an option for the

Labor ID: SWG2012 EQ ID: EP11R06 Currency in US dollars TRACES MII Version 4.2

Date	Author	Note

Contractor to bid Contract 05 as pump-out to PA 2 based on durations and schedules). The remainder of the channel is to be dredged with 30" pipeline dredges, with the material discharged into various, existing placement areas located along the waterway (PA 2, 4B, 5A, 5B, 7, and 8). Dredging costs are developed using Cost Engineering Dredge Estimating Program (CEDEP). Dredge production rates and losses are reduced to account for Resident Management System (RMS) historical effective working times and stiffer "new work" materials. Cost for mobilization and demobilization are developed using CEDEP, assuming the dredges are based in New Orleans, Louisiana. Dredge estimates are based on standard operation practices for the Galveston District, which assume conventional contracting practices of large business IFBs. For estimation purposes and contractor capabilities (derived from current Sabine-Neches Waterway dredging project, which includes four pipeline dredges working simultaneously), no more than three (3) dredges will be underway at any given time. In addition, dredges will be located no less than one (1) mile apart due to Coast Guard regulations; for estimate purposes, the dredges have been strategically spaced at stations so as not to impede dredging workflow.

The cost for Sea Turtle Protection is associated with hopper dredging and includes: 1) cost for two (2) trawlers per hopper; 2) a sea turtle protection device fitted to the hopper; and 3) 24-hour monitoring survey.

The cost for raising placement areas is included under this code of account. Part of the cost for raising a placement area includes clearing, grubbing, and stripping the area; seeding the outside of the dikes is not considered. Labor rates and overhead costs are adjusted to reflect Galveston District, Region 6. The placement area dikes are built using 3-CY dragline buckets, with an optimal production rate of 125-CY/HR, respectively. A total of three (3) draglines are working at the same time. For estimate purposes, dike works are lumped by perimeter and training dikes, locations, and bucket sizes. Articulated concrete block is to be placed approximately 22+000 to 34+000. Production assumed at 50-CY/HR in addition to transport of material from Central Texas via railcars, then trucks, then barges, and finally to the site. Material characteristics are provided by SWG, Engineering Division, Geotechnical and Structural Section (EC-ES).

ACCOUNT CODE 30 - ENGINEERING AND DESGIN:
The cost for this account are developed using the guidelines provided in the TPCS, with the agreement of the cost engineer and the project manager.

ACCOUNT CODE 31 - CONSTRUCTION MANAGEMENT:
The cost for this account are developed using the guidelines provided in the TPCS, with the agreement of the cost engineer and the project manager.

1/21/2014 8:43:54 AM PORT

Analysis of Possible BIH Dock Upgrade Costs due to Deepening of Brownsville Ship Channel
September 5, 2013; revised October 21, 2013

At the behest of the Galveston District (SWG) of the United States Army Corps of Engineers (USACE), the Department of Engineering Services of the Brownsville Navigation District (BND), d.b.a. Port of Brownsville, has performed an analysis of the possible costs to upgrade the existing BND docks that would be within the area of the Brownsville Ship Channel to be deepened from the current authorized depth of 42 feet to the Tentatively Selected Plan (TSP) new depth of 52 feet.

On an email from Ms. Katie Williams to Brenda Hayden dated 7/23/2013, the following assumptions were indicated:

I looked at what I included in the docks and this is what I have. I assumed the AmFELS dock would be deepened to 51' and the Liquid Dock, Oil Dock 3, 4, & 5, Dock 15, BC Dock, and Oil Dock 1 & 2 would be deepened to 49'.

In addition, the BND recently opened bids on the new Cargo Dock 16, to be located at Stations 80+500 to 81+100 of the Brownsville Ship Channel. The project was bid with two alternatives: a 42 ft. deep dock and a 50 ft. deep dock. As shown in the attached tabulation, the low bid for the shallow dock was $20,924,230.00, and the low bid for the deep dock was $24,938,687.00, for a difference of $4,014,457.00. After discussing the probable upgrade costs with the dock's design engineer, our estimation is that the upgrade costs could be between 150% to 250% of the difference in cost if the dock was to be built deep. That gave us a range of $6 Million to $9 Million, which I chose to average to $7.5 Million for estimating purposes.

For the 600 feet of proposed dock, the $7.5 Million upgrade estimate resulted in an estimated cost per foot of $12,500 to deepen the dock in the future from 42 ft. to 50 ft. The per-foot cost was applied to each of the affected docks, based on the following TSP deepening plan, as approved in the TSP Milestone meeting:

Ship Channel Segment **From Sta. To Sta.**
Deepen to 54 feet -17+000 0+000
Deepen to 52 feet 0+000 84+200
Keep at 42 feet 84+200 86+000
Keep at 36 feet 86+000 End

The results were then summarized, with the following considerations:
- AmFELS has an area where they are dredging to 70 feet depth, so it is reasonable to assume that no upgrade will be necessary in that area.
- Oil Dock 4 does not exist, as it burned down about 15 years ago, so no upgrade is needed there. Analysis of Possible BIH Dock Upgrade Costs September 5, 2013 due to Deepening of Brownsville Ship

Labor ID: SWG2012 EQ ID: EP11R06 Currency in US dollars TRACES MII Version 4.2

Date Author Note

Channel Rev. October 21, 2013

The following table is the summary of this analysis. The color-shaded lines are those not needing upgrades.
Deepened to 51' **Approximate Limits Length** (ft) **Upgrade**
From To Cost
AmFELS Quay 72+850 75+300 2,450 Not needed Deepened to 49'
Approximate Limits Length (ft) **Upgrade**
From Sta. To Sta. Cost
Oil Dock 1 85+700 86+000 300 $ 3,750,000
Oil Dock 2 84+980 85+280 300 $ 3,750,000
Oil Dock 3 81+100 81+420 320 $ 4,000,000
Oil Dock 4 Does not exist N/A Not needed
Oil Dock 5 84+100 84+360 260 $ 3,250,000
Bulk Cargo Dock 83+850 84+250 400 $ 5,000,000
Cargo Dock 15 81+400 82+000 600 $ 7,500,000
Cargo Dock 16 80+500 81+100 600 $ 7,500,000
Liquid Cargo Dock 79+260 79+620 360 $ 4,500,000
Totals: 2,140 $ 39,250,000

It must be understood that the scope of this analysis is general and preliminary, and that a more detailed analysis based on detailed design and specific considerations may yield different results.

Mr. Ariel Chavez II, P.E. / R.P.L.S.
Director of Engineering Services
Port of Brownsville
956/592-3973 (Cel) - 956/831-6153 (Fax)

Markup Properties

Direct Cost Markups	**Category**	**Method**
OVERTIME	Overtime	Overtime

	Days/Week	*Hours/Shift*	*Shifts/Day*	*1st Shift*	*2nd Shift*	*3rd Shift*
Standard	*5.00*	*8.00*	*1.00*	*8.00*	*0.00*	*0.00*
Actual	*5.00*	*8.00*	*1.00*	*10.00*	*0.00*	*0.00*

Day	*OT Factor*	*Working*	*OT Percent*	*FCCM Percent*
Monday	*1.50*	*Yes*	*10.00*	*(20.00)*
Tuesday	*1.50*	*Yes*		
Wednesday	*1.50*	*Yes*		
Thursday	*1.50*	*Yes*		
Friday	*1.50*	*Yes*		
Saturday	*1.50*	*No*		
Sunday	*2.00*	*No*		

Contractor Markups	**Category**	**Method**
FOOH (Running%)	JOOH	Running %
HOOH (Running%)	Allowance	Running %
PROFIT (Running%)	Profit	Running %
BOND	Bond	Bond Table

Class B, Tiered, 24 months, 1.00% Surcharge

Contract Price	*Bond Rate*
500,000	*15.84*
2,000,000	*9.57*
2,500,000	*7.59*
2,500,000	*6.93*
100,000,000,000	*6.34*

Owner Markups	**Category**	**Method**
CONTINGENCY	Contingency	Running %

Labor ID: SWG2012 EQ ID: EP11R06 Currency in US dollars TRACES MII Version 4.2

Description	Quantity	UOM	DirectCost	SubCMU	CostToPrime	PrimeCMU	ProjectCost
Project Cost Summary Report			**171,970,183**	**3,258,607**	**175,228,790**	**5,157,583**	**180,386,373**
01 CONTRACT 01	**1.00**	**LS**	**13,886,802**	**38,445**	**13,925,247**	**68,844**	**13,994,091**
01 01 NON-FED/FED COSTS	**1.00**	**LS**	**13,886,802**	**38,445**	**13,925,247**	**68,844**	**13,994,091**
01 01 12 NAVIGATION PORTS AND HARBORS	**1.00**	**LS**	**13,886,802**	**38,445**	**13,925,247**	**68,844**	**13,994,091**
02 CONTRACT 02	**1.00**	**LS**	**44,114,806**	**1,657,285**	**45,772,091**	**2,618,965**	**48,391,056**
02 01 NON-FED/FED COSTS	**1.00**	**LS**	**44,114,806**	**1,657,285**	**45,772,091**	**2,618,965**	**48,391,056**
02 01 12 NAVIGATION PORTS AND HARBORS	**1.00**	**LS**	**44,114,806**	**1,657,285**	**45,772,091**	**2,618,965**	**48,391,056**
03 CONTRACT 03	**1.00**	**LS**	**19,667,060**	**818,835**	**20,485,895**	**1,293,985**	**21,779,880**
03 01 NON-FED/FED COSTS	**1.00**	**LS**	**19,667,060**	**818,835**	**20,485,895**	**1,293,985**	**21,779,880**
03 01 12 NAVIGATION PORTS AND HARBORS	**1.00**	**LS**	**19,667,060**	**818,835**	**20,485,895**	**1,293,985**	**21,779,880**
04 CONTRACT 04	**1.00**	**LS**	**37,210,494**	**0**	**37,210,494**	**0**	**37,210,494**
04 01 NON-FED/FED COSTS	**1.00**	**LS**	**37,210,494**	**0**	**37,210,494**	**0**	**37,210,494**
04 01 12 NAVIGATION PORTS AND HARBORS	**1.00**	**LS**	**37,210,494**	**0**	**37,210,494**	**0**	**37,210,494**
05 CONTRACT 05	**1.00**	**LS**	**6,734,897**	**342,646**	**7,077,543**	**541,475**	**7,619,017**
05 01 NON-FED/FED COSTS	**1.00**	**LS**	**6,734,897**	**342,646**	**7,077,543**	**541,475**	**7,619,017**
05 01 12 NAVIGATION PORTS AND HARBORS	**1.00**	**LS**	**6,734,897**	**342,646**	**7,077,543**	**541,475**	**7,619,017**
06 CONTRACT 06	**1.00**	**LS**	**29,307,250**	**0**	**29,307,250**	**0**	**29,307,250**
06 01 NON-FED/FED COSTS	**1.00**	**LS**	**29,307,250**	**0**	**29,307,250**	**0**	**29,307,250**
06 01 12 NAVIGATION PORTS AND HARBORS	**1.00**	**LS**	**29,307,250**	**0**	**29,307,250**	**0**	**29,307,250**
07 CONTRACT 07	**1.00**	**LS**	**21,048,876**	**401,395**	**21,450,271**	**634,314**	**22,084,585**
07 01 NON-FED/FED COSTS	**1.00**	**LS**	**21,048,876**	**401,395**	**21,450,271**	**634,314**	**22,084,585**
07 01 12 NAVIGATION PORTS AND HARBORS	**1.00**	**LS**	**21,048,876**	**401,395**	**21,450,271**	**634,314**	**22,084,585**

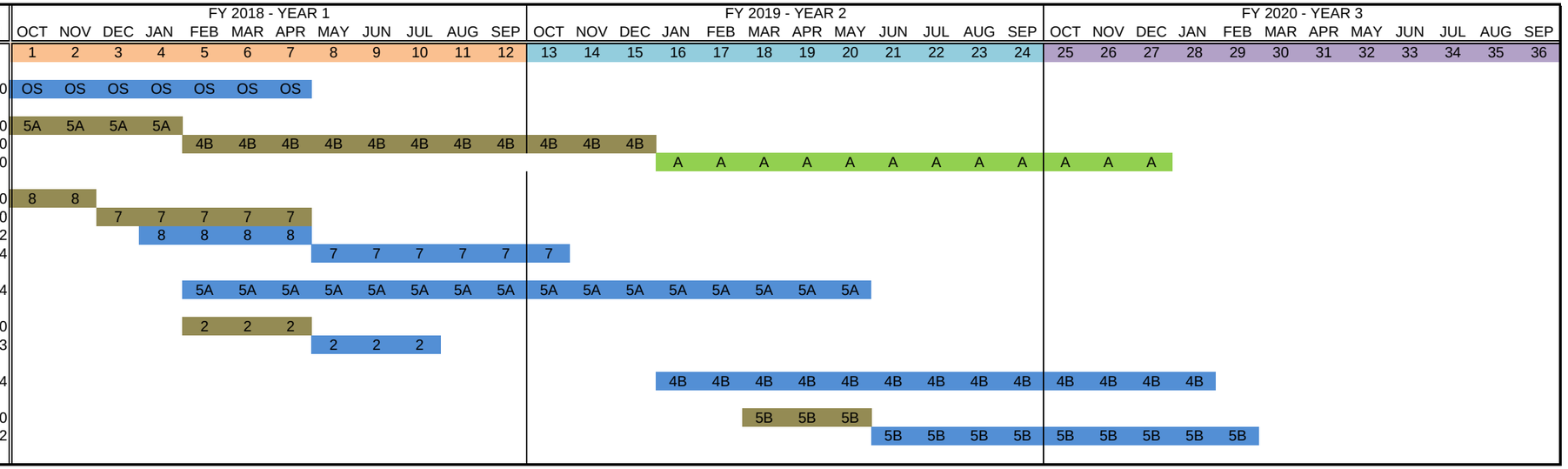
Labor ID: SWG2012 EQ ID: EP11R06 Currency in US dollars TRACES MII Version 4.2

--- NEW WORK ---
P2-370840 - BRAZOS ISLAND HARBOR, TEXAS, CHANNEL IMPROVEMENT PROJECT
FEASIBILITY STUDY
OCTOBER 2013 PRICE LEVELS
CONTRACT CALENDAR

CONTRACT	DESCRIPTION	DURATION (month)	DESIGN MIDPOINT	START DATE	MIDPOINT	END DATE
1	Dredge: ODMDS	7	Oct-16 (2017Q1)	Oct-17 (2018Q1)	Jan-18 (2018Q2)	Apr-18 (2018Q3)
2	Dike: PA 5A, PA 4B	15	Oct-16 (2017Q1)	Oct-17 (2018Q1)	May-18 (2018Q3)	Dec-18 (2019Q1)
	Associated Costs	12		Jan-19 (2019Q2)	Jun-19 (2019Q3)	Dec-19 (2020Q1)
3	Dike: PA 8, PA 7 Dredge: 8, 7	13	Oct-16 (2017Q1)	Oct-17 (2018Q1)	Apr-18 (2018Q3)	Oct-18 (2019Q1)
4	Dredge: 5A	16	Feb-17 (2017Q2)	Feb-18 (2018Q2)	Sep-18 (2018Q4)	May-19 (2019Q3)
5	Dike: PA 2 Dredge: 2	6	Feb-17 (2017Q2)	Feb-18 (2018Q2)	May-18 (2018Q3)	Jul-18 (2018Q4)
6	Dredge: 4B	11	Jan-18 (2018Q2)	Jan-19 (2019Q2)	Jun-19 (2019Q3)	Nov-19 (2020Q1)
7	Dike: 5B Dredge: 5B	12	Mar-18 (2018Q2)	Mar-19 (2019Q2)	Aug-19 (2019Q4)	Feb-20 (2020Q2)

--- NEW WORK ---
P2-370840 - BRAZOS ISLAND HARBOR, TEXAS, CHANNEL IMPROVEMENT PROJECT
FEASIBILITY STUDY
OCTOBER 2013 PRICE LEVELS
VISUAL CALENDAR

NO.	DESCRIPTION	DURATION
CONT 1	Dredge for ODMDS	6.30
CONT 2	PA 5A	3.60
	PA 4B	10.90
	ASSOCIATED	12.00
CONT 3	PA 8	1.40
	PA 7	4.40
	Dredge for PA 8	3.02
	Dredge for PA 7	5.84
CONT 4	Dredge for PA 5A	15.94
CONT 5	PA 2	2.40
	Dredge for PA 2	2.93
CONT 6	Dredge for PA 4B	10.84
CONT 7	PA 5B	2.80
	Dredge for PA 5B	8.92



--- NEW WORK TSP ---
BRAZOS ISLAND HARBOR, TEXAS CHANNEL IMPROVEMENT PROJECT
FEASIBILITY STUDY
OCTOBER 2013 PRICE LEVEL
50 YEAR O&M COST

	DREDGE	DEWATERING	LEVEES	TOTAL
YEAR 1				0
YEAR 2	7,175,110			7,175,110
YEAR 3	7,175,110			7,175,110
YEAR 4	21,930,458	4,065,631		25,996,089
YEAR 5	20,685,272	2,201,686		22,886,958
YEAR 6	13,541,421	1,014,656		14,556,077
YEAR 7	5,586,841	954,651		6,541,492
YEAR 8	29,105,568	4,065,631		33,171,199
YEAR 9	12,876,788			12,876,788
YEAR 10	7,808,484	2,201,686	3,170,350	13,180,520
YEAR 11	7,175,110			7,175,110
YEAR 12	35,471,879	5,080,287	2,141,095	42,693,261
YEAR 13				0
YEAR 14	18,463,629	954,651		19,418,280
YEAR 15	14,983,594	2,201,686		17,185,280
YEAR 16	21,930,458	4,065,631		25,996,089
YEAR 17	7,175,110			7,175,110
YEAR 18	19,243,099	1,014,656		20,257,755
YEAR 19				0
YEAR 20	36,914,052	6,267,317	3,170,350	46,351,719
YEAR 21	12,761,951	954,651		13,716,602
YEAR 22				0
YEAR 23	12,876,788			12,876,788
YEAR 24	35,471,879	5,080,287	2,141,095	42,693,261
YEAR 25	7,808,484	2,201,686	8,509,145	18,519,315
YEAR 26	7,175,110			7,175,110
YEAR 27	12,876,788			12,876,788
YEAR 28	27,517,299	5,020,282		32,537,581
YEAR 29	7,175,110			7,175,110
YEAR 30	21,349,905	3,216,342	3,170,350	27,736,597
YEAR 31				0
YEAR 32	34,807,246	4,065,631		38,872,877
YEAR 33	7,175,110			7,175,110
YEAR 34				0
YEAR 35	20,570,435	3,156,337		23,726,772
YEAR 36	41,173,557	5,080,287	2,141,095	48,394,939
YEAR 37				0
YEAR 38	7,175,110			7,175,110
YEAR 39	7,175,110			7,175,110
YEAR 40	29,738,942	6,267,317	3,170,350	39,176,609
YEAR 41	12,876,788			12,876,788
YEAR 42	19,128,262	1,969,307		21,097,569
YEAR 43				0
YEAR 44	29,105,568	4,065,631		33,171,199
YEAR 45	20,685,272	2,201,686		22,886,958
YEAR 46				0
YEAR 47	7,175,110			7,175,110
YEAR 48	35,471,879	5,080,287	2,141,095	42,693,261
YEAR 49	5,586,841	954,651		6,541,492
YEAR 50	20,685,272	2,201,686	12,690,025	35,576,983
TOTAL O&M:	$730,785,799	$85,604,237	$42,444,950	$858,834,986