US Army Corps
of Engineers®

APPENDIX 3

Montauk Point, New York

Hurricane and Storm Damage Reduction Project

Project Cost and Schedule Risk Analysis Report

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New England District
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Cost Engineering Section

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EXECUTIVE SUMMARY

Under the auspices of the US Army Corps of Engineers (USACE), New England District, this report presents a recommendation for the project cost and schedule contingencies for the Montauk Point, New York Hurricane and Storm Damage Reduction Project. The Montauk Point Lighthouse at the easternmost point of Long Island New York is in danger of being destroyed due to bluff erosion. The lighthouse, constructed in 1796, is on the National Register of Historic places and was designated as a National Historic Landmark in 2012. A Feasibility Study evaluating various alternatives for protecting the lighthouse was completed in 2006. The selected alternative consisted of the construction of an 840-foot long stone revetment to protect the Montauk Point lighthouse. The project was authorized by Congress in 2007. In the Disaster Relief Appropriations Act of 2013, funds were provided to complete the authorized, but unconstructed project. USACE is currently reviewing the project to validate the Feasibility Study conclusions and make recommendations for potential design refinements to improve the strength and constructability of the proposed design, and verify the cost estimate. The results of that review will be documented in a Limited Reevaluation Report. The following Cost and Schedule Risk Analysis presented is for the recommended plan only.

Table 1 portrays the full costs of the project based on the current scope and design with consideration for potential anticipated contracts. **Costs updated to effective price level date of 1 October 2014.

Table 1. Total Project Cost (Fully Funded) Cost Summary

Montauk Point, NY HSLRR		COST	CNTG	TOTAL incl Escalation
		($1,000)	($1,000)	($1,000)RND
10	BREAKWATERS & SEAWALLS	12,212	3,333	16,227
01	LANDS AND DAMAGES	174	17	200
30	PLANNING, ENGINEERING AND DESIGN	947	69	1059
31	CONSTRUCTION MANAGEMENT	1282	130	1532
	TOTAL PROJECT COSTS	**14,615**	**2,776**	**19017**
	Schedule Duration & Completion		**18 months**	**30 Nov 2015**

Notes:
1) Costs include the recommended contingency of 24.23%.
2) Costs exclude O&M and Life Cycle Cost estimates.

This estimate is the Total Project Cost or Fully Funded costs developed in the Total Project Cost Summary spreadsheet. It is the construction cost estimate with contingency developed from the Abbreviated Risk Analysis (ARA), escalated through the project period. The development of these figures may be found in the main report of this appendix.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

COST ESTIMATE

The cost estimate is based on the design plan from the civil engineering section in addition to the quantities. The estimate is based on the current plans, while a key assumption was determined by the PDT that the construction effort will be land based due to accessibility, marine conditions, and distance and height of the revetment from MLLW. The key recommendation is the further development of the means of construction of the revetment to determine the approach as a land or marine based construction effort.

RISK ANALYSIS

Risk Mitigation was conducted through an Abbreviated Risk Analysis of the project as it is currently presented in addition to the acknowledgement of risk in the scope and estimated quantities of material. The District has taken an approach to mitigate this risk through a conservative approach to the size of revetment in addition to the stone cost and more importantly the method of placement. The mitigation of this risk will be further discussed in the main report. Additional factors assessed that may have additional impact to the project were considered and addressed in the base cost. These factors were weather and jobsite conditions and commodities/raw materials. The district chose to mitigate through direct cost addition to each reach due to a large amount of historical information and contractor familiarity to the area. The amounts included in the project cost provide an amount that the PDT is confident will provide substantive costs to mitigate issues. The District will continue to monitor and include all risks in continuing assessment of contingency and amend as necessary as an essential element to the continued development of the project.

The key cost risk drivers identified through formal risk and sensitivity analysis were; Armor Stone Material Costs, Excavation, Armor Stone Construction Placement, and Weather Impact to Construction, which together contribute an absolute value of 19.94 percent of the statistical cost variance.

Site Preparation – Mobilization. This risk is associated with the current design and what the PDT believes is the most economical and least risky means of construction. Evaluation of the constructability of the design led the PDT to determine the most economical; therefore most likely winning bid for the construction contract would be a land based construction operation. Risk was mitigated during the formulation of the cost estimate through conservative development of the required site development. The team and the cost engineer believe there are additional risks that must be mitigated such as differing site locations and review of existing site conditions requiring additional development to support construction efforts.

Excavation – Schedule and Re-Handling. This moderate risk impacts the work effort to excavate the existing condition. Risks addressed include the possibility of re-handling the stone due to tight site constrictions after unloading. The costs developed did include some mitigation through decreased productivity, however uses the risk to account for additional unforeseen handling impacts. Additional to the excavation risk impact are weather delays to the productivity to excavate in marine conditions. The remainder of the risk not handled in the cost analysis is mitigated through the application of contingency to the project cost.

Armor Stone – Adverse Weather Impact. The risk is related not correlated with other risks, however is related to environmental factors and is included in the risk assessment of these other features of work. There is a strong likelihood that the level of effort will be less than presumed, however this effort may equally be increased as noted by the recent increased Atlantic Ocean storm activity in the last 10 years, hence increased levels of effort and duration may be required. There also exists an opportunity for savings by constraining the contractor timeframe for construction to the most advantageous schedule. The risk for this factor was developed based on the negative overall potential impact of a potential is likely with an overall significant impact, therefore has been mitigated through increased contingency percentage.

Weather Impact to Construction. Weather impact to construction presents a highly significant unknown accounted in the cost analysis through conservative productivity, however there was no delay or work stoppage included in the cost estimate nor a formal schedule risk analysis. This has been mitigated purely through the risk analysis conducted in the ARA resulting in an overall cost risk adjustment.

Armor Stone Material Costs. There was concern regarding material costs and the potential cost risk of material purchase and delivery, therefore it was reviewed. Since the cost of armor stone is considerable, this warranted a review since any associated risk will have a significant impact to risk contingency. This risk review resulted in an assessment of likely with marginal impact. Though the impact is marginal, the inherent cost to purchase and deliver the stone results in an overall larger though not significant impact on the project. There is additional underlying impact of fuel price on this risk due to the gross cost of delivering large stones to a remote and challenging worksite. This is largely dependent on the timing of the construction contract and national economic factors. This item presents potential risk for cost and availability may impact schedule slightly which has been taken into account, as well as opportunity for savings for the same. This risk is mitigated through contingency risk percentage on the project costs and added cost escalation to the midpoint of construction.

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

MAIN REPORT

1.0 PURPOSE

Under the auspices of the US Army Corps of Engineers (USACE), New England District, this report presents a recommendation for the project cost and risk analysis for the Montauk Point, NY HSLRR.

2.0 BACKGROUND

The Montauk Point Lighthouse at the easternmost point of Long Island New York is in danger of being destroyed due to bluff erosion. The lighthouse, constructed in 1796, is on the National Register of Historic places and designated as a National Historic Landmark in 2012. A Feasibility Study evaluating various alternatives for protecting the lighthouse was completed in 2006. The selected alternative consisted of the construction of an 840-foot long stone revetment to protect the Montauk Point lighthouse. The project was authorized by Congress in 2007. In the Disaster Relief Appropriations Act of 2013, funds were provided to complete the authorized but unconstructed project. The USACE is currently reviewing the project to validate the Feasibility Study conclusions and make recommendations for potential design refinements to improve the strength and constructability of the proposed design, and verify the cost estimate. The results of that review will be documented in a Limited Reevaluation Report.

2.1 REPORT SCOPE

The scope of the cost and risk analysis report is to calculate and present the cost and schedule contingencies developed using the Abbreviated Risk Analysis (ARA) 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 all project features. The study and presentation does not include consideration for life cycle costs.

The following will present the development of the Construction Costs per the schedule developed to support the project cost development. From this, the ARA was developed using the PDT in a formal setting to complete the risk review from which the contingency percentage was developed. The costs and contingencies were then input to the TPCS to present the Total Project Cost or the Fully Funded Cost.

3.0 PROJECT COST ANALYSIS

3.1 Project Scope

The revetment will be reconstructed by removing unsound and undersized armor stone (six ton) and replaced with a new section of 15 ton armor stone. A new toe will also be installed to support the revetment, consisting of 15 ton armor stone, and will require excavation along the section and waterway. Additional slope protection consists of one ton and six ton stone on higher elevation sections with tie-ins to existing. The upper slope will also receive a mattress layer (geo-textile and sand layer) placed below the new stone armor. Significant site and preparation work is expected in order to enhance the site for construction, consisting of haul and access roads, staging areas, and ramps with drive surfaces onto the revetment.

3.2 Methodology

The PDT discussed, over several meetings, the constructability of this project as dictated by the design; the design was checked against constructability in regards to section height, slope, and stone size. The cost engineer used the PDT discussions, the design, and quantities developed from the design to formulate the cost estimate. Quantities were calculated by NAEs Civil Design Section, using computer-aided take-off software from the actual design drawings. The PDT discussions as well as the design were used to create the work breakdown structure in the cost estimate, consisting of: Mobilization, Site Preparation, Excavation, Revetment Fill, and Armor Stone Placement. These major work items where further broken into subcategories, at to what work was needed to be accomplished in order to complete the task. The estimate was prepared with crews of labor and equipment based on historical knowledge and past experience of coastal stone work in the greater New England area. This includes several similar projects contracted by NAE in the past two years. Crew make-up and productivity in the estimate was based on the construction practices of these past projects. One of the larger cost drivers of the project is recognized as the 15 ton armor stone. NAE consulted with a stone quarry in Branford, CT, on availability and cost of stone delivered to the Montauk project. These details are noted in the estimate.

3.3 Assumptions

The following data sources and assumptions were used in quantifying the costs associated with the Montauk Point HSLRR Project.

- Stone Source: Estimate assumes stone import from Branford CT, transported by truck and stockpiled on the site.
- Construction methodology: Estimate assumes that loader equipment will be used to move stone from site stockpiles to the revetment sections, where a crane and

excavator will be used to place the stones via land based platform installation. Armor stone set primarily with 100,000 lb + excavator class, with some assistance by crane for far distance section setting.

- Estimate assumes no dewatering will be needed for excavation and stone placement at the toe of the structure.
- Estimate assumes competitive IFB, and does not account for cost of SBA acquisition.
- Estimate assumes a Prime Contractor will manage the work, employing a Heavy Civil Subcontractor to perform excavation and stone installation.
- Estimate assumes that the Prime Contractor will not be local to site, and will require Per Diem for management personnel. Assume that earth work subcontractor will be local to site, that employees will travel to site daily, but that the work schedule will be 4 days at 10 hours. Overtime has been applied to the estimate to account for this. Site is remote, and experienced and capable contractor availability to the site is expected to be minimal.
- Stone setting productivity of the 15 ton armor stone is assumed at 18 stones placed per day.
- Global Production: 85%. Global production set to account for marine work, weather delays, and lost work days associated with heavy civil construction on the US Northeast coastline. Construction will take place through all weather seasons, due to length of schedule.

3.4 Quantity Development

Quantities for the cost estimate were developed independently by the Civil Engineering Section using InRoads®. The cost engineer reviewed and coordinated updates to various cost items to use all potential measurable quantities in the development of the cost estimate. Table 2 (below) is a summary of the quantities developed.

Table 2. Quantity Developed

MONTAUK REVETMENT

PRELIMINARY QUANITITES

Assumptions	
Stone Density (lb/ft3)	165
Porosity (%)	30%
Void ratio (%)	20%

HSLRR DESIGN - TOB EL 21, BENCH EL 10, RUN-UP EL 25, 1:2 SLOPE

1. EXCAVATION	Cubic Yards	CY w/ void and porosity ratio
a. EXISTING STONE REVETMENT	6693	**8000**
b. SAND ALONG TOE (3' DEEP)	4200	

2. REVETMENT FILL	Cubic Yards	Tons w/ void and porosity ratio
a. 1 TON FILL (INCLUDES RUN-UP PROTECTION AND FILL BEHIND NEW REVETMENT)	2,419	**4,500**
b. 15 TON STONE	26,037	**49,000**
	Tons	
c. TIE-IN (6 TON STONE ON BOTH SIDES OF REVETMENT, 16 STONES EACH SIDE)	**200**	
	Square FT	
d. FILTER FABRIC	**12,250**	
	Cubic Yards	
e. GRAVEL (12" LAYER ON TOP OF FILTER FABRIC)	**450**	
	Tons	
f. EXISTING UNSUITABLE STONE PLACED AT TOE (ESTIMATION)	**600**	

3. GRADING	
	Square FT
a. STAGING AREA (BOTH STAGING AREAS)	38735

4. ACCESS ROAD IMPROVMENT	
	Cubic Yards
a. SOUTHERN BEACH ACCESS ROAD (12' WIDE, 12" GRAVEL BASE)	200
b. BENCH ACCESS ROAD (12' WIDE, 12" GRAVEL BASE)	390
c. NORTHERN BEACH ACCESS ROAD (12' WIDE, 12" GRAVEL BASE)	110
d. IMPROVE EXISTING NORTHERN ACCESS ROAD (8" GRAVEL BASE)	185
TOTAL	**900**
	Tons
e. CONSTRUCTION RAMP (BOTH SIDES OF REVETMENT, 6 TON STONE, 12' WIDE, 16' LONG, 8' DEEP)	300

3.5 Construction Schedule

Construction schedule has been created based on this estimate and the quantities of work, recognizing overlap and congruent work items, and is as follows (From NTP): (1) 2 months of submittals, work plans, stone harvesting and delivery, setting up site. (2) 1 month of additional site preparation, access roads, and mobilization of crew and equipment. (3) 3 months of berm and excavation. (4) 9 months of armor stone installation. (5) 2 months of filter fabric and 1 ton stone installation. (6) 1 month of 6 ton stone installation, site repair, clean-up, and demobilization. Total project site time assumed from above is 18 months. It is recognized that several work items noted will take longer than carried, but it is assumed that the time frame of this work will overlap the next phase of work, since more than one crew will be working. The construction schedule is tabulated on a critical path calculation, not a start and stop of each project task.

Table 3. Construction Schedule. Cost Appendix to be updated following public review of draft.

3.6 Cost Estimate

Figure 1. Folder Level View of the MII Construction Cost Estimate.

Print Date Sun 25 January 2015
Eff. Date 10/1/2014

U.S. Army Corps of Engineers
Project FSEstimate: Montauk Point, NY Revetment - NAE FS Design
COE Standard Report Selections

Time 17:30:51

Project Cost Summary Report Page 1

Description	ProjectCost
Project Cost Summary Report	**12,211,626**
	12,211,625.84
10 BREAKWATERS AND SEAWALLS	**12,211,626**
	12,211,625.84
Revetment Construction	**12,211,626**
0001 Mobilization and Demobilization	**195,229**
	440,861.03
0002 Site Preparation	**440,861**
	946,929.67
0003 Excavation	**946,930**
	602,877.99
0004 Revetment Fill	**602,878**
	10,025,728.18
0005 Armor Stone	**10,025,728**

Labor ID: NLS2012 EQ ID: EP14R01

Currency in US dollars

TRACES MII Version 4.2

4.0 RISK ANALYSIS

4.1 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 PCX. The risk analysis process reflected within this report uses probabilistic cost risk analysis methods within the framework of the excel Abbreviated Risk Analysis (ARA) program developed by the Cost CX in Walla Walla per regulation. 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 risk analysis is considered as an ongoing process and will be 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 PCX.

- 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.

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the base case cost estimate, schedule, and funding profiles using the excel ARA to conduct an abbreviated, though effective 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 New England District. Consequently, these documents serve as the basis for the risk analysis.

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

4.2 Methodology / Process

The Abbreviated Risk Analysis or ARA was developed relying on local District staff to provide expertise and information gathering. The Chief of Cost Engineering facilitated risk identification meetings on site with the PDT. The initial risk identification meeting also included qualitative analysis to produce a risk register that served as the framework for the risk analysis. Revisions to the cost estimate and schedule occurred and was provided on 24 October 2013. The Risk analysis was developed after receipt of the draft cost estimate and transmitted January 20, 2013 for ITR review by the New York District(NAN) since New England District(NAE) is acting as a service supplier to perform the project development and cost files. Upon receipt of comments from NAN, the complete cost files to include the MII cost estimate MII, the ARA, and estimate were updated and submitted for final ITR closeout on 10 March 2014.

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.

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 primary steps, in functional terms, of the risk analysis process are described in the following subsections.

4.3 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 Excel based ARA spreadsheet. 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.

Formal PDT meetings were held for the purposes of identifying and assessing risk factors. The formal initial meeting conducted on October 24, 2013 included the following PDT members:

Figure 2. Project Delivery Team

Name	Organization	Title
Barbara Blumeris	USACE - NAE	Project Manager/Planner
Scott Greene	USACE – NAE	Technical Lead
George Claflin	USACE – NAE	Geotech
Patricia Bolton	USACE – NAE	Chief, Cost Engineering
John Winkleman	USACE - NAE	Hydrology
Mathew Tessier	USACE – NAE	Civil Engineering
Andrew Jordan	USACE – NAE	Cost Engineering
Paul Young	USACE - NAE	Geology
Bill Gray	USACE - NAE	Engineering, General

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

Additionally, numerous conference calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.4 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. 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.

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.

4.5 Quantify Risk Factor Impacts

The quantitative impacts 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 developed in the ARA program.

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. The levels of breakdown for the features of work were determined by the PDT to develop the cost estimate. Development of the Risk Register was done with review of the determined features of work per each of the risk elements. This process used an iterative approach to estimate the following risk impacts of each risk element:

- Concerns, multiple if necessary, per each risk element.
- Logic and Justifications for each risk element to determine the likelihood and impact.
- Likelihood from unlikely, possible, likely, and very likely
- Impact from negligible, marginal, significant, critical, and crisis.

The resulting product from the PDT discussions is captured within the risk register as presented in Appendix A. 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.

4.6 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Abbreviated Risk Analysis program, developed using Microsoft Excel format of the cost estimate. 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. 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 the ARA. Risk Curves are provided by the Cost DX in Walla Walla which determine the risk for the maximum potential cost growth for each risk element the features of work the PDT has identified in each of the features of work.

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.

4.7 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 the probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Figure 3. Risk Matrix

Risk Level

	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Figure 3 is the matrix used to develop the associated risk levels determined according to the selected likelihood and impact level determined in the risk register by the PDT and recorded in the risk register.

The result of the Abbreviated Risk Analysis is a consolidated spreadsheet provided in Table 3 below which highlights the resultant risks from the risk analysis applied to each individual feature of work. Each of these features of work are then imported to the Total Project Cost Summary (TPCS) with the associated risks, or contingencies applied which is the same cost presented in the first column of the TPCS as the project Estimated Cost.

Table 4. Project Construction Cost Contingency Summary (x100)

Abbreviated Risk Analysis

Project Name & Location:	**Montauk Point, Long Island New York**	**District:**	**NAE**
Project Development Stage/Alternative:	**Feasibility (Recommended Plan)**	**Alternative:**	**Alt C**
Risk Category:	**Moderate Risk: Typical Project Construction Type**	**Meeting Date:**	**10/24/2013**

Total Estimated Construction Contract Cost = $ 12,211,626

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ 174,350		10.00%	$ 17,435	$ 191,785
1	10 BREAKWATERS AND SEAWALLS	Site Preperation	$ 440,861		20.68%	$ 91,151	$ 532,012
2	10 BREAKWATERS AND SEAWALLS	Mob & Demob	$ 195,229		40.95%	$ 79,942	$ 275,171
3	10 BREAKWATERS AND SEAWALLS	Excavation	$ 946,930		44.75%	$ 423,722	$ 1,370,652
4	10 BREAKWATERS AND SEAWALLS	Revetment Fill	$ 602,878		44.35%	$ 267,394	$ 870,272
5	10 BREAKWATERS AND SEAWALLS	Armor Stone	$ 10,025,728		24.64%	$ 2,470,327	$ 12,496,056
6					0.00%	$ -	$ -
7					0.00%	$ -	$ -
8					0.00%	$ -	$ -
9					0.00%	$ -	$ -
10					0.00%	$ -	$ -
11					0.00%	$ -	$ -
12	All Other (less than 10% of construction costs)	Remaining Construction Items	$ -	0.0%	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 946,401		7.27%	$ 68,784	$ 1,015,185
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 1,282,221		10.14%	$ 130,062	$ 1,412,283
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ 174,350	10.00%	$ 17,435	$ 191,785.00
Total Construction Estimate	$ 12,211,626	27.29%	$ 3,332,537	$ 15,544,163
Total Planning, Engineering & Design	$ 946,401	7.27%	$ 68,784	$ 1,015,185
Total Construction Management	$ 1,282,221	10.14%	$ 130,062	$ 1,412,283
Total	**$ 14,614,598**	**24.28%**	**$ 3,548,819**	**$ 18,163,416**

	Base	50%	80%
Range Estimate ($000's)	$14,615k	$16,744k	$18,163k

4.8 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 Abbreviated Risk Analysis (ARA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of key recommendations for continued management of the risks identified and analyzed in this study. The complete list of risks identified by the PDT may be found in Appendix A for continued monitoring and mitigation of all identified risks. Please note that this list is not all inclusive and should not substitute a formal risk management and response plan.

1. Key Cost Risk Drivers: The key risk drivers identified through sensitivity analysis were Risk CE-2 (Site Prep-Mobilization), CE-3(Excavation - weather & re-handling), and EX-5(Armor Stone – Adverse Weather Impact), which together with all of the other factors have already been computed in the percent of the statistical schedule variance as a part of the ARA risk analysis computations.

a) Site Preparation - Mobilization. This risk identified is significant and may be mitigated during further development of the project. The PDT discussed this at length as this may be dependent on the method of construction as determined by the contractor due to the variance in equipment ownership and means/methods re: access to the site via land or sea. Within this risk exists other either contentious or mitigating factors, therefore the risk was increased to assure proper capture of the contingency which may be mitigated through design, contract, and construction. Certain factors have already been cost mitigated through the inclusion in the cost development of significant site improvement to handle truck movement and demob/reconstruction of the site. It was decided by the PDT that this risk must be included at this level to assure this risk is mitigated through contingency risk % on the project cost and added cost escalation to the midpoint of construction.

b) Excavation – Schedule & Re-Handling. This moderate risk impacts only the Excavation feature of work, however results in a the second largest % contingency on 8% of the project cost resulting in a significant overall const contingency. The risk developed herein is purposely conservative since the PDT reasoned that it is possible that there may be further potential for design development impacting the contractor's ability to handle the armor stone in an efficient manner. This feature of work requires some additional design development, however it is also acknowledged that the current design and cost associated is constructible. It was the decision of the PDT risk team to consider the real potential for the inherent risks of the current design respective of actual construction means on the site. This risk is largely dependent on the full plans and specs development and will be largely mitigated through the design process prior to solicitation. Additionally, the PDT feels confident the design risk mitigation and the competitive solicitation will mitigate the cost risk to include the potential of added costs through change orders. The PDT recommends decisive risk mitigation during design and has mitigated this risk through the application of contingency to the project cost.

c) Armor Stone – Adverse Weather Impact. This risk directly impacts the contractor ability to maintain production while working on the revetment excavation and development. This feature of work included both the supply and placement armor stone, therefore the impact of the placement risk is intentionally amplified to assure the complete potential fo cost risk is addressed in this contingency. The PDT discussed a number of possible impacts by weather to the placement of the armor stone to include the perceived and documented increased potential of a significant weather event. This is largely due to the increased recent storm activity as noted by the last 10 years of significant impact storms to the Northeast. The PDT was very aware of this impact and decided the best assumption to mitigate cost risk is to assume the delivery of the armor stone via truck, thus increasing the costs and reducing risks. This however is not a complete mitigation since recent storms have proven a significant impact to the local infrastructure. This risk is weighted to the right indicating that this is addressed as a more significant factor and increasing the risk percentage for these areas. This risk has been mitigated through increased contingency percentage.

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

3. Risk Management: Project leadership should use of 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.

4. 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 measure, 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).

5.0 RESULTS – TOTAL PROJECT COST SUMMARY (TPCS)

The Total Project Cost Summary (TPCS) is the final and complete funding document for the project, presenting the construction cost, project first cost, and the Total Project Cost or the Fully Funded Cost. The TPCS is the final cost document with the construction cost estimate applied contingency and escalated to the midpoints of the features of work and the remaining work breakdown structure to include Lands and Damages (if any), Planning, Engineering & Design, and Construction Management.

The final TPCS is shown in Table 4. The first column is the construction cost or Estimated Cost (Price Level). The price level is the initially developed cost estimate that includes contingencies at the date of the preparation of the estimate. The middle column of the TPCS is the Constant dollar cost and is the estimated cost brought to the Effective Price level (EPL). The EPL for constant dollar cost is the date of the common point in time of the pricing used in the cost estimate. Constant dollar cost at current price levels is the cost estimate used for reference only. For this definition, the current price level is the Program Year estimate, which is most current for the budget request. The last column is the Total Project Cost (TPC). TPC is the constant dollar cost fully funded with inflation to represent the total cost of the project. The inflation is included to the estimated midpoint of activity.

The resultant TPCS from the cost estimate, risk analysis, and escalation is provided below is a summary of the cost products provided for this project.

Table 5. Total Project Cost Summary

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

Printed:1/25/2015
Page 1 of 3

PROJECT: Montauk Point, NY HSLRR
PROJECT N P2 403361
LOCATION: Long Island, NY

DISTRICT: NAN - New York District PREPARED: 1/26/2015
POC: CHIEF, COST ENGINEERING, xxx

This Estimate reflects the scope and schedule in report; Project X Major Rehabilitation Report June 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 A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 10/1/20145 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
03	RESERVOIRS	$12,212	$3,333	27.3%	$15,544	0.0%	$12,212	$3,333	$15,544	$0	$15,544	4.4%	$12,748	$3,479	$16,227
04	DAMS	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
05	LOCKS	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
06	FISH & WILDLIFE FACILITIES	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
07	POWER PLANT	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
08	ROADS, RAILROADS & BRIDGES	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
09	CHANNELS & CANALS	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
10	BREAKWATER & SEAWALLS	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$12,212	$3,333		$15,544	0.0%	$12,212	$3,333	$15,544	$0	$15,544	4.4%	$12,748	$3,479	$16,227
01	LANDS AND DAMAGES	$174	$17	10.0%	$192	0.0%	$174	$17	$192	$0	$192	4.4%	$182	$18	$200
30	PLANNING, ENGINEERING & DESIGN	$947	$69	7.3%	$1,016	0.0%	$947	$69	$1,016	$0	$1,016	4.2%	$987	$72	$1,059
31	CONSTRUCTION MANAGEMENT	$1,282	$130	10.1%	$1,412	0.0%	$1,282	$130	$1,412	$0	$1,412	8.5%	$1,391	$141	$1,532
	PROJECT COST TOTALS:	$14,615	$3,549	24.3%	$18,164		$14,615	$3,549	$18,164	$0	$18,164	4.7%	$15,307	$3,710	$19,017

CHIEF, COST ENGINEERING, xxx

PROJECT MANAGER, xxx

CHIEF, REAL ESTATE, xxx

ESTIMATED FEDERAL COST: 65% $12,361
ESTIMATED NON-FEDERAL COST: 35% $6,656
ESTIMATED TOTAL PROJECT COST: $19,017

COST- APPENDIX A

Montauk Point, Long Island New York Alt C

Feasibility (Recommended Plan)

Abbreviated Risk Analysis

Meeting Date: 24-Oct-13

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Scope Growth				**Maximum Project Growth**		**60%**
PS-1	Site Preperation	• Possibility of water control to be added to scope • Project Length estimated based on known work items.	Site preperation developed far in advance of feasibility through a detialed site visit and development of alternatives and options for the site development. Used prior projects to develop duration.	Significant	Possible	3
PS-2	Mob & Demob	• Investigations sufficient to support design assumptions?	PDT is aware of challenge to site. This was discussed during and post the site visit. Alternatives were discussed and an alternative was selected (though very possible) which mitigates the risk to cost and schedule increase. Mob & demob costs included in the cost estimate include a detailed number of pieces of equipment to construct per the items and	Negligible	Unlikely	0
PS-3	Excavation	• Possibility of slope collapse prior to/during construction (ie. Storm damage or caused by construction work)	Exacavation development completed by the civil engineer which is encompassing of the full area possible for disturbance under current guidance. Should additional area be required for excavation, this would be the basis of change to the scope and would be significant as indicated to the impact. Also, If slough occurs, then additional excavation and material may	Significant	Unlikely	2
PS-4	Revetment Fill	• Possibility of slope collapse prior to/during construction (ie. Storm damage or caused by construction work) • Additional stone may be required if not as many of the relocated stones are the correct size.	Scope growth on the fill already includes a 20% contingency recieved by Civil engineering per their appendix. The team does not see a way for the amount of revetment fill to go beyond the current scope due to phyicals site constraints. If slough occurs, then additional material may be needed to rebuild. Also, increased cost due to having to import additional	Significant	Possible	3
PS-5	Armor Stone	• Potential for scope growth, added features and quantities?	Scope is well defined by the areas and mission. There are limitations to the current design to exceed the footprint - considerations have been made but limited by environmetal considerations and may not go into the intertidal area. The PDT assumed a very conservative amount of Armor Stone in addition to the choice of size of armor stone.	Negligible	Unlikely	0
PS-12	Remaining Construction Items	These items were less significant, chose not to evaluate.	The PDT addressed other potential scope growth items during the development of the alternatives analysis. Any additional adds to scope would be negligible since the scope is well defined and would consititue a revision and resubmission. In addition, the proposed HSRR revetment design does not require dewatering. 18 month project duration used in	Negligible	Unlikely	0
PS-13	Planning, Engineering, & Design	• Updated survey may cause update to design.	Currently relying on existing survey data. Survey is not significantly old. Recent updates to survey data have proven little differences to include +/- impacts.	Marginal	Possible	1
PS-14	Construction Management	• Project duration could be longer than anticiapted	Currently duration estimate is 18 months . The PDT evaluated the construciton time and feels this is adequate to accommodate for local conditions and community impacts such as delays, etc.	Marginal	Likely	2
Acquisition Strategy				**Maximum Project Growth**		**40%**
AS-1	Site Preperation	• Contracting plan firmly established? • Limited bid competition anticipated?	NAE has done a significant amount of revetment construction over the past 3 years and has confidence on the bid climate which has increased in competitiveness - significantly.	Negligible	Unlikely	0
AS-2	Mob & Demob	• Remoteness of site may drive mob/demob costs and should be noted within solicitation. Contractor needs to have capability to economically mobilize to site.	Already accounted for in mob/demob estimate through the additional equipment mobilizations by the Prime.	Marginal	Possible	1
AS-3	Excavation	• Contractor needs to have large marine stone work experience and capability (company size and ability to complete project within reasonable time) to avoid large mods due to poor bid/estimate on contractors part. Contractor planning and methodology is important.	Should be competitive bid or best value bid to avoid an unqualified low bidder winning. The risk here would NOT be increased construction contract cost, but rather a low bidder creating a T4D environment or unable to accomplish the work requiring a new bidding, hence additional costs - therefore significatn to the excavation where the mainstay of the work effort exists.	Significant	Possible	3

AS-4	Revetment Fill	• Contractor needs to have large marine stone work experience and capability (company size and ability to complete project within reasonable time) to avoid large mods due to poor bid/estimate on contractors part. Contractor planning and methodology is important.	Should be best value bid to avoid an unqualified low bidder winning. Discussion by the PDT same as above … rating similiarly. Same contractor to perform and same acquisition concerns addressed will require additional contingency for small business which is not the current market.	Significant	Possible	3
AS-5	Armor Stone	• Limited Bid Competition • Contractor needs to have large marine stone work experience and capability (company size and ability to complete project within reasonable time) to avoid large mods due to poor bid/estimate on contractors part. Contractor planning and methodology is important.	Armor Stone procurement will not be as highly affected by the acquisition strategy whether restricted or full competitive since the price inlucluded in the cost estimate is a quoted 2015 price (SAME again) delivered. This is the cost to deliever to the site as it is already a subcontracted supplier.Should be unrestricted/open bid or best-value bid to avoid an unqualified low bidder winning. Expected limited bidders due to site and typr of project.	Significant	Unlikely	2
AS-12	Remaining Construction Items	These items were extremely less significant.	No concerns related to acquisition.	Negligible	Unlikely	0
AS-13	Planning, Engineering, & Design	None	Developed with input from E/P.	Negligible	Unlikely	0
AS-14	Construction Management	None	Construction management cost addressed type of contractor possible in the development of costs. NAE is VERY experienced with 8a/small business with the highest rate in NAD and used this percent in the dev't of the cost estimate. The PDT has included all considerations and do not feel the acquisiiton strategy will not impact the construciton management of the project.	Negligible	Unlikely	0
Construction Elements				Maximum Project Growth		30%
CON-1	Site Preperation	• Temporary Roadways - maintenance (end access and berm driving surface - wear and weather/tide damage)	The PDT was confident that the design is well developed, however the design may be impacted once in design to accommodate local access for tourism and safety. Low amount of impact since amount of change limited by site size.	Negligible	Likely	1
CON-2	Mob & Demob	• Special mobilization? PDT Discussed relative mob/Demob costs due to potential sea mob - not possible as there is no access.	Most of the site access requires little improvement. Demob may require some road improvement due to traffic damage to roadway. This impact is addressed with a likely and critical assessment to address the risk of roadway reconstruction.	Critical	Likely	5
CON-3	Excavation	• Having to rehandle more stone than estimated. • Standby time due to weather/storm surge delays and site contraints.	Weather days built into the cost estimate, however must follow through in construction. Construction coordination remains important. Elements of excavation may occur and deemed signifiacnt impact to the cost therefore significant rating.	Significant	Likely	4
CON-4	Revetment Fill	• Standby time due to weather/storm surge delays and site contraints.	Construction coordination important with weather built into schedule. Construction elements built into revetnement has been well developed - likely to have some changes though minimal due to very small impact.	Negligible	Likely	1
CON-5	Armor Stone	• Standby time due to weather/storm surge delays and site contraints. • Design incomplete, stone size may increase. • High risk due to site access.	Increased stone size total tonage still remain similar to estimate and less handling would be required resulting in some savings. Potential increase in stone size to larger than 15 ton is not to the degree that larger equipment than estimated will be needed.	Marginal	Possible	1
CON-12	Remaining Construction Items	These items were less significant.	No PDT concern.	Negligible	Unlikely	0
CON-13	Planning, Engineering, & Design	None.	Developed based on input from E/P. PDT built this into their costs. The absolute dollar value of the project in addiiont to this as a Civil Project would have little impact if additional items added.	Negligible	Possible	0
CON-14	Construction Management	None.	NAE has accomplished a number of marine construction projects during the last 3 years of significant value. Revetments have little potential to create added risk for construciton management.	Negligible	Unlikely	0
Quantities for Current Scope				Maximum Project Growth		20%
Q-1	Site Preperation	None.	General Conditions were estimated according to recent experience. The complete PDT including the cost engineer did the site visit to fully understand the complexities. Quantity increase limited due to limited space availability - assumed large area.	Negligible	Unlikely	0
Q-2	Mob & Demob	Quantity		Marginal	Possible	1
Q-3	Excavation	May be more or less stone to relocate.	Stone excavation qualtities are estimated based on 2012 LIDAR survey and 2005 Topographic survey. Site specific survey may result in minor adjustments in quantities.	Marginal	Possible	1

Q-4	Revetment Fill	None.	Digital contour model developed based on 2012 LIDAR survey and 2005 topographic survey. Site specific survey may result in minor changes in quantities.	Significant	Possible	3
Q-5	Armor Stone	None.	Design quantities should be very close as we are able to estimate with great detail and accounted for 20% waste of stone due to on site rejection, impact is largely placement - not procurement thus marginalizing impact to to mitigation as noted above.1. Original quantity estimated at stone is at 6,693 CY. 7. The total tons of stone required are calculated from	Marginal	Unlikely	0
Q-12	Remaining Construction Items	These items were less significant in risk; chose not to evaluate.		Negligible	Unlikely	0
Q-13	Planning, Engineering, & Design	None.	E/P discussion did not believe quantities significantly impacted risk.	Negligible	Unlikely	0
Q-14	Construction Management	None.	Construction Management discussed with change in quantities. Mgmt deemed to have impact more related to designs that are challenging to measure. Estimate assumed full time Corps Supervision.	Negligible	Unlikely	0
Specialty Fabrication or Equipment					**Maximum Project Growth**	**75%**
FE-1	Site Preperation	None.	Tyical plans for this project - little and unlikely risk dtermined by PDT.	Negligible	Unlikely	0
FE-2	Mob & Demob	None.	Large but normal equipment assumed by the estimator - confirmed by construction.	Negligible	Unlikely	0
FE-3	Excavation	None.	Large but normal equipment.	Negligible	Unlikely	0
FE-4	Revetment Fill	None.	Large but normal equipment.	Negligible	Unlikely	0
FE-5	Armor Stone	None.	Large but normal equipment.	Negligible	Unlikely	0
FE-12	Remaining Construction Items	None. • Unusual parts, material or equipment manufactured or installed.	none	Negligible	Unlikely	0
FE-13	Planning, Engineering, & Design	None.	No impact	Negligible	Unlikely	0
FE-14	Construction Management	None.	No impact	Negligible	Unlikely	0
Cost Estimate Assumptions					**Maximum Project Growth**	**35%**
EST-1	Site Preperation	Some Concerns, typically addressed by mitigation with high assumptions.	Site Preperation plans well developed with limited room on the site for any additional changes or areas for preperation. Estimate assumed larger area for development but accepts additional area may be added or changes to cross sections.	Marginal	Possible	1
EST-2	Mob & Demob	None	Site preparation cost estimate developed by experienced estimator -former civil/site contractor, included additional effort for mobilization. Risk for additional mob/demob costs accepted but would not be significant due to limited area for more equipment.	Marginal	Possible	1
EST-3	Excavation	Some Concerns, typically addressed by mitigation with high assumptions.	In general, 2012 RS Means cost book was used material, equipment and labor cost and productivity rates except where noted otherwise. Estimator also relied recent NAE breakwater work for assumptions made. Where noted, quotes were used.	Significant	Possible	3
EST-4	Revetment Fill	Some Concerns, typically addressed by mitigation with high assumptions.	In general, 2012 RS Means cost book was used on equipment and labor cost while productivity rates and material costs provided with notes otherwise. Estimator also relied recent NAE breakwater work for assumptions made. Where noted, quotes were used such as on all quarry products.	Significant	Possible	3

EST-5	Armor Stone	Some Concerns, typically addressed by mitigation with high assumptions.	In general, 2012 RS Means cost book was used for equipment and labor cost and productivity rates were based on experience and confirmation with project engineers working similiar revetment projects in the New England District. Except noted otherwise. Estimator also relied recent NAE breakwater work for assumptions made. Where noted	Significant	Unlikely	2
EST-12	Remaining Construction Items	None		Negligible	Unlikely	0
EST-13	Planning, Engineering, & Design	Concern that scope creem may impact cost estimate.	PED developed by the E/P team with the teams' included added time to cover design.	Negligible	Unlikely	0
EST-14	Construction Management	None	Construciton management provided the estimator with the costs, described as plenty of supervision assumed to cover if the project went over by one month.	Negligible	Unlikely	0
External Project Risks					**Maximum Project Growth**	**40%**
EX-1	Site Preperation	Delay in receiving project funds.	Federal funding for construction is available through existing Sandy appropriations. However, construction is funded 50% Federal /50% non-Federal. There is a very small but unlikely possibiliity that non-Federal Funds may be delayed due to opposition of surfing community to the new revetment construction.	Marginal	Unlikely	0
EX-2	Mob & Demob	Yes, • Fuel is currently is at a relatively high cost.	Assumed high cost of fuel (diesel) $3.81/gal. (mitigated risk). Costs have since declined rapidly and not expecte to go over $100/barrell in this decade according to financial reports.	Marginal	Unlikely	0
EX-3	Excavation	None.	Weather standby time accounted for in Construction Elements and schedule with a month float.	Negligible	Unlikely	0
EX-4	Revetment Fill	None.	Weather standby time accounted for in Construction Elements and schedule with a month float. Fill to be more impacted by weather, however impacts such as local surfers, etc may have some impact but mitigated by federal authority.	Negligible	Likely	1
EX-5	Armor Stone	• Lead time to stockpile enough armor stone to ensure continuous work on revetment is large.	Weather standby time accounted for in Construction Elements - mitigated in estimate. Note in contract that Contractor shall ensure enough stone is stockpiled so continuous work can occur once project begins. PDT comfortable with extra cost risk.	Moderate	Likely	3
EX-12	Remaining Construction Items	These items were less significant in risk, chose not to evaluate	None	Negligible	Unlikely	0
EX-13	Planning, Engineering, & Design	Yes, Political influences may cause modification to design.	Added time spent on design to consider all aspects of project. Public review process prior to PED will mitigate this risk.	Negligible	Unlikely	0
EX-14	Construction Management	Yes, • Potential severe weather/tides could delay project.	Weather standby time to incoporated in construction planning.	Negligible	Possible	0