US Army Corps of Engineers®
Honolulu District

Appendix A-3

East Hagatna Emergency Shoreline Protection Project

Draft Integrated Feasibility Report and Environmental Assessment

August 2025

1. Project Description

The study purpose is to identify a plan that will provide emergency shoreline protection from coastal erosion to Marine Corps Drive and public utilities in the area.

1.1 Alternatives:

Three major Alternatives were considered for this study (not including NO ACTION). Alternatives were priced to a Class 4 estimate level for comparative purposes. Estimates for this phase may be developed by applying parametric processes of various cost sources, using quotes, calculations, unit prices, cost books, or historical data as backup. Use of MCACES software was utilized and the costs of the Planning, Engineering, and Design feature (30 account) and the Construction Management feature (31 account) are included as a percentage of the construction costs. The costs for the Lands and Damages were obtained through the PDT from the real estate office. Alternatives are developed to the same constant dollar basis for fair comparison. Project specific risk-based contingencies are identified for each alternative under comparison.

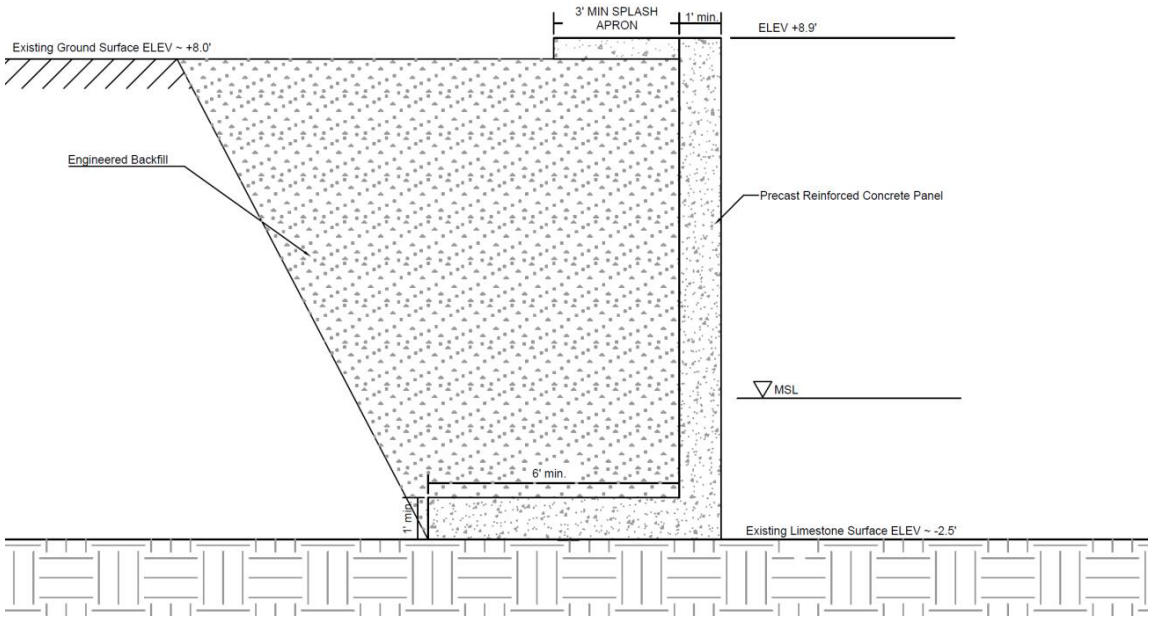
1.1.1 Alternative 1: No-Action

1.1.2 Alternative 2: Revetment Tribar

1.1.3 Alternative 3: Precast Concrete Seawall

1.1.4 Alternative 4: Concrete Rubble Masonry (CRM) Wall

1.2 Tentatively Selected Plan



Alternative 3: Precast Concrete Seawall

Components:

- Precast Concrete
- Engineered Backfill
- Formed Concrete Splash Apron

2. Cost Summary

The following table includes cost summary of the various alternatives. The TSP alternative is shown in YELLOW below as alternative 3: Precast Concrete Seawall.

		East Hagatna Alternative Estimates					5/8/2025
		Includes 30 and 31 Account for PED and S&A.					
Alt.		**Measure**	**Quantity**	**U/M**	**Total Direct Cost**	**Contingency**	**Total Project Cost**
Alt. 1	**No Action**				**N/A**	**N/A**	**N/A**
						41%	
Alt. 2	**Revetment Tribar**				**$15,310,942**	**$ 6,227,801**	**$ 21,538,742**
	01	Lands and Damages	1	LS	**177,350**	**23,028**	**$ 200,378**
	06	Environmental Mitigation	0.63	AC	**0**	**0**	**$ -**
	18	Cultural Mitigation	1	LS	**216,306**	**88,686**	**$ 304,992**
		Construction					
		Existing Wall Demo	711	CY	918,431	376,557	$ 1,294,988
		Backfill Wall	237	CY	9,259	3,796	$ 13,055
		Geotextile	4444	SY	27,742	11,374	$ 39,116
		Tribar Revetment	1600	LF	8,824,805	3,618,170	$ 12,442,975
		Associated Cost	1	EA	386,112	158,306	$ 544,417
		Reseeding	5280	SY	149,481	61,287	$ 210,769
		Backfill behind Revetment	233	CY	6,944	2,847	$ 9,791
		Concrete Stairs	1	EA	31,299	12,833	$ 44,131
		Cultural Resource Monitor	1	EA	301,131	**123,464**	$ 424,595
	16	**Construction Subtotal**			**10,655,204**	**4,368,634**	**15,023,838**
	30	**Engineering and Design (25%)**			**2,663,801**	**1,092,158**	**3,755,959**
	31	**Supervision and Admin (15%)**			**1,598,281**	**655,295**	**2,253,576**
						39%	
Alt. 3	**Precast Concrete Seawall**				**$11,687,973**	**$ 4,512,171**	**$ 16,200,145**
	01	Lands and Damages	1	LS	**177,350**	**23,028**	**$ 200,378**
	06	Environmental Mitigation	0.04	AC	**0**	**0**	**$ -**
	18	Cultural Mitigation	1	LS	**440,734**	**171,886**	**$ 612,620**
		Construction					
		Existing Wall Demo	711	CY	918,431	358,188	$ 1,276,620
		Construct Precast Wall	1,600	LF	5,514,566	2,150,681	$ 7,665,246
		Reseeding	3,555	SY	100,645	39,252	$ 139,897
		Associated Cost	1	EA	390,364	152,242	$ 542,606
		Tree Removal & Replacement	20	EA	285,865	111,488	$ 397,353
		Culverts	3	EA	17,299	6,747	$ 24,046
		Concrete Stairs	3	EA	77,631	30,276	$ 107,907
		Cultural Resource Monitor	1	EA	602,263	234,882	$ 837,145
	16	**Construction Subtotal**			**7,907,064**	**3,083,755**	**10,990,819**
	30	**Engineering and Design (25%)**			**1,976,766**	**770,939**	**2,747,705**
	31	**Supervision and Admin (15%)**			**1,186,060**	**462,563**	**1,648,623**
						50%	
Alt. 4	**Concrete Rubble Masonry Wall**				**$13,792,936**	**$ 6,830,821**	**$ 20,623,756**
	01	Lands and Damages	1	LS	**177,350**	**23,028**	**$ 200,378**
	06	Environmental Mitigation	0.07	AC	**0**	**0**	**$ -**
	18	Cultural Mitigation	1	LS	**440,734**	**220,367**	**$ 661,100**
		Construction					
		Existing Wall Demo	711	CY	918,431	459,216	$ 1,377,647
		Construct CRM Wall	1,600	LF	6,783,440	3,391,720	$ 10,175,160
		Reseeding	2,844	SY	80,516	40,258	$ 120,774
		Associated Cost	1	EA	390,364	195,182	$ 585,546
		Tree Removal & Replacement	20	EA	285,865	142,933	$ 428,798
		Culverts	3	EA	17,299	8,649	$ 25,948
		Concrete Stairs	1	EA	31,299	15,649	$ 46,948
		Cultural Resource Monitor	1	EA	903,394	451,697	$ 1,355,091
	16	**Construction Subtotal**			**9,410,609**	**4,705,304**	**14,115,913**
	30	**Engineering and Design (25%)**			**2,352,652**	**1,176,326**	**3,528,978**
	31	**Supervision and Admin (15%)**			**1,411,591**	**705,796**	**2,117,387**

3. Basis of Estimate

3.1 Basis of Design

The design details are described in the East Hagatna, Guam, CAP Section 14 Integrated Feasibility Report and Environmental Assessment. The alternatives provide the beach locations, site access, and work limits for each alternative. The plans show the proposed alternative level diagrams and quantities allow comparison of the alternatives.

Alternative 1: No Action
The No-Action Alternative is synonymous with no Federal (Corps) Action. This alternative is analyzed as the future without-project (FWOP) condition for comparison with the action alternatives.

Alternative 2: Revetment
This design involves the removal and replacement of 1,600 ft of existing seawall with revetment. Construction of the Tribar revetment would be conducted with the use of conventional land-based earth moving equipment. The existing wall would be removed, and the revetment would be constructed from the toe to the crest elevation. To provide stability to the toe of the structure, a 1-2 ft trench would be excavated into the limestone with an 8-inch concrete block placed flushed into the bottom of the trench which will prop up the terminal unit and then be sealed by a concrete fill. The tribar units have fixed dimensions and are placed directly on top of each other in sloped rows. Careful placement during construction will ensure that units properly interlock, units are not damaged during placement, and that design dimensions are met. To accommodate the thickness of the structure, the ground elevation will need to be excavated approximately 1-2 ft to accommodate the crest elevation of the structure (+8.9ft MSL). A splash apron composed of formed concrete over a gravel fill behind the crest of the structure will tie the structure to the existing ground. Excavated material can be used to backfill the beach in front of the structure, or on the ends fronting the tie backs. The final footprint would be approximately 28 ft. wide (18 ft sloped structure +6.5 ft crest + 3 ft splash apron). The total structure height is approximately 11.5 ft. from toe to crest (-3.5 ft to +8.5 ft MSL), with the crest of the revetment aligned (and replacing) the crest of the existing wall.

Alternative 3: Precast Concrete Seawall
This design would involve the use of individual cantilever concrete panels to replace 1,600 ft of existing seawall. Concrete wall panels would be constructed offsite. Installation of the precast concrete panel wall would consist of excavating the existing soils to the limestone shelf and placing the precast concrete panels. After construction, the excavated area would be regraded to the elevation of the existing ground surface. The exposed face of the wall is assumed to receive a 2” shotcrete surface as an architectural feature. This design has a top elevation of 8.9 ft above MSL and a base that is 7 ft wide, with the total disturbed area being approximately 20 ft due to excavation and backfill of the existing soils.

Alternative 4: Concrete Rubble Masonry (CRM) Wall
This design consists of a gravity retaining wall composed of concrete rubble masonry (CRM) supported on a reinforced cast-in-place concrete foundation. Construction of the CRM wall would consist of excavating the existing soils to the limestone shelf, placing the reinforced concrete foundation, and then installing the CRM wall on top of the concrete base. After construction, the excavated area would be regraded to the elevation of the existing ground surface.

3.2 Basis of Quantities

Quantities were developed using a typical profile provided by the technical team.

3.3 Construction Estimate

Work was predominantly estimated utilizing MII Estimating Software with specified input factors. The alternative analysis included unit costs of all project features and contrasted the options in order to scale relative differences. The next phase is having further design definition that is used to refine the project features.

Major Construction Features for the recommended plan were estimated as follows.

3.3.1 Mobilization & Demobilization

Equipment and Labor is assumed to be available within the Guam regional area and estimated at 10% of the direct construction costs.

3.3.2 Existing Wall Demolition

The existing wall is made up of block, concrete and rock rubble and will be demolished and the backfilled prior to construction. The demolition will be hauled offsite and disposed at a local waste facility.

3.3.3 Excavation

Initial excavation will be to reach the existing limestone surface at a depth of ~11' utilizing benching of the material at a 1:1 slope above 5 from the bottom of the excavation. The bottom 3'4" of the excavation will be under water and the plan is to provide local dewatering in order to place bedding rock in the bottom of the trench. Estimate includes an allowance for a trench box and dewatering and is also addressed in the abbreviated risk analysis under the Cost Estimate Assumptions Risk. There may be a few areas where benching is not possible and additional 250' of shoring is assumed.

3.3.4 Precast Cantilever Wall

The precast concrete wall sections are assumed to be fabricated in 5' sections weighing approximately 6.5 tons. Precast panels are delivered to the construction site and placed into the trench utilizing a 14 ton crane. The wall is then backfilled with a combination of existing sand a flowable fill concrete on the landside. Excess material is assumed to be clean sand and hauled to a suitable disposal site withing 4 miles of the construction site with no disposal fees.

3.3.5 Concrete Stairs

Three concrete stairs are assumed for access to the beach. Construction is assumed to be cast in place concrete building the footings, walls, landing, and risers. Stairs include a 2-line pipe stainless steel handrail.

3.3.6 Tree Removal and Replacement

The estimate assumes 20 trees would need to be removed and replanted for the Seawall alternative installation.

3.3.7 Cultural Resource Monitor

The estimate assumes a cultural resource monitor is onsite during active excavation elements.

3.3.8 Reseeding

Reseeding of the staging areas is assumed at the completion of construction.

3.3.9 General Conditions, Overhead, and Profit

The estimate assumes that the prime contractor will self-perform most of the work. Subcontractors have been added for the precast concrete fabrication and seeding work. Prime and Subcontractor markups are shown below.

Prime Contractor

Markup	Own Work	Sub Work
Mobilization [Running %]	10.00%	10.00%
JOOH [Running %]	25.00%	25.00%
HOOH [Running %]	15.00%	15.00%
Profit [Running %]	10.00%	10.00%
Bond [Running %]	1.00%	1.00%

Subcontractor

Markup	Own Work	Sub Work
Mobilization [Running %]	10.00%	10.00%
JOOH [Running %]	10.00%	10.00%
HOOH [Running %]	15.00%	15.00%
Profit [Running %]	10.00%	10.00%

3.3.10 Miscellaneous Markups, Assumptions, & General Notes

- Escalation (~9%) was taken into account for the alternative analysis.
- HTRW and UXO clearance were not included as part of the scope of work.
- Costs for the 30 & 31 accounts (PED and CM respectively) were assumed at 25% and 15% respectively of the contract total.
- Standard Adjustment (Updated May 2025) applied to MII the estimate cost book to adjust to current price level.

Standard Adjustments to use in M2	
Materials	**3.019%**
Equipment	***0.442%***
Sub Bid	**2.781%**
REPRICE COST BOOK TO PRESENT	

- A tariff adjustment factor of ~12% is applied to cost book material and material quotes to account for future tariff costs.
- There are no work windows or restriction. No overtime rate was applied in MII and assumes a single shift working a typical 40 hour work.
- MII Equipment rates per EP 1110-1-8, Volume 12, 2024.
- 2025 Davis Bacon Wage Rates for Guam were assumed in the estimate. Labor shortages have been reported in Guam and an additional $5/hr was added to the Davis Bacon Wage rates plus a $10/hr per diem rate and $2/hr travel costs.

4. Construction Schedule

The anticipated base year for construction is 2028. The current estimated duration for the project is 12 months of construction with a single construction contract. There are no construction work window limitations.

5. Acquisition Plan

The current acquisition strategy is assumed fully open and competitive though an actual contracting plan has yet to be established.

6. Risk Assessment

An abbreviated risk analysis (ARA) was performed to develop a weighted contingency for the construction cost estimate. The current weighted construction contingency for the TSP Alternative 3 is approximately 39%. The contingency accounts for contract acquisition, contractor competition, scope changes, labor availability and cost uncertainties. The concerns outlined in the ARA could have an overall impact on the project. Project costs have the potential to increase due to economic conditions and the level of apparent competition during the solicitation process. Due to the level of technical information available, current plan set provided by the PDT, and Moderate Risk level overall the estimate is considered Class 4 (per ER 1110-2-1302).

7. References

U.S. Army Corps of Engineers, 1993, *Engineering and Design Cost Engineering Policy and General Requirements, Engineering Regulation 1110-1-1300,* Department of the Army, Washington D.C., 26 March 1993.

U.S. Army Corps of Engineers, 1999, *Engineering and Design for Civil Works Projects, Engineering Regulation 1110-2-1150,* Department of the Army, Washington D.C., 31 August 1999.

U.S. Army Corps of Engineers, 2016, *Civil Works Cost Engineering, Engineering Regulation 1110-2-1302,* Department of the Army, Washington D.C., 30 June 2016.

U.S. Army Corps of Engineers, 2019, *Civil Works Construction Cost Index System (CWCCIS), Engineering Manual 1110-2-1304,* Department of the Army, Washington D.C., 31 March 2020.

Unified Facilities Criteria, 2011, *Handbook: Construction Cost Estimating,* Unified Facilities Criteria (UFC) 3-740-05, Department of Defense, 1 June 2011.

8. Attachments

a. Abbreviated Risk Analysis

Abbreviated Risk Analysis

Project (less than $40M): **East Hagatna Shore Protection** **Alternative: Alt 2,3,4**

Project Development Stage/Alternative: **Alternative Formulation**

Risk Category: **Moderate Risk: Typical Project Construction Type** **Meeting Date: 1/19/2024**

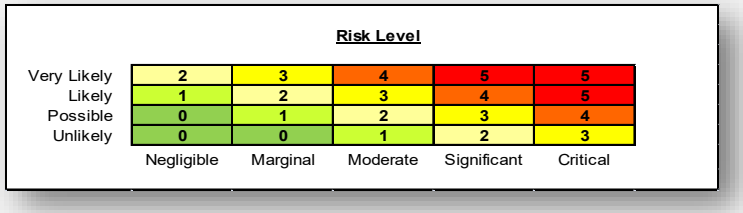
Total Estimated Construction Contract Cost = $ -

	CWWBS	Feature of Work	Estimated Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0%	$ -	$ -
1	10 BREAKWATERS AND SEAWALLS	Tribar Revetment	$ 10,700,000		41%	$ 4,386,097	$ 15,086,097
2	10 BREAKWATERS AND SEAWALLS	Precast Concrete Seawall	$ 7,900,000		39%	$ 3,097,402	$ 10,997,402
3	10 BREAKWATERS AND SEAWALLS	Concrete Rubble Masonry Wall	$ 9,411,000		50%	$ 4,685,232	$ 14,096,232
4			$ -		0%	$ -	$ -
5			$ -		0%	$ -	$ -
6			$ -		0%	$ -	$ -
7			$ -		0%	$ -	$ -
8			$ -		0%	$ -	$ -
9			$ -		0%	$ -	$ -
10			$ -		0%	$ -	$ -
11			$ -		0%	$ -	$ -
12	All Other	Remaining Construction Items	$ -	*0.0%*	0%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ -		0%	$ -	$ -
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ -		0%	$ -	$ -
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

East Hagatna Shore Protection Alt 2,3,4

Alternative Formulation
Abbreviated Risk Analysis
Meeting Date: 19-Jan-24



Risk Register

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth				**Maximum Project Growth**		**75%**
PS-1	Tribar Revetment	There has not been any detailed study of the wave climate and need for wave attenuation on the shoreline, which could change design/quantity.	USACE is very experienced with design and construction of revetments. Additional protection measures or modification to proposed measures may need to be modified due to wave climate but should be reflected in current assumptions. Quantity risk is considered low and is more likely to have greater impact. Risk of losing beach and habitat value and could rquire additional survey costs.	Marginal	Possible	1
PS-2	Precast Concrete Seawall	There has not been any detailed study of the wave climate and need for wave attenuation on the lakefront structures, which could change design/quantity.	USACE is very experienced with design and construction of concrete structures. Additional protection measures or modification to proposed measures may need to be modified due to wave climate but should be reflected in current assumptions. Quantity risk is considered low and is more likely to have greater impact. Tree scope of work is assumed and likely to change based on final wall layout.	Marginal	Possible	1
PS-3	Concrete Rubble Masonry Wall	There has not been any detailed study of the wave climate and need for wave attenuation on the shoreline, which could change design/quantity.	USACE is very experienced with design and construction of concrete and rubble structures. Additional protection measures or modification to proposed measures may need to be modified due to wave climate but should be reflected in current assumptions. Quantity risk is considered low and is more likely to have greater impact. Tree scope of work is assumed and likely to change based on final wall layout.	Marginal	Possible	1
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Tribar Revetment	Contracting plan is not established at this stage of development. Various technical challenges and related design and construction complexities can result in differing contract strategies that result in less or greater Government risks and resulting project costs.	Type of contracting strategy will likely be based on project size, district experience, completion of plans and specs, and schedule for construction implementation. Project size and contract strategies can effect ability to bond contractors, bidding competition and Gov't risks verses contractor risks. It is likely to impact overall project costs, larger projects even more so. Contract strategy can greatly influence a final project cost from least risk to greatest: funding availability, contract value, competitive bids, firm-fixed lowest price, best value, design/build, cost plus incentive fee.	Marginal	Possible	1

AS-2	Precast Concrete Seawall	Contracting plan is not established at this stage of development. Various technical challenges and related design and construction complexities can result in differing contract strategies that result in less or greater Government risks and resulting project costs.	Type of contracting strategy will likely be based on project size, district experience, completion of plans and specs, and schedule for construction implementation. Project size and contract strategies can effect ability to bond contractors, bidding competition and Gov't risks verses contractor risks. It is likely to impact overall project costs, larger projects even more so. Contract strategy can greatly influence a final project cost from least risk to greatest: funding availability, contract value, competitive bids, firm-fixed lowest price, best value, design/build, cost plus incentive fee.	Marginal	Possible	1
AS-3	Concrete Rubble Masonry Wall	Contracting plan is not established at this stage of development. Various technical challenges and related design and construction complexities can result in differing contract strategies that result in less or greater Government risks and resulting project costs.	Type of contracting strategy will likely be based on project size, district experience, completion of plans and specs, and schedule for construction implementation. Project size and contract strategies can effect ability to bond contractors, bidding competition and Gov't risks verses contractor risks. It is likely to impact overall project costs, larger projects even more so. Contract strategy can greatly influence a final project cost from least risk to greatest: funding availability, contract value, competitive bids, firm-fixed lowest price, best value, design/build, cost plus incentive fee.	Marginal	Possible	1
Construction Elements				**Maximum Project Growth**		**25%**
CON-1	Tribar Revetment	Water in Excavation for toe. Potential labor shortages. Congestion, weather impacts, construction near heavily used recreational area.	Construction practices can manage these concerns.	Moderate	Unlikely	1
CE-2	Precast Concrete Seawall	Water in Excavation. Potential labor shortages. Congestion, weather impacts, construction near heavily used recreational area.	Working in excavation below MSL a concern keeping trench dewatered. Construction practices can manage these concerns. UXO and Cultural resouces could be discovered and cause a schedule delay.	Moderate	Possible	2
CE-3	Concrete Rubble Masonry Wall	Water in Excavation for cast in place concrete. Potential labor shortages. Congestion, weather impacts, construction near heavily used recreational area.	Working in excavation below MSL a concern keeping trench dewatered. Construction practices can manage these concerns but likely to increase costs. UXO and Cultural resouces could be discovered and cause a schedule delay.	Moderate	Likely	3
Specialty Construction or Fabrication				**Maximum Project Growth**		**65%**
SC-1	Tribar Revetment	Numerous assumptions are made w/ a conceptual design, but no special equipment or fabrications are anticipated.	Major construction is a tribar revetment. Prefabricating 1.0 TN Tribar units has not been done on Guam and there could be lessons learned in creating a local fabrication facility.	Marginal	Likely	2
SC-2	Precast Concrete Seawall	Numerous assumptions are made w/ a conceptual design, but no special equipment or fabrications are anticipated.	Major construction is precast concrete and reinforcement. Additional cost impacts are possible due to unknown subsurface conditions.	Marginal	Possible	1
SC-3	Concrete Rubble Masonry Wall	Numerous assumptions are made w/ a conceptual design, but no special equipment or fabrications are anticipated.	Major construction is cast in place concrete, reinforcement, and rubble wall. Additional cost impacts are possible due to unknown subsurface conditions.	Moderate	Possible	2
Technical Design & Quantities				**Maximum Project Growth**		**30%**
T-1	Tribar Revetment	Designs are not yet established. Quantities for this feature have not been developed to any level of detail.	Design and quantities have not been developed in any detail at this point making it possible the quantities change to a degree as design progresses. Most risk is considered in establishing the initial scope.	Moderate	Possible	2

T-2	Precast Concrete Seawall	Designs are not yet established. Quantities for this feature have not been developed to any level of detail.	Design and quantities have not been developed in any detail at this point making it possible the quantities change to a degree as design progresses. Most risk is considered in establishing the initial scope. Large footprint could be challenging excavating around existing structures such as the existing highway on the West end of the project.	Significant	Possible	3
T-3	Concrete Rubble Masonry Wall	Designs are not yet established. Quantities for this feature have not been developed to any level of detail.	Design and quantities have not been developed in any detail at this point making it possible the quantities change to a degree as design progresses. Most risk is considered in establishing the initial scope. Large footprint could be challenging excavating around existing structures such as the existing highway on the West end of the project.	Significant	Possible	3
Cost Estimate Assumptions				**Maximum Project Growth**		**35%**
EST-1	Tribar Revetment	Most cost changes will be based on design scope and quantity changes, which are addressed elsewhere.	Much of the production are based on theoretical production and could be much lower. Hauling of material adds complexity and risk to cost estimate. Labor rates based on DB rates from Guam. Labor shortages have been reported and may cost more than estimated. Cultural Resourse Scope of work not identified and cost estimate based on PDT estimate based on previous projects. Actual costs likely to changed based on MOA.	Moderate	Likely	3
EST-2	Precast Concrete Seawall	Most cost changes will be based on design scope and quantity changes, which are addressed elsewhere.	Many unknowns with excavation, quantity changes, and subsurface conditions. Estimate assumes minimal dewatering and assumes precast can be set into place on leveling rock. Hauling of material adds complexity and risk to cost estimate. Labor rates based on DB rates from Guam. Labor shortages have been reported and may cost more than estimated. Cultural Resourse Scope of work not identified and cost estimate based on PDT estimate based on previous projects. Actual costs likely to changed based on MOA.	Moderate	Possible	2
EST-3	Concrete Rubble Masonry Wall	Most cost changes will be based on design scope and quantity changes, which are addressed elsewhere.	Much of the production are based on local historic production. Rubble Masonry wall construction production in trench may be slower than estimated. Hauling of material adds complexity and risk to cost estimate. Labor rates based on DB rates from Guam. Labor shortages have been reported and may cost more than estimated. Cultural Resourse Scope of work not identified and cost estimate based on PDT estimate based on previous projects. Actual costs likely to changed based on MOA.	Moderate	Likely	3
External Project Risks				**Maximum Project Growth**		**40%**
EX-1	Tribar Revetment	External risk included in the risk register (and contingency) are extreme escalation and delays/impacts by others (outside organizations, municipalities, public interest groups, etc.)	Project delays increase likelihood of scope growth and cost increases. Similarly, multiple interest and political groups can result in unexpected changes and delays. Recent history indicates an annual national construction escalation rate of 3.5%. The support for the project is high so hypbrid seawall delay risks are unlikely.	Marginal	Possible	1

EX-2	Precast Concrete Seawall	External risk included in the risk register (and contingency) are extreme escalation and delays/impacts by others (outside organizations, municipalities, public interest groups, etc.)	Project delays increase likelihood of scope growth and cost increases. Similarly, multiple interest and political groups can result in unexpected changes and delays. Recent history indicates an annual national construction escalation rate of 3.5%. The support for the project is high so hypbrid seawall delay risks are unlikely.	Marginal	Possible	**1**
EX-3	Concrete Rubble Masonry Wall	External risk included in the risk register (and contingency) are extreme escalation and delays/impacts by others (outside organizations, municipalities, public interest groups, etc.)	Project delays increase likelihood of scope growth and cost increases. Similarly, multiple interest and political groups can result in unexpected changes and delays. Recent history indicates an annual national construction escalation rate of 3.5%. The support for the project is high so hypbrid seawall delay risks are unlikely.	Marginal	Possible	**1**

East Hagatna Shore Protection Alt 2,3,4
Alternative Formulation
Abbreviated Risk Analysis

Risk Evaluation

WBS	Potential Risk Areas	Project Management & Scope Growth	Acquisition Strategy	Construction Elements	Specialty Construction or Fabrication	Technical Design & Quantities	Cost Estimate Assumptions	External Project Risks	Cost in Thousands
10 BREAKWATERS AND SEAWALLS	**Tribar Revetment**	**1**	**1**	**1**	**2**	**2**	**3**	**1**	$10,700
10 BREAKWATERS AND SEAWALLS	Precast Concrete Seawall	**1**	**1**	**2**	**1**	**3**	**2**	**1**	$7,900
10 BREAKWATERS AND SEAWALLS	Concrete Rubble Masonry Wall	**1**	**1**	**3**	**2**	**3**	**3**	**1**	$9,411