

Draft Integrated Feasibility Report and Environmental Assessment



August 2025

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Draft Integrated Feasibility Report and Environmental Assessment
East Hagatna Emergency Shoreline Protection
Hagatna, Guam

Prepared By:
U.S. Army Corps of Engineers
Honolulu District

August 2025

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), Honolulu District, has prepared a Draft Integrated Feasibility Report and Environmental Assessment (IFR/EA) for the East Hagatna Emergency Shoreline Protection Feasibility Study. The study area is located in East Hagatna along South Marine Corps Drive in the U.S. Territory of Guam, for which the Government of Guam, represented by the Guam Department of Public Works, is the non-federal sponsor (NFS). In accordance with applicable federal law, regulation, and USACE policy, this IFR/EA identifies coastal erosion hazards and analyzes a series of potential alternatives, including the “No Action” alternative, to address coastal erosion risks in the study area. Additionally, this IFR/EA, evaluates and discloses impacts that would result from the implementation of potential emergency shoreline protection measures in the study area.

The study is authorized under Section 14 of the Flood Control Act of 1946 (Section 14), as amended (33 United States Code [USC] 701r), for Emergency Shoreline Protection under the USACE Continuing Authorities Program (CAP). This report documents the plan formulation process to select a Tentatively Selected Plan (TSP), along with environmental, engineering, and cost analyses of the TSP, which will allow additional design and construction to proceed following approval of this report.

Generally, plan formulation and evaluation for CAP Section 14 studies will focus on the least cost alternative that provides emergency shoreline protection to public infrastructure. The least cost alternative plan is justified if the cost of the proposed alternative is less than the costs necessary to relocate the threatened facilities (Engineer Pamphlet [EP] 1105-2-58).

Within the study area, approximately 1,630 feet (ft) of South Marine Corps Drive is at imminent risk of failure due to storm surge and wave attack. An existing seawall constructed between the shoreline and the main thoroughfare in the study area is threatened by shoreline erosion and is experiencing severe undercutting, leaving South Marine Corps Drive vulnerable to increased future damage. The plan formulation process identified several structural and non-structural emergency shoreline protection management measures to potentially address coastal erosion risk in the study area. An initial array of 6 alternatives underwent early rounds of qualitative and semi-quantitative screening. Additional evaluation, comparison, and optimization of alternatives assisted in identifying and evaluating the final array of four action alternatives (Alternative 1 – No Action Alternative, Alternative 2 – Revetment, Alternative 3 – Precast Concrete Seawall, Alternative 4 – Concrete Rubble Masonry Seawall).

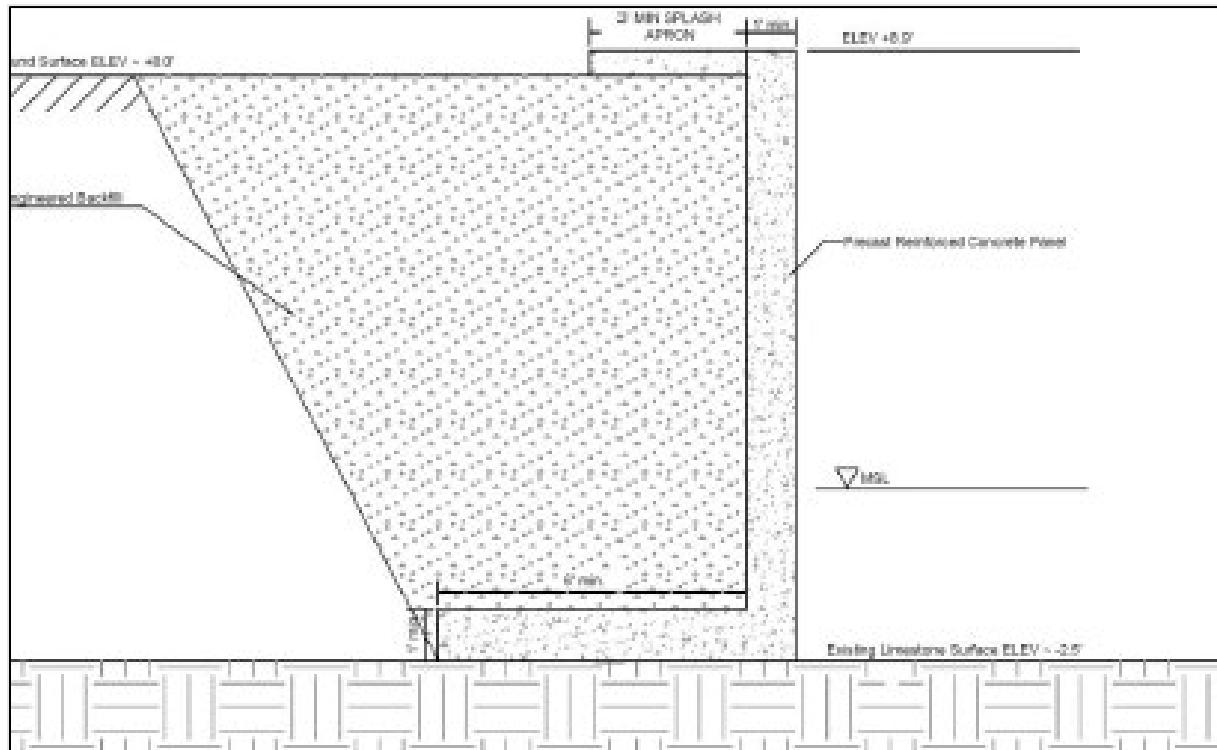
Based on formulation and evaluation of potential alternatives, the TSP is Alternative 3 Precast Concrete Seawall. This alternative consists of replacing approximately 1,630 linear ft of existing, compromised seawall with a precast concrete seawall. The top crest elevation needed for the design to meet the USACE 50-year design requirement for sea level change (SLC) and be adaptable to 100-year SLC under the intermediate scenario is 8.9-ft above Mean Sea Level (MSL). This design has a crest width of 1-ft 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.

AS justified under CAP Section 14, the TSP is the least cost, environmentally acceptable alternative that is less than the cost of facility relocation (\$67.9 million). At the Fiscal Year (FY) 2025 price level, the total project first cost estimate for the TSP is approximately \$16.2 million. Consistent with cost-sharing requirements for CAP Section 14 projects, the federal share of total project first costs is estimated at \$11.2 million and the non-Federal share is estimated at \$5.0 million.

Due to the limited nature of construction disturbance, the activities of the TSP i.e., Proposed Action, are not expected to cause any long-term adverse environmental effects in the immediate study area. Best management practices (BMPs) would be implemented, where appropriate, to ensure that potential construction-related impacts are avoided and minimized to a less than significant level (see Section 6.9 Environmental Commitments). No compensatory mitigation is required. Further examination of impacts from the proposed design will be part of the Design and Implementation Phase.

The Governor of Guam expressed support for Alternative 3 as the TSP through a support letter dated February 28, 2024. To solicit stakeholder input on this study, this draft IFR/EA will be released to the public and federal, territory and local agencies for a 30-day public review period from August 8, 2025, to September 9, 2025. A virtual public meeting will be held on August 20, 2025 to present the TSP and allow the public to respond and ask questions during the review period. Public and agency comments on the draft report will be incorporated into the final report. The final report is scheduled to be complete in December 2025.

TENTATIVELY SELECTED PLAN:



LIST OF ACRONYMS AND ABBREVIATIONS

AEP	Annual Exceedance Probability
APE	Area of Potential Effects
BEA	Bureau of Economic Analysis
BLS	Guam Department of Labor-Bureau of Labor Statistics
BMP(s)	Best Management Practices
CAA	Clean Air Act
CAP	Continuing Authorities Program
CDP	Census-Designated Place
CE	Common Era
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Current Employment Survey
CFR	Code of Federal Regulations
COSA	Construction and Staging Area
CRM	Concrete Rubble Masonry Wall
CSRA	Cost and Schedule Risk Analysis
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
D&I	Design & Implementation phase
dBa	A-weighted Decibels
EC(s)	Environmental Commitments
EFH	Essential Fish Habitat
EFHA	EFH Areas Protected from Fishing
EO	Executive Order
EOP	Environmental Operating Principles
EP	Engineer Pamphlet
ER	Engineer Regulation
ESA	Endangered Species Act
ESI	Environmental Sensitivity Index
FCD	Federal Consistency Determination
FCSA	Feasibility Cost Sharing Agreement
FEMA	Federal Emergency Management Agency
FID	Federal Interest Determination
FONSI	Finding of No Significant Impact
FRM	Flood Risk Management
ft	Feet / Foot
FWCA	Fish and Wildlife Coordination Act
FWOP	Future Without Project
FY	Fiscal Year
GBSP	Guam Bureau of Statistics and Plans
GCA	Guam Code Annotated
GCMP	Guam Coastal Management Program

GDAWR	Guam Division of Aquatic and Wildlife Resources
GDCA	Guam Department of Chamorro Affairs
GDP	Gross Domestic Product
GDPW	Guam Department of Public Works
GEPA	Guam Environmental Protection Agency
GHURA	Guam Housing and Urban Renewal Auth
GPT	Guam Preservation Trust
GSHPO	Guam State Historic Preservation Officer
HAPC	Habitat Areas of Particular Concern
HCD	NMFS, PIRO, Habitat Conservation Division
HRRA	Hagatna Restoration and Redevelopment Authority
HST	Hawaii Standard Time
HTRW	Hazardous, Toxic, and Radioactive Wastes
IFR/EA	Integrated Feasibility Report and Environmental Assessment
IUCN	International Union for Conservation of Nature
LERRD	Lands, Easements, Rights-Of-Way, Relocations, and Disposals
MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NGS	National Geodetic Survey
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNBF	Natural and Nature-Based Features
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutants Discharge Elimination System
NRCS	Natural Resources Conservation Service
OMRR&R	Operations, Maintenance, Repair, Replacement, and Rehabilitation
OSE	Other Social Effects
P&G	Principles and Guidelines
P.L.	Public Law
PDT	Project Delivery Team
PED	Preconstruction, Engineering, and Design
PIFWO	USFWS Pacific Islands Fish and Wildlife Office
PIRO	NMFS, Pacific Islands Regional Office
POD	Pacific Ocean Division
PPA	Project Partnership Agreement
PR&G	Principles, Requirements, and Guidelines
PRD	NMFS PIRO Protected Resources Division
SBH	Small Boat Harbor
SHPO	State Historic Preservation Officer
SLC	Sea Level Change
SLR	Sea Level Rise

SOI	Secretary of the Interior
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TSP	Tentatively Selected Plan
U.S.	United States
UOG	University of Guam
USACE	United States Army Corps of Engineers
USC	United States Code
USDOT	US Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
WOTUS	Water(S) of the US
WPRFMC	Western Pacific Regional Fishery Management Council
WQC	Water Quality Certification
WRDA	Water Resources Development Act

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1 INTRODUCTION

This section provides information on the United States Army Corps of Engineers (USACE) planning process, study purpose, need and scope, study authority, study area, previous studies that contributed to this feasibility study. It also provides a summary of problems and opportunities and objectives and constraints considered in formulating study alternatives.

1.1 USACE Planning Process

The USACE uses an iterative six-step planning process, as outlined in Engineer Regulation (ER) 1105-2-103, “*Planning Policy for Conducting Civil Works Planning Studies*”, which includes the following steps (USACE 2023a):

- Identification of water and related land resources problems and opportunities (relevant to the planning setting) associated with the federal objective and specific state and local concerns
- Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities
- Formulation of alternative plans
- Evaluation of the effects of the alternative plans
- Comparison of alternative plans
- Selection of a Tentatively Selected Plan (TSP) based upon the comparison of alternative plans

This Integrated Feasibility Report and Environmental Assessment (IFR/EA) will mirror the process noted above, beginning with defining the problems and opportunities and culminating in the selection and description of a Tentatively Selected Plan.

This IFR/EA discusses and discloses environmental effects, beneficial or adverse, that may result from proposed project in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) § 4321 et seq.); the Council on Environmental Quality (CEQ) (regulations published in 40 Code of Federal Regulations (CFR) Part 1500 et seq.; and USACE procedures for implementing NEPA published in 33 CFR Part 230¹. This IFR/EA also documents project compliance with other applicable Federal environmental laws, regulations, and requirements.

Engineer Pamphlet (EP) 1105-2-58, “*Continuing Authorities Program*” defines the contents of feasibility reports authorized under the Continuing Authorities Program (CAP; USACE 2019). This document and its appendices present the information required by regulation and USACE policy as an IFR/EA.

¹ The Council on Environmental Quality (CEQ) issued a rule rescinding its National Environmental Policy Act (NEPA) regulations, effective April 11, 2025. This follows recent court rulings that found that the CEQ lacks the authority to issue binding NEPA regulations

1.2 Study Purpose, Need and Scope

The purpose of this feasibility study is to evaluate the threat to critical infrastructure posed by coastal erosion and to identify potential emergency shoreline protection solutions to critical infrastructure in East Hagatna. This study is needed because the East Hagatna shoreline is subject to frequent storm wave attacks and big wave events. Coastal erosion due to these factors puts South Marine Corps Drive, a major highway in the capitol city of Hagatna, Guam, at risk of imminent damage and failure.

The study scope includes the development and evaluation of a series of potential alternative plans focused on emergency shoreline protection for a critical stretch of South Marine Corps Drive in East Hagatna, Guam. Alternatives were developed in consideration of study area problems and opportunities as well as objectives and constraints and evaluated against the CEQ's 2013 Principles, Requirements, and Guidelines (PR&G) four evaluation criteria: completeness, effectiveness, efficiency, and acceptability (CEQ 2013). The evaluation of alternative plans that address shoreline protection needs assisted in identifying the least cost, environmentally acceptable plan.

1.3 Study Authority

Funding for this feasibility study is authorized pursuant to Section 14 of the Flood Control Act of 1946 (Section 14) (Public Law [P.L.] 79-525), as amended (33 USC 701r). Under the CAP, Section 14 authorizes USACE to partner with a non-federal sponsor (NFS) to study, design, and construct emergency streambank and shoreline protection for public facilities in imminent danger of failing due to bank failure caused by natural erosion and not by inadequate drainage, by the facility itself, or by operation of the facility. The full text of Section 14 is as follows:

"The Secretary of the Army is authorized to allot from any appropriations heretofore or hereafter made for flood control, not to exceed \$50,000,000 per year, for the construction, repair, restoration, and modification of emergency streambank and shoreline protection works to prevent damage to highways, bridge approaches, lighthouses (including those lighthouses with historical value), and public works, churches, hospitals, schools, and other nonprofit public services, when in the opinion of the Chief of Engineers such work is advisable: Provided, that not more than \$15,000,000 shall be allotted for this purpose at any single locality from the appropriations for any one fiscal year, and if such amount is not sufficient to cover the costs included in the Federal cost share for a project, as determined by the Secretary, the non-Federal interest shall be responsible for any such costs that exceed such amount."

EP 1105-2-58 limits emergency shoreline protection projects authorized under Section 14 to essential public facilities and facilities owned by non-profit organizations that have been properly maintained and are in imminent threat of damage or failure by natural erosion processes of streambanks and shorelines. Eligible facilities include highways, highway bridge approaches, lighthouses, public works, churches, public and private non-profit hospitals, schools, and other public or non-profit facilities offering public services open to all on equal terms. South Marine Corps Drive is an essential public facility, open to all on equal terms, has been properly maintained, and is in imminent

threat of damage by natural shoreline erosion. Therefore, the complex is eligible for consideration of protection under Section 14.

The NFS for this project is Government of Guam (GovGuam), represented by the Guam Department of Public Works (GDPW). Although the project is represented by GDPW, the Guam Bureau of Statistics and Plans (GBSP) is the planning and coordinating agency authorized by GovGuam to solicit support from federal agencies to address coastal management concerns.

In August 2021 a Feasibility Cost Sharing Agreement (FCSA) was executed between USACE and the Government of Guam. Section 14 studies have a federal participation limit of \$15 million. In the Feasibility phase, the first \$100,000 is 100 percent % federally funded and the balance is cost shared 50 percent federal to 50 percent non-federal. In the Design & Implementation (D&I) phase, the cost share is 65 percent federal to 35 percent non-federal. Additionally, Section 1156 of the Water Resources Development Act (WRDA) of 1986 (33 USC 2310), as amended, provides a non-Federal cost share waiver applied to both the Feasibility and Design and Implementation phases for studies located within any U.S. Territory, such as Guam. At the time of FCSA execution, the Section 1156 waiver was \$530,000. In federal fiscal year (FY) 2025, the Section 1156 waiver is set at \$658,000 and will change annually based on changes in inflation rates. The cost share waiver deducts from the non-Federal share and adds to the Federal share. The non-Federal sponsor for this project is the Government of Guam, represented by the Department of Public Works (DPW). Additional information on projected cost share requirements can be found in Section 6.8 Cost Sharing.

1.4 Location and Description of the Study Area

Guam is located in the North Pacific Ocean between the Commonwealth of the Northern Mariana Islands (to the north) and the Federated States of Micronesia (to the south), as shown in the inset map of Figure 1. Guam is a U.S. territory and is represented by a delegate in the U.S. Congress. The Guam delegate at the time of this report is Representative James Moylan (Republican). Located 3,950 miles west of Hawaii, Guam is the westernmost point in the U.S.

The study area is centrally located on the west central Guam coast along East Hagatna Bay in the capital city of Hagatna², the government and commercial trade center of Guam since the beginning of Spain's occupation over 450 years ago. 2020 U.S. Census Bureau data indicates that there are approximately 154,000 residents of Guam, of which, 943 reside in Hagatna.

² The capital village of Hagåtña was named Agana prior to 1998. For the purposes of this report, diacritical marks were removed from "Hagatna". Both names (Hagatna and Agana) may be used interchangeably within this document.



Figure 1: Guam location map with study area

The East Hagatna Emergency Shoreline Protection study area encompasses a 2,100 foot (ft) long stretch of Trinchera Beach along East Hagatna Bay, which runs parallel to South Marine Corps Drive (also referred to as Highway 1). In some places, less than 20 ft of shoreline separates the road from the beach. The project extent is bounded on the western end by a strip mall parking lot that has an access ramp through the seawall down to the beach, and centers on the Veteran's Sunset Beach Park. Upland of the eastern extent of the project area is the Antonio B. Won Pat International Airport.

The study area includes 1,630 linear ft of existing seawall situated parallel to and between the East Hagatna Bay shoreline and South Marine Corps Drive (Figure 2).

The project footprint may extend as far as 20 ft seaward from the existing seawall, 30 ft inland of the existing seawall, and 5 ft down into the limestone subgrade. The existing seawall height ranges from approximately 7.5 to 8.9 ft above MSL and is composed of large volcanic rocks cemented together. As-built designs for the existing seawall, likely built after a 1993 USACE feasibility study for the project area, were not provided to the study team.

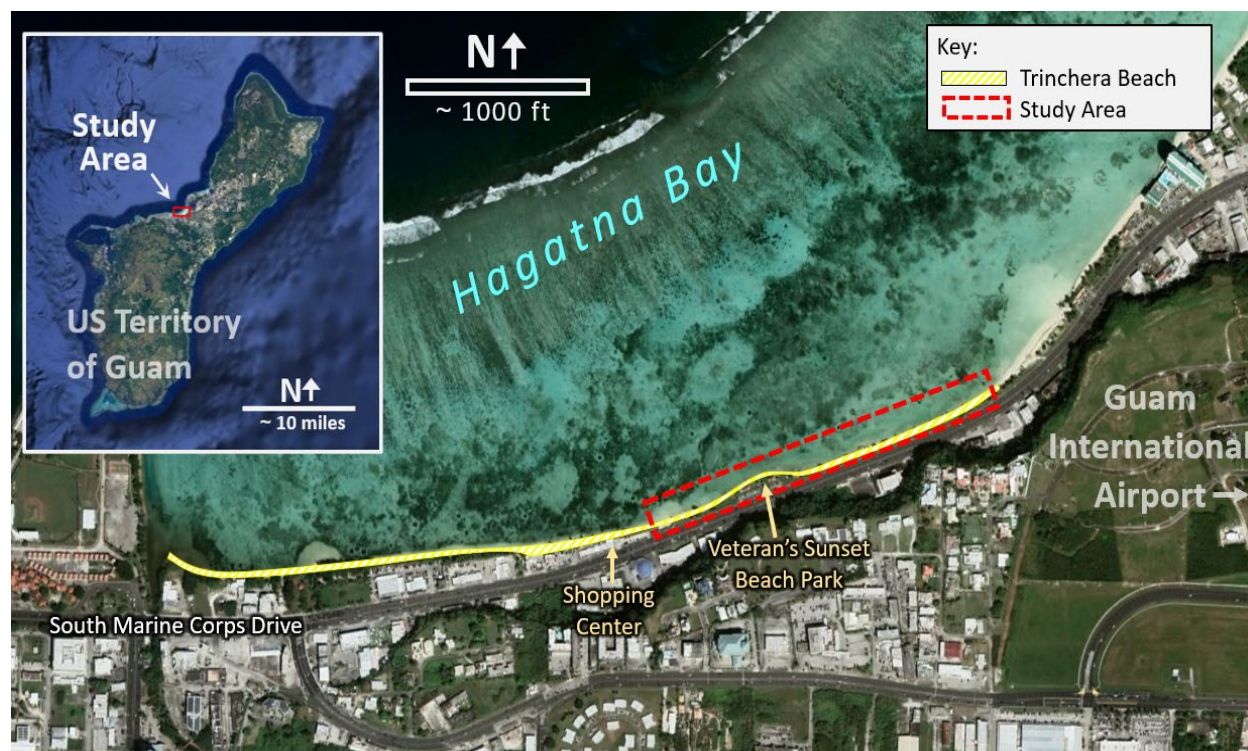


Figure 2: Approximate extent of study area along East Hagatna Bay.

1.5 Previous Studies

A history of USACE studies in and around the study area is included below. Prior to 1998 the capital village of Hagatna was called Agana. In 1998, the Guam Legislature changed the name from the English "Agana" back to the original Chamorro form "Hagatna". Studies prior to 1998 will refer to Agana and other English spellings of place names, including Agana River and Agana Bay.

- **Guam Comprehensive Study, USACE, Pacific Ocean Division (POD), 1979.** This study identified the water resource problems and needs for the Territory of Guam and was the parent study for the Agana Bayfront feasibility study (USACE 1988). The Stage 1 report included problem identification, planning objectives, potential management and nonstructural measures, and potentially significant impact for regional harbors, water supply, flood plain management, and shore protection and beach restoration. (USACE 1979).
- **Shoreline Investigation, USACE, POD, 1981.** This study described existing shoreline features, structures, and conditions and showed the boundaries of storm surge and storm wave flooding at Agana Bay (USACE 1981).

- **Flood Insurance Study, Territory of Guam, USACE, POD, September 1983.** The study was completed by USACE for the Federal Emergency Management Agency (FEMA) under the authorities of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The flood insurance study investigated the existence and severity of flood hazards on the island of Guam. The study also developed flood risk data for various areas of the community that have been used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. A section of the report covered the problems of coastal flooding and documented several accounts of damages by wind-generated waves. (USACE 1983)
- **Guam Comprehensive Study - Agana Bay Typhoon and Storm-Surge Protection Study (Technical Documentation), USACE, POD, January 1984.** This was the first report to attempt identification of the problems and needs related to coastal flooding in the Agana Bay area. Due to the lack of data, the documentation did not include typhoon stage-frequency analyses. (USACE 1984)
- **Typhoon Stage-Frequency Analysis for Agana Bay, Guam (Draft Technical Report), USACE, Coastal Engineering Research Center, Waterways Experiment Station, July 1987.** The purpose of the study was to determine the frequency of flood levels along the shoreline of Agana Bay that are caused by the combined effects of astronomical tides and typhoon-induced water levels (USACE 1987).
- **Agana Bayfront Storm Surge Protection Study, Territory of Guam (Draft Feasibility Report and Environmental Impact Statement), USACE, Honolulu Engineer District, April 1989.** This report identified the coastal flooding problems and needs of the low-lying areas of Agana Bay. Various measures were considered to reduce coastal flood damages caused by storm surge. Environmental consequences of the measures were investigated (USACE 1989).
- **East Agana, Territory Guam, Shore Protection Study, Reconnaissance Report, USACE, Honolulu Engineer District, April 1990.** The reconnaissance level report is the predecessor to the 1993 feasibility phase investigation. It identified the coastal flooding problem in East Agana and identified a potential solution to the problem. (USACE 1990)
- **Draft East Agana, Territory of Guam, Detailed Project Report and Environmental Assessment, USACE, Honolulu Engineer District, July 1993 (terminated at Sponsor's request).** The report identified a federal interest in shore protection measures along two reaches of the East Agana shoreline (USACE 1993). This project was terminated at the request of the non-Federal sponsor. After the termination of this study, a concrete masonry rubble seawall was constructed by the Government of Guam. in the stretches identified in the 1993 report.
- **East Hagatna Section 103 Federal Interest Determination Report, USACE, Honolulu District, 2015.** USACE prepared a Federal Interest Determination (FID) report under the CAP Section 103 program for coastal flood risk management. The Section 103 program has a federal per-project expenditure limit of \$10,000,000. The FID evaluated the design and implementation of shore protection measures along approximately 2.1 miles of eroding shoreline at East

Hagatna Bay to protect upland development and property from wave action and coastal storm inundation. Due to the imminent threat of storm damage and immediate need for erosion protection, this study was converted to a CAP Section 14 for emergency shoreline protection (USACE 2015).

1.6 Problems and Opportunities

This section summarizes the first step of the six-step planning process: Identification of water and related land resources problems and opportunities (relevant to the planning setting) associated with the federal objective and specific state and local concerns.

1.6.1 Overview of Coastal Erosion Challenges

Guam is in an area of the Pacific Ocean that has a high risk for tropical storms and typhoons, and the low-lying coastline of East Hagatna is subject to frequent storm wave attack. Large storm events and associated high waves and storm surge have caused significant erosion, undermining the existing seawall. The existing seawall is not anchored into the limestone foundation and instead, sits atop the ground surface, leaving it vulnerable to wave attack. Continual undermining of the seawall has put South Marine Corps Drive and public utilities in the immediate vicinity of the study area at imminent risk of damage. Future sea level rise will continue to exacerbate this condition and accelerate the rate of erosion and damage.

South Marine Corps Drive is a major arterial roadway that extends approximately 22 miles from Andersen Air Force Base in Yigo on the northeastern corner of the island down to Naval Base Guam in Santa Rita in the central western area of the island. Both military bases play a vital role in regional and national security. Closure of South Marine Corps Drive or significant traffic delays would result in impacts to the U.S. Military's ability to prepare for and respond to a crisis in the region.

Additionally, South Marine Corps Drive connects numerous island villages on the west side of the island including the capital city of Hagatna. Guam DPW traffic counts indicate an average of 51,234 vehicles pass through the section of road at risk daily. Damage to the road and public utilities beneath it would delay the southern villages' access to essential services such as hospitals and emergency responders, thereby resulting in health and safety risks, as well as a significant disruption to Guam's economy.

1.6.2 Problems

The following problem statements are based on information gathered during scoping and are supported by information documented in past reports:

- The structural integrity of the existing seawall is being threatened by high wave energy events that erode the shoreline along South Marine Corps Drive.
- Collapse of the existing seawall due to erosion and undermining will leave South Marine Corps Drive and public utilities along the roadway exposed to damage from wave attack and storm surge.
- Critical damage to or closure of South Marine Corps Drive threatens strategic readiness in Guam, the local economy, and the provision of public and

emergency services to the people of Guam. Closure of the road may also pose an indirect risk to life safety to the residents of Guam through the decreased ability to provide emergency services.

The most critical problem in the study area is the imminent failure of an existing seawall that would leave South Marine Corps Drive subject to heavy damage from storm surge and wave attack. Figures 3 to 5, captured by USACE Project Delivery Team (PDT) members on a site visit in January 2022, show the existing condition of approximately 2,100 linear ft of Trinchera Beach in the study area. The greatest damage to the existing seawall is along Veteran's Sunset Beach Park, where some sections of wall are undercut by up to 2 ft of seawater. This undercutting is already causing the seawall to crack and undermine the structural integrity of the seawall. Figure 3 shows the rocks and concrete skirt eroding out of the seawall on the eastern edge of Veteran's Sunset Beach Park. The western access staircase is in danger of collapsing into the ocean. Erosion has also dislodged some of the larger rocks from the seawall, especially on the eastern end of Veteran's Sunset Beach Park (USACE 2022a).



Figure 3: Existing seawall on eastern edge of Veteran's Sunset Beach Park, facing southwest (USACE 2022a). The beach has eroded below the rocks and concrete skirt, causing the seawall to crack, and undermining its structural integrity.



Figure 4: Existing seawall at Trinchera Beach Park, facing northeast (USACE 2022a)



Figure 5: Close up view facing south of the undercut East Hagatna Bay seawall (USACE 2022a)

If the existing seawall fails, South Marine Corps Drive and associated public utilities will be subject to more frequent and severe storm damage as the shoreline in the study area continues to erode. This will be exacerbated by long-term sea level rise. Heavy damage to the South Marine Corps Drive may necessitate road closure or relocation. This would result in economic loss and the potential for decreased public and emergency service provision for people who depend on the road. Without federal intervention, it is assumed that the Government of Guam will bear the full burden of protecting South Marine Corps Drive. Because there are limited funds for infrastructure repair and civil works projects in Guam, the Government of Guam will likely need to repair or replace failing sections of wall in a piecemeal approach, which may have limited effectiveness due to constraints on local funding for water resource infrastructure projects.

1.6.3 Opportunities

Opportunities to attain desirable future outcomes incidental to implementing a solution to the identified problems include:

- Increase community resiliency to coastal storms and erosion.
- Maintain the provision of public and emergency services along South Marine Corps Drive.
- Proactively plan for future sea level change (SLC) along Guam's shorelines, and
- Maintain public access to the East Hagatna Bay for recreation and tourism.

1.7 Objectives and Constraints

This section further builds upon the first step of the planning process by identifying planning objectives and constraints. These will be the basis for formulation of alternative plans outlined in Section 3.

1.7.1 Federal Objective

The federal objective, as stated in ER 1105-2-103, is : (1) protect the Nation's environment by maximizing sustainable economic development, avoiding unwise use of floodplains and flood-prone areas, and protecting, restoring, and mitigating for unavoidable damage to natural systems; (2) reasonably maximize all benefits with appropriate consideration of costs, with public benefits including environmental, economic, and social goals; and (3) provide the partner, Tribes, state and federal agencies, stakeholders, and decision makers with an opportunity to compare and examine alternatives and trade-offs to water resource problems.

1.7.2 Planning Objective

The planning objective for the study is to identify a solution that protects South Marine Corps Drive from failure due to erosion over the 50-year period of analysis.

Under CAP Section 14, the least cost alternative plan is justified if the total cost of the proposed alternative is less than the cost to relocate South Marine Corps Drive.

1.7.3 Planning Constraints

The high cost of implementation in remote territories such as Guam is a study constraint. There are two main contributing factors to this constraint:

First, Section 1156 of WRDA 1986 provides a territorial cost-sharing waiver under the Feasibility and Design & Implementation phases of CAP studies. When this feasibility study was initiated in 2021, the Section 1156 waiver was \$511,000. The Design and Implementation waiver is set at the FY 2024 level of \$658,000. While the intent of the territorial waivers is to reduce costs for tribal and territorial non-Federal sponsors, under a Section 14 authority with a limited federal expenditure of \$10 million, the territorial design and implementation waiver does not reduce the non-federal sponsor's final cost share and hinders the study's ability to qualify under a CAP Section 14 authority. The

study team would need to find an implementable solution at a much lower cost than that of a non-territory, which will be difficult in a remote location such as Guam.

Secondly, given the recent period of high inflation and the high costs associated with mobilizing equipment and personnel to remote territories such as Guam, there may be a limited number of alternatives that qualify within the range of coastal erosion management measures and alternatives that may be considered and selected under this authority.

In addition to high-cost constraints, the location and configuration of the existing seawall places a spatial constraint on the formulation of potential solutions. Subsequently, any improvements to the portion of damaged seawall resulting from this study cannot further exacerbate or induce damages to other portions of the seawall.

1.7.4 Planning Considerations

In consideration of existing local planning statutes, the study must demonstrate consistency with the Conservation of Natural Resource element in the Guam Comprehensive Development Plan (Guam Bureau of Statistics and Plans (GBSP) 1979) and the Guam Territorial Seashore Protection Act of 1974 (PL 12-108, Chapter V-A), including the following provisions from Executive Order 78-23:

“Shore Area Development: Only those uses shall be located within the Seashore Reserve which: (1) enhance, are compatible with or do not generally detract from the surrounding coastal area's aesthetic and environmental quality and beach accessibility; or (2) can demonstrate dependence on such a location and the lack of feasible alternative sites.

Visual Quality: Preservation and enhancement of, and respect for the island's scenic resources shall be encouraged through increased enforcement of and compliance with sign, litter, zoning, subdivision, building and related land-use laws; visually objectionable uses shall be located to the maximum extent practicable, so as not to degrade significantly views from scenic overlooks, highways, and trails.”

and Government Code Section 13450 of the Territory Beach Areas Act:

“The indiscriminate building of structures on the ocean shores of Guam should be discouraged.”

2 EXISTING CONDITIONS (AFFECTED ENVIRONMENT (40 CFR 1502.15))

This section documents the second step in the six-step planning process: *Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities*. The Existing Conditions section constitutes the Affected Environment section for NEPA purposes. Resources in the Affected Environment are described below and are analyzed for effects in Section 4.0. The following resources that makeup the physical, natural, build, economic and cultural environment are described below: weather; air quality; geomorphology, hydrology, and hydraulics; water resources and quality; hazardous, toxic, and radioactive wastes; noise and vibration; terrestrial habitats and species; marine habitats

and species; threatened and endangered species and critical habitat; essential fish habitat; invasive species; navigation; land use, public infrastructure, and utilities; traffic and circulation; socio-economic conditions; cultural and subsistence activities; aesthetics; and historic and archaeological resources.

The temporal scope of the study is a period of 50 years, beginning in 2026 and ending in 2076. The spatial scope of analysis for this study focuses on the proposed action area, which includes the immediate and surrounding environment within which USACE considers potential effects of the proposed action. The proposed action area is inclusive of the study area and extends beyond the construction footprints of each alternative to where indirect impacts to resources may be reasonably expected to occur. It is the largest geographic scope of analysis within which all impacts to resources described in this section are later evaluated in Section 4.0. Within the proposed action area, the construction footprint encompasses 1,630 linear ft of existing seawall situated parallel to and between the East Hagatna Bay shoreline and South Marine Corps Drive (Figure 6). The project footprint may extend as far as 20 ft seaward from the existing seawall, 30 ft inland of the existing seawall, and 5 ft down into the limestone subgrade.



Figure 6: Approximate extent of the action area along Hagatna Bay.

For each resource, the existing conditions within the proposed action area are described with a summary of historic conditions where applicable. A forecast of the “Future Without Project (FWOP)” conditions of the “No Action” Alternative is provided in Section 4 for each respective resource category. No resource categories were screened

from analysis. However, the level of detail in the description of each resource corresponds to the magnitude of the potential direct, indirect, or cumulative impacts on each resource and focuses only on resources that would be potentially affected by the alternatives and have the most material bearing on the decision-making process.

2.1 Physical Environment

This section summarizes the physical environment within the proposed action area. Additional details are provided in Appendices A-1 Engineering, A-2 Geotechnical, and A-4 Environmental.

2.1.1 Weather

As described in detail in Appendix A-1 Engineering, Guam is tropical, with warm and humid conditions throughout the year of 86-90 °F during the day and 75-77 °F at night and a constant ocean temperature of 81°F. Seasons are defined by variations in wind and rainfall. The dry season is January through May. Annual rainfall average is above 80 inches. Easterly trade winds are dominant during the dry season when wind speeds of 15 to 25 miles per hour are very common. December and June are transitional. The wet season is July through November, with variable winds from July to October, and an increase in typhoons.

From 1946 to 1991, Guam was directly affected by 20 typhoons. On an annual average, two to three of these storms pass within 200 miles of Guam. Guam's location greatly increases its chances of being affected by a severe storm (USACE 1990, 1993, 2015, 2020). Within the last 30 years, the severe typhoons that have impacted the island include: Typhoon Paka in 1997, with an estimated maximum sustained wind speed of 107 knots at Apra Harbor, destroyed roughly 1,500 buildings, leaving an estimated 5,000 people homeless (EQE International 1998 and NCDC 1997); Typhoon Pongsona in 2002, left more than 60% of the island's water wells inoperable and destroyed approximately 1,300 homes (FEMA 2003 and Gillespie 2002); Typhoon Wutip in February 2019, with sustained winds of 130 knots; and Typhoon Mawar in June 2023, with sustained winds of 122 knots.

2.1.2 Air Quality

The United States Environmental Protection Agency (USEPA) has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants including carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, ozone, and lead. Guam's air quality is generally considered good. Piti, Piti-Cabras, and Tanguisson in Guam are non-attainment areas for sulfur dioxide (USEPA 2023a). The rest of Guam, including the proposed action area, is in attainment of air quality standards. The proposed action area is located well outside the buffer zones of these non-attainment areas.

Current emissions are incurred in the project area for recurring shoreline, highway, utility, and park repairs every year. Highway repair requires excavation, fill base coarse asphalt, markings, curb and gutter and sidewalk, plus temporary bypass costs, mobilization and demobilization, revetment and contingency (USACE 1990).

2.1.3 Geomorphology, Hydrology, Hydraulics

The low-lying East Hagatna shoreline is bounded to the south by a 100-ft-high limestone cliff (the tree line to the south-southeast of the existing seawall in Figure 2), which is the southwest corner of the northern limestone plateau geomorphic province of Guam (Tracey et al. 1964). A strip of small commercial establishments is located between South Marine Corps Drive and the cliff (USACE 1993; Siegrist and Reagan 2008).

The proposed action area is in the floodplain of East Hagatna Bay (FEMA 2007). The shoreline is low and flat with a maximum elevation of 7.5 to 8.9 ft above MSL (NOAA NGS 2020). Trinchera Beach extends along approximately 3,400 ft of the East Hagatna shoreline. The beach is narrow, 10 to 20 feet wide, and is almost awash at high tide. The backshore area consists of a narrow and poorly developed coastal plain varying in width from 50 ft to about 1/2 mile (USACE 1993). In Veteran's Sunset Beach Park there is no beach. Toward the eastern extent of the project (towards Tamuning), the beach is approximately 15 ft wide. The beach material is fine calcareous sand with extensive coral, gravel, and rubble. Portions of the shoreline are covered almost exclusively with gravel, rocks, rubble, and small limestone boulders (Figures 3 to 5).

Seaward from the shoreline is a well-developed reef flat which ranges in width from 1/8 mile at the west end (at Pigo) of East Hagatna Bay to 1/2 mile at the east-northeast end (at Tamuning) (see Figure 7). The reef flat is bisected at about midpoint by the man-made peninsula of Paseo de Susana Park and the adjacent Federal Channel (yellow polygon on Figures 7 and 8) for the Agana Small Boat Harbor (managed by the port of Guam as Agana Boat Basin, now known as Gregorio D. Perez Marina). The reef consists of living coral and algae along the reef margin (seaward) and moderately dense skeletal coral formations, beach rock, and unconsolidated coral sediments along the shoreline (Tracey et al. 1964). Small sand and alluvial deltas formed in the vicinities of storm drains and the inner reef flat has a covering of fine sand and silt (USACE 1993).

The shoreline along the proposed action area is characterized by poorly sorted sand, with a high percent coverage by coral rubble, gravel, rubble, and small limestone boulders. The narrow strip of beach has a slope of about 10% and is awash at high tide (USACE 1990). Soils within the terrestrial proposed action area are of the urban land – ustorthents complex (NRCS 2021).

Within the 50-year study period (2026 to 2076) more frequent and severe tropical storms in combination with relative sea level rise are expected to exacerbate shoreline erosion (Appendix A-1).



Figure 7: Water Quality Conditions for East Hagatna Bay and its tributaries as displayed in the How's My Waterway Mapper (USEPA 2023b).

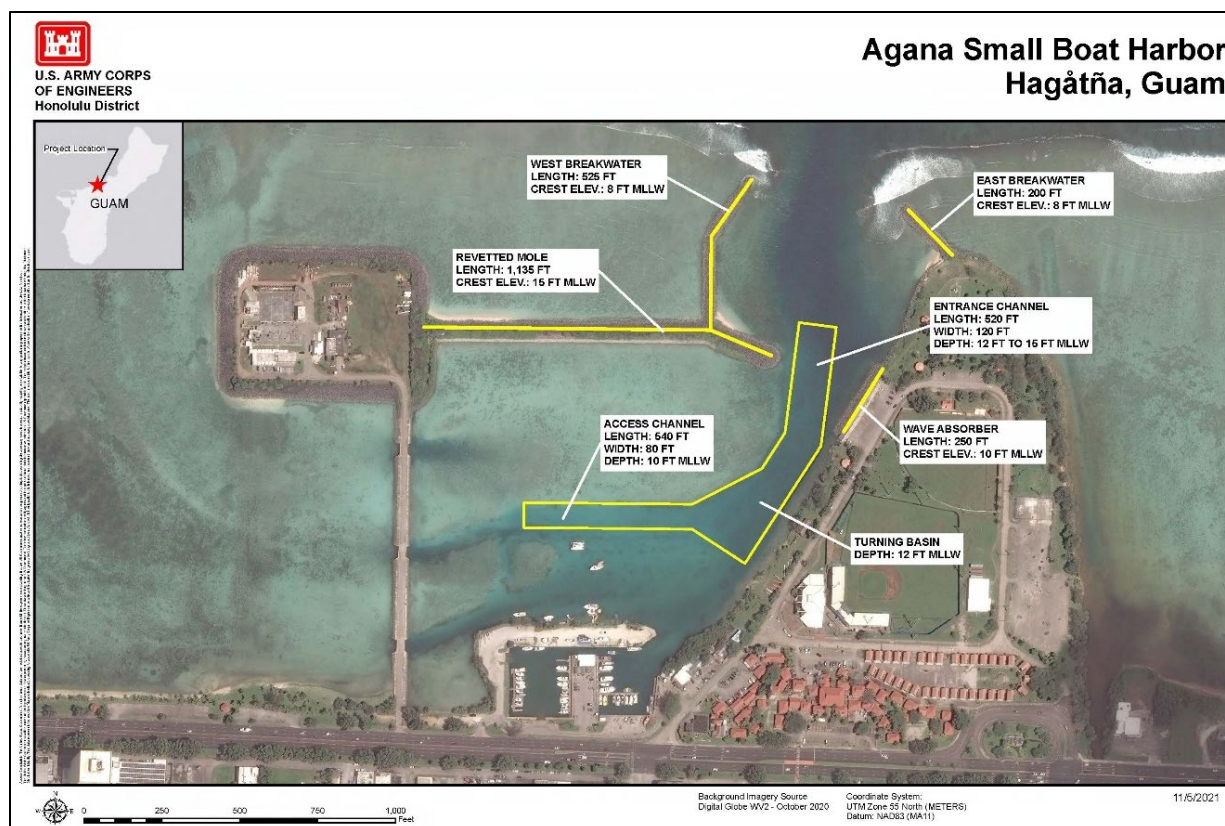


Figure 8: Agana Small Boat Harbor, now called Gregorio D. Perez Marina and managed by the Port of Guam. USACE is responsible for Operation & Maintenance of the Federal Channel and other structures indicated in yellow.

Hydrology within the proposed action area is discussed relative to East Hagatna Bay. There are no other surface waters within the proposed action area. East Hagatna Bay water depth ranges from 0 to 3 ft with the tides along the shoreline of the proposed action area. Tides on Guam are semi-diurnal with a mean range of 1.62 ft and a diurnal range of 2.35 ft based on the 1983-2001 epoch (NOAA 2022a).

Projected sea level rise within the 50-year study period (2026 to 2076) will be approximately 1.28 ft (Figure 8 Appendix A-1 Engineering). The design water level, based on short-term, storm-driven water level changes superimposed on the astronomical tides (Figure 9, Appendix A-1 Engineering) is approximately 1.4 ft relative to MHHW or 2.3 ft relative to MSL.

2.1.4 Water Resources and Quality

33 CFR 328.3(a) defines “waters of the United States” as it applies to the USACE regulatory jurisdiction pursuant to Section 404 of the Clean Water Act (CWA). East Hagatna Bay is a reach of the Pacific Ocean, subject to the ebb and flow of the tide, and part of the territorial seas of Guam; and accordingly, is a water of the U.S. The landward limit of CWA jurisdiction extends to the High Tide Line at and fronting the existing seawall (see 33 CFR 328.3(c)(4)). There are no tributaries, adjacent wetlands, or other jurisdictional waters of the U.S. within the proposed action area.

There are no streams with special designations under Wild and Scenic River Act of 1968 (16 USC §1271 et seq.) and no designated wild and scenic rivers in Guam (National Wild and Scenic Rivers System 2015). This Act is not applicable.

No Estuary of National Significance designated under the Estuary Protection Act of 1968 (16 USC §§1221-26) exists within American Samoa, CNMI, Guam, or Hawaii. This Act is not applicable to POH.

There are no designated coastal barrier resource system units designated under the Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990 (16 USC §3501 et seq.) that will be affected by this project. These Acts are not applicable.

Executive Order (EO) 11988 requires federal agency actions to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. To comply with EO 11988, the policy of USACE is to formulate projects that, to the extent possible, avoid or minimize adverse effects associated with the use of the floodplain and avoid inducing development in the floodplain unless there is no practicable alternative.

The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. and regulating quality standards for surface waters. The CWA defines waters of the U.S. to include all interstate waters, lakes, rivers, streams, territorial seas, tributaries to navigable waters, interstate wetlands, wetlands that could affect interstate or foreign commerce, and wetlands adjacent to other waters of the U.S (WOTUS). The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, without a permit.

Sections 305(b) and 303(d) of the CWA, respectively, require States, Territories, and authorized Tribes to assess waterbodies, as well as identify and make a list of those surface water bodies that are polluted. A review of all “existing and readily available” state or territorial surface water quality data must be reviewed and compared compare their water quality standards. Section 303(d) of the CWA authorizes the USEPA to list impaired waters and develop water pollution reduction plans, or Total Maximum Daily Loads (TMDLs), for those waterbodies that are classified as lower quality. The TMDL defines the upper threshold of a given pollutant that a waterbody can contain and still meet water quality standards.

The Territory’s water quality standards designate the waters of Hagatna Bay as M- 2, which requires preserving a balanced, indigenous population of marine organisms, especially shellfish and corals, and intended uses including water sports, aesthetic enjoyment, and mariculture. East Hagatna Bay water quality is reported as good for 2020 (USEPA 2023b). Previous USACE studies identified 30 storm drain outfalls throughout the Bay which discharge solids, nitrate-nitrogen, and coliform bacteria exceeding water quality standards (USACE 1993). The Agana River, west of the proposed action area (Figure 6), is impaired for aquatic life, fish and shellfish consumption, and swimming and boating due to bacteria and other microbes, low oxygen, and PCBs. A storm drain east of the proposed action area is impaired for aquatic life, swimming and boating due to bacteria and other Microbes, low oxygen, murky water, nitrogen and/or phosphorus, and salts (USEPA 2023b). TMDLs have not yet been developed for any of these impaired waters.

Regulations for conducting CWA Section 404(b)(1) analysis (40 CFR 230.40-230.45) describe the following six special aquatic sites that should be considered in any proposed action area:

2.1.4.1 Sanctuaries and Refuges

There are no sanctuaries or refuges within Hagatna Bay.

2.1.4.2 Wetlands

EO 11990 required federal agencies to “minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.” To meet these objectives, federal agencies are required, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

There are no wetlands within the proposed action area and no wetlands would be affected by any project activities (USACE 2022a). EO 11990 Protection of Wetlands is not applicable.

2.1.4.3 Mud Flats

The Proposed action area does not include any mudflats (NMFS 2023a).

2.1.4.4 Vegetated Shallows

Scattered patches of seagrass and algae are 82 ft away from the proposed action area and include the seagrasses *Enhalus acoroides*, *Halophila gaudichaudii*, and *Halodule uninervis*; and the macroalgae *Acanthopora spicifera*, *Avrainvillae* spp., *Caulerpa filicoides*, *Caulerpa macrophysa*, *Caulerpa sertularioides*, *Dictyota* spp., *Halimeda opuntia*, *Padina* spp., and *Sargassum vulgare*. There is only sand within the proposed action area (NMFS 2023a).

2.1.4.5 Coral Reefs

The coral reef is located 164 ft seaward from the proposed action area and includes *Porites australiensis*, *Porites cylindrica*, and *Pocillopora damnicornis* (Raymundo et al. 2022, NMFS 2023a).

2.1.4.6 Riffle and Pool Complexes

The proposed action area does not include riffle and pool complexes.

2.1.5 Hazardous, Toxic and Radioactive Waste (HTRW)

Per ER 1165-2-132 (USACE 1992), HTRW includes any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 USC 9601 et seq (CERCLA), including Unexploded Ordinance (UXO).

“Construction of Civil Works projects in HTRW-contaminated areas should be avoided where practicable. This can be accomplished by early identification of

potential problems in reconnaissance, feasibility, and PED [preconstruction, engineering, and design] phases before any land acquisition begins. Costs of environmental investigations to identify any existence of HTRW and studies required for formulation of the NED [National Economic Development] plan, recognizing the existence and extent of any HTRW, and studies required to evaluate alternatives to avoid HTRW will be cost shared the same as cost sharing for the phase the project is in (i.e., feasibility, PED, or construction). Where HTRW contaminated areas or impacts cannot be avoided, response actions must be acceptable to [US]EPA and applicable state regulatory agencies.”

While UXO are a risk of any ground disturbance beneath or outside the current wall base given the World War II combat history of the island of Guam, based on a review of USEPA’s EnviroAtlas, and How’s My Watershed, USACE understands that there are no known sources that would have contributed HTRW in the proposed action area (USEPA 2023ba, 2023c; USACE 1993). Additionally, the USACE is not proposing an activity that would introduce or otherwise become a source of HTRW in the proposed action area.

2.1.6 Noise and Vibration

Much of the City of Hagatna is a developed urban community. Commercial, institutional and government operations are centralized to within its limits. Vehicular traffic associated with Route 1 South Marine Corps Drive, Route 4 and airline traffic associated with the A.B. Won Pat Guam International Airport and vessel operations at the marina result in significant daytime ambient noise levels (Gourley et al. 2014).

2.2 Natural Environment

The natural environment of the proposed action area encompasses 1.1 acres of intertidal habitat, 1630 ft of shoreline, and 1.45 acres of terrestrial habitat in Trinchera and Veteran’s Sunset Beach Parks (Figure 2). Baseline natural environment condition is based on observations made by the National Marine Fisheries Service (NMFS) during marine surveys in November 2023, observations made by the PDT during a site visit on January 10-12, 2022 (USACE 2022a), National Oceanic and Atmospheric Administration’s (NOAA) 2005 Environmental Sensitivity Index (NOAA 2005), and the Surveys performed in 1992 by the United States Fish and Wildlife Service (USFWS) for a 1993 Environmental Assessment Shoreline Protection Feasibility Study (USFWS 1992) which was not implemented, as well as resource specific literature as detailed below. Figure 9 illustrates NOAA’s 2005 Environmental Sensitivity Index (ESI) of natural and cultural resources in East Hagatna Bay.

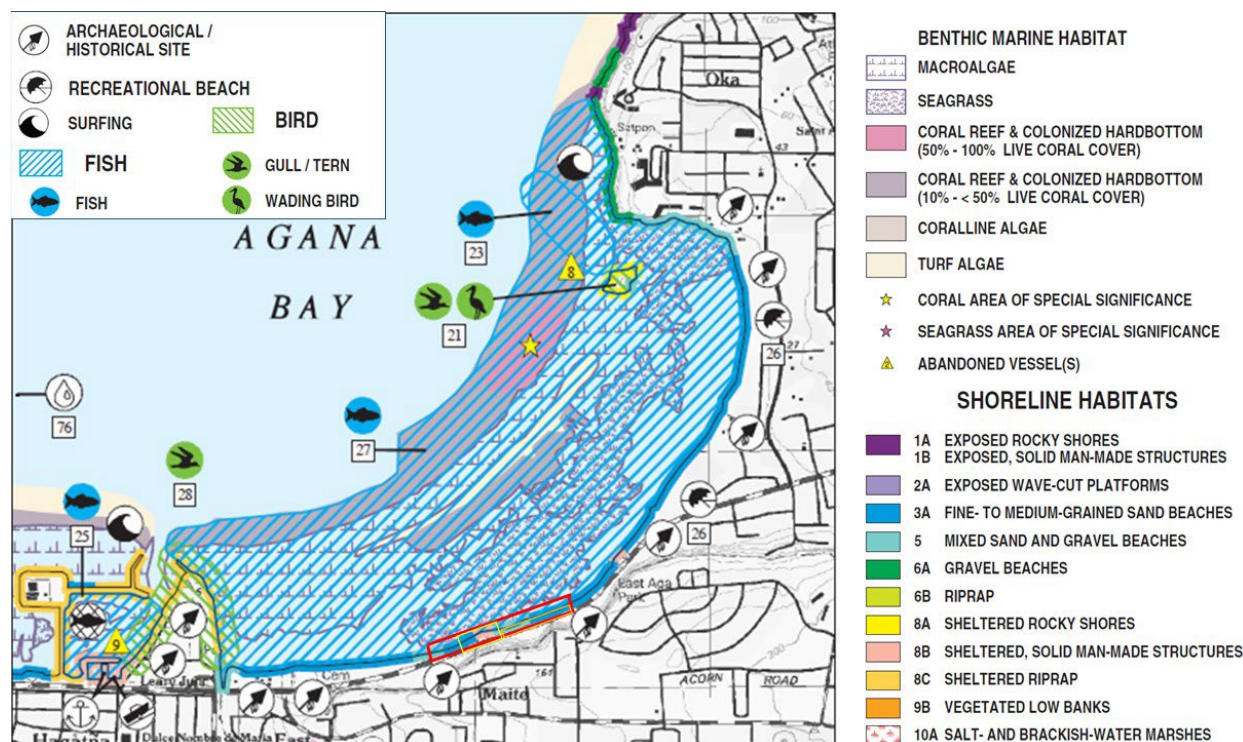


Figure 9: NOAA's 2005 Environmental Sensitivity Index Map 12 with the proposed action area in red, Veteran's Sunset Beach Park in yellow, and Trinchera Beach in orange.

2.2.1 Terrestrial Habitats and Species

Terrestrial wildlife habitat in the proposed action area is limited to the sparse, urbanized habitat of Trinchera Beach Park and Veteran's Sunset Beach Park (Figure 9). This area includes limited land varying from 10 to 60 ft wide between the seawall and South Marine Corps Drive, and a narrow discontinuous sandy beach on the ocean side of the seawall, described in more detail in Section 0.

2.2.1.1 Terrestrial Vegetation

Vegetation within the beach parks consist of an actively maintained lawn planted with indigenous coconut palm (*Cocos nucifera*) and ironwood (*Casuaria equisetifolia*) trees and the introduced ornamentals plumeria (*Plumeria* sp.) and fish poison tree (*Barringtonia asiatica*). Clumps of indigenous beach morning glory (*Ipomoea pescaprae*) grow along the seaward base of the seawall in some locations. A small number of coconut palm and ironwood trees are also rooted on the beach at the base of the seawall. No invasive plants were observed by the PDT (USACE 2022a). Vegetation within the proposed action area commonly occurs in beach areas throughout Guam.

Replacement of any trees removed will be required mitigation under Guam law (5 GCA Government Operations Guam Code Annotated CH. 63 Fish, Game, Forestry & Conservation § 63302: Unlicensed Tree-Cutting on Public Lands; Prohibited). Tree removal also requires a license (5 GCA § 63302).

2.2.1.2 Terrestrial Birds

The Migratory Bird Treaty Act (MBTA; 16 USC § 703-712) and Migratory Bird Conservation Act (16 USC §§715-715D, 715E, 715F-715R) was enacted to ensure protection of migratory bird resources that are shared among the U.S., Canada, Mexico, Japan, and Russia. The MBTA makes it unlawful to “pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or egg of any such bird, or any product”.

The responsibilities of federal agencies to protect migratory birds are set forth in EO 13186. USFWS is the lead agency for migratory birds. The USFWS issues permits for takes of migratory birds for activities such as scientific research, education, and depredation control, but does not issue permits for incidental take of migratory birds. The MBTA does not apply to non-native species introduced to the U.S. or its territories by mean of intentional or unintentional human assistance. E.O. 13186 Responsibilities of Federal Agencies to Protect Migratory Birds requires, among other things, a Memorandum of Understanding (MOU) between the USACE and USFWS concerning migratory birds. Neither the Department of Defense MOU nor the USACE Draft MOU clearly address migratory birds on lands not owned or controlled by USACE. For many USACE civil works projects, the real estate interests are provided by the non-Federal sponsor. Control and ownership of the Project lands remain with a non-Federal interest. Measures to avoid disturbing migratory birds are described in Attachment 8 of Appendix A-4 and are incorporated by reference. The USACE will include standard migratory bird protection requirements in the Project plans and specifications and will require the contractor to abide by those requirements. The project complies with the Order.

While shorebirds are reported in East Hagatna Bay (See Section 2.2.2.3, below), only urban birds have been reported in Trinchera Park. The PDT did not note any birds in the park during their visit (USACE 2022a). Migratory birds were recorded by Guam Division of Aquatic and Wildlife Resources (GDAWR) passing through between late August and early May along the East Hagatna Bay coast (Quitugua 2022). Migratory bird surveys and incidental sightings for migratory birds (Table 1), and Sali (Micronesian starlings) (Table 2) were provided by Guam Department of Agriculture for the East Hagatna area. The Sali surveys are located along transects near East Hagatna but not within the proposed action area. The most active nesting pairs are located at Paseo and Sirena Park, near the Hagatna boat basin and well outside the proposed action area, but it is still possible for the Sali to forage in the East Hagatna area (Duenas 2022).

Table 1: Migratory Bird Survey Results. Source: GDAWR 2022.

Common Name	Species	2019	2020	2021	2022
Eurasian Tree Sparrow	<i>Passer montanus</i>	21	No surveys due to covid restrictions		0
Philippine Turtle Dove	<i>Streptopelia dusumieri</i>	4			0

Table 2: Sali (Micronesian Starling) Survey Results. Source: GDAWR 2022.

Location	2019	2020	2021	2022
Padre Palomo Park Transect	0	No surveys due to covid restrictions	0	0
Paseo/ Sirena Park Transect	2 (Nesting)		7 (Nesting)	4 (Nesting)
Incidental Sightings	0	1, flying from beach towards mountain side	1, flying from beach towards mountain side	0

According to the International Union for Conservation of Nature (IUCN), both the Eurasian Tree Sparrow and the Sali are categorized on the IUCN Animal Threat Category List as Least Concern i.e., widespread and abundantly occurring. The Philippine Collared Dove is categorized by the IUCN as Vulnerable, facing a high risk of extinction in the wild (IUCN 2014).

During CZMA consultations Guam DoAg added that “The project area is an active area for nesting white fairy tern, *Gygis alba* and yellow bittern, *Ixobrychus sinensis*, protected under the Migratory Bird Treaty Act. Nesting season is year-round for both species. Between August and May, migratory shorebirds frequent the shoreline to forage and roost. Micronesian starling, *Aplonis opaca*, are cavity nesters and nest year-round.”

2.2.1.3 Terrestrial Mammals

No large terrestrial animals were recorded during the 1992 USFWS surveys or 2022 PDT site visit. Skinks, geckos, and rats were the dominant terrestrial vertebrates at the site (USFWS 1992). The PDT did not observe any mammals during their visit in January 2022 (USACE 2022a). GDAWR has reported Mariana fruit bat (*Pteropus mariannus mariannus*) passing through the area in early morning (dawn) most likely returning to a roost, and at dusk leaving a roost. The roosts are most likely north of East Hagatna along the limestone cliff (Flores 2022). For this specific site on East Hagatna, GDAWR has seen fruit bats on the breadfruit trees along the cliff wall, roosting and foraging during breadfruit season between 2010 and 2013. There are some bread fruit trees along the cliff side, so there may be fruit bats in the area during breadfruit season from February to October (Quitugua 2022). The Mariana fruit bat is listed as Threatened under the Endangered Species Act (ESA, See Section 2.2.3, below).

2.2.2 Marine Habitats and Species

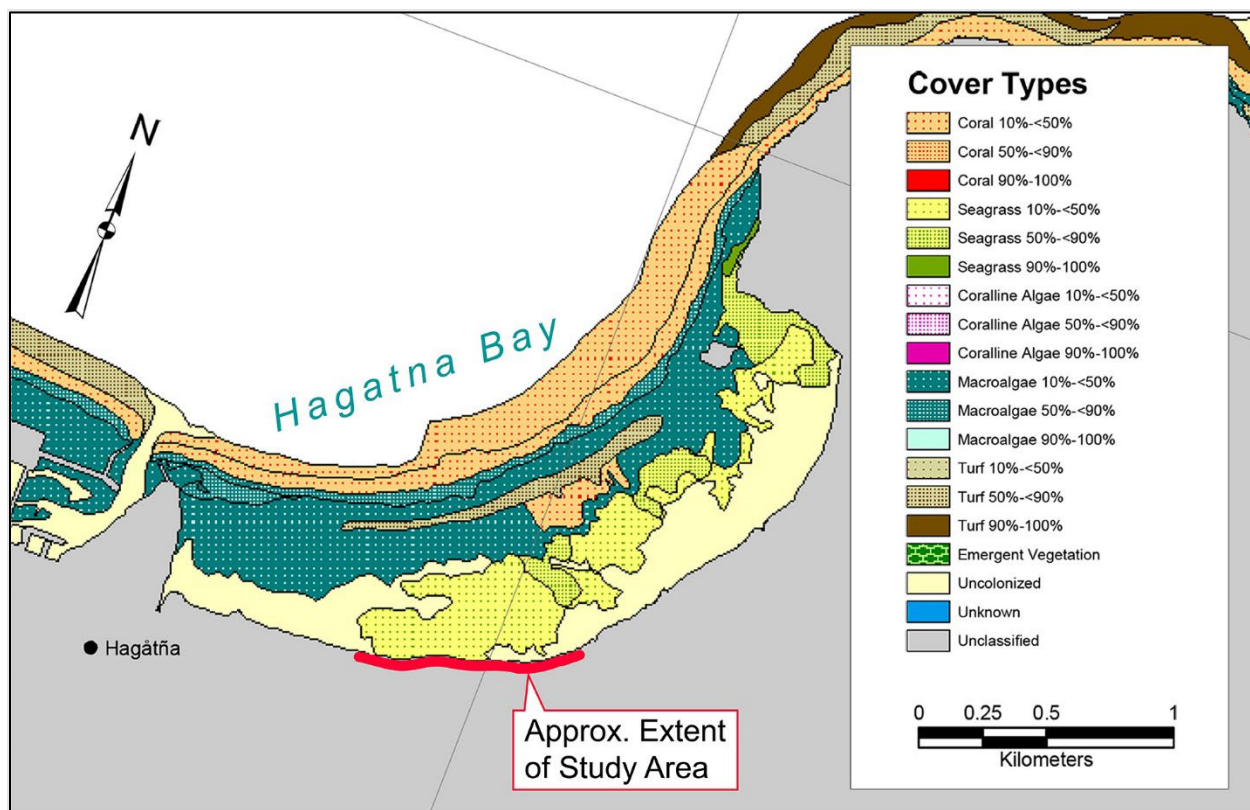


Figure 10: Benthic habitat cover types within East Hagatna Bay (adapted from NOAA 2005)

As described in Section 2.2, the habitat that would be directly impacted by the proposed project is a narrow, highly variable intertidal strand of sand, coral rubble, gravel, and rock (as seen in Figures 3-5), supporting no obvious aquatic communities. Previous surveys of the East Hagatna Bay benthic environments (NOAA 2005, USFWS 1992) found the benthic habitat within several hundred yards of shore consists of uncolonized sand, or sand sparsely colonized by seagrasses (Figure 10). The nearest areas of coral were found well offshore (Figure 10).

NMFS surveyed the proposed action area along the sea wall and at 25m and 50m from the shoreline in November 2022 (NMFS 2023a, Attachment 1h of Appendix A-4). The intertidal region extended 20 feet from the existing seawall and was predominantly sand with less than 30% cover of aggregate cobble and rubble. The intertidal and submerged substrates were dominated by sand with scattered patches of seagrass and algae noted in the 25 and 50 m distant areas. Coral colonization was scattered and limited, with 12 individual colonies recorded in the 50 m distant area. Species that are listed as management units (Magnuson-Stevens Fishery Conservation and Management Act, MSA 16 USC § 1801 et seq.) or as threatened or endangered (United States Endangered Species Act, ESA 16 USC § 1531 et seq.) were not observed.

2.2.2.1 Marine Vegetation

NOAA (2005) benthic habitat maps depict areas of sand sparsely colonized by sea grasses scattered amongst the bare sand within several hundred meters of the shoreline (Figure 10). The PDT (USACE 2022a) did not observe seagrass within the proposed proposed action area (Figures 3-5). NMFS (2023) observed scattered patches of seagrass and algae 82 ft away from the Proposed action area including the seagrasses *Enhalus acoroides*, *Halophila gaudichaudii*, and *Halodule uninervis*; and the macroalgae *Acanthopora spicifera*, *Avrainvillae spp.*, *Caulerpa filicoides*, *Caulerpa macrophysa*, *Caulerpa sertularioides*, *Dictyota spp.*, *Halimeda opuntia*, *Padina spp*, and *Sargassum vulgar*; but only sand within the proposed action area.

2.2.2.2 Marine Invertebrates and Associated Habitat

The living reef in East Hagatna (East Agana) Bay is 400 meters from the shoreline, based on Raymundo et al. (2022) mapping. Overall East Hagatna Bay has low community diversity and is dominated by stress-resilient *Porites spp.* (Raymundo et al. 2022). Scattered colonies of *Acropora muricata* and *A. cf. pulchra* colonies occurred amongst the *Porites spp.* No *Acropora globiceps* (listed as Threatened under ESA) have been observed (Raymundo et al. 2022, p.36, NMFS 2023a). The PDT (USACE 2022a) did not observe live coral within the proposed proposed action area (Figures 3-5). NMFS (2023a) observed bivalve *Pinna spp.* 82 feet from shore and octopus and the corals *Porites australiensis*, *Porites cylindrica*, and *Pocillopora damnicornis* 164 feet from shore.

2.2.2.3 Shore Birds

Shore birds are commonly seen foraging on the nearshore sand flats at East Hagatna Bay during early morning and late afternoon hours especially around the deltas which formed in front of the storm drains. The Pacific Reef Heron (*Egretta sacra*) is the only observed shore bird considered to be a resident species. The rest are migratory and present in the largest numbers from September to April (Jenkins 1983). The PDT (USACE 2022a) did not observe any birds within the proposed action area (Figures 3-5), though they were not there in the morning. GDAWR has recorded migratory shore birds passing through along the East Hagatna Bay coast between late August and early May (Quitugua 2022). Migratory bird surveys (Table 3) and incidental sightings (Table 4) for migratory seabirds were provided by GDAWR for the East Hagatna area (Duenas 2022).

Table 3: Migratory Shore Bird Survey Results. Source: GDAWR 2022.

Common Name	Species	2019	2020	2021	2022
White Tern	<i>Gygis alba</i>	30	No surveys due to covid restrictions		7
Pacific Reef Heron	<i>Egretta sacra</i>	1			2
Yellow Bittern	<i>Ixobrychus sinensis</i>	1			0
Common Sandpiper	<i>Actitis hypoleucos</i>	2			3

Table 4: Incidental Shore Bird Sightings (Collected Throughout the Year). Source: GDAWR 2022.

Common Name	Species	2019	2020	2021	2022
Pacific Reef Heron	<i>Egretta sacra</i>	1	2	0	3
Ruddy Turnstone	<i>Arenaria interpres</i>	0	0	6	0
Whimbrel	<i>Numenius phaeopus</i>	0	0	1	0
Common Sandpiper	<i>Actitis hypoleucos</i>	0	0	2	1

2.2.2.4 Marine Fish

Fish diversity and abundance are reportedly higher in the outer reef flat, decreasing as one moves closer to shore (USACE 1993). The PDT (USACE 2022a) did not observe any fish within the proposed proposed action area (Figures 3-5). NMFS (2023a) observed the fish *Canthigaster bennetti*, *Caranx spp.*, *Chaenopsidae spp.*, *Chromis viridis*, *Corythoichthys intestinalis*, *Dascyllus aruanus*, *Echidna nebulosa*, *Gerres oyena*, *Lethrinus harak*, *Mulloidichthys flavolineatus*, *Rhinecanthus aculeatus*, *Scolopsis lineata*, and *Siganus spinus* 82 feet from shore, and *Chlorurus sordidus*, *Labroides dimidiatus*, *Myripristis adusta*, *Myripristis kuntee*, and *Sargocentron spiniferum* were observed 164 feet from shore. No fish were observed in the proposed action area (NMFS 2023a).

This Project will have no effect on anadromous fish species; therefore the Anadromous Fish Conservation Act (16 USC §§757A-757G) does not apply.

2.2.2.5 Marine Mammals

All marine mammals are protected under Marine Mammal Protection Act (MMPA; 16 USC § 1361 et seq.), which prohibits takes of all marine mammals in the U.S. (including territorial seas) with few exceptions. 16 USC 1362 defines “take” as “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” No take or harassment of marine mammals are anticipated through the proposed project.

Marine Mammals have not been reported in East Hagatna Bay (USFWS 1992, USACE 1993, NMFS 2023a). Hagatna Bay is not a known haul out, breeding, or foraging location for marine mammals and no interactions are anticipated. The project will comply with this Act.

2.2.3 Threatened and Endangered Species and Critical Habitat

Section 7 of the ESA requires each federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of critical habitat for such species. Federal agencies are further required to consult with the appropriate federal agency, either the USFWS or NOAA-NMFS, for federal actions that “may affect” a listed species or adversely modify critical habitat. Federal agencies must use the best available scientific and commercial data when making an effect determination relating to the impact of their actions.

The USFWS Pacific Islands Fish and Wildlife Office (PIFWO) and the NMFS Pacific Islands Regional Office (PIRO) are the federal regulatory agencies that oversee

consultations for compliance with the ESA in Guam. The NMFS and USFWS share jurisdiction for recovery and conservation of sea turtles listed under the ESA. NMFS leads the conservation and recovery of sea turtles in the marine environment and USFWS leads the conservation and recovery of sea turtles on nesting. A Memorandum of Understanding outlines the specific roles of each agency.

The GDAWR is the territorial agency responsible for managing and preserving the marine and wildlife resources in Guam. GDAWR also distributes hunting regulations that control the taking of various wildlife species, including fruit bats and native birds.

USACE requested initial technical assistance from USFWS and NMFS on March 15, 2022, and received a list of species listed or proposed for listing under both NMFS and USFWS jurisdiction that may be present on or in the vicinity of the proposed project location, as well as confirmation that there is no designated or proposed federally designated critical habitat occurring within the immediate vicinity of the proposed action area (Attachment 2).

Threatened and endangered species which may occur within the Action Area are listed in Table 5. There are no known turtle nesting sites in the Action Area, but turtles may be foraging (Flores 2022). The PDT did not observe any threatened or endangered species in the park during their visit (USACE 2022a). NMFS (2023a; Appendix A-3 Attachment 1h) did not observe any species that are listed as threatened or endangered (ESA, 16 USC § 1531 et seq.) during the surveys. There is no designated critical habitat in the Action Area or its vicinity, though critical habitat is proposed for both *Acropora globiceps* and Green sea turtle (NMFS 2023a).

GDAWR has reported Mariana fruit bat (*Pteropus mariannus mariannus*) passing through the area in early morning (dawn) most likely returning to a roost, and at dusk leaving a roost. The roosts are most likely north of East Hagatna along the limestone cliff (Flores 2022). For this specific site on East Hagatna, GDAWR has seen fruit bats on the breadfruit trees along the cliff wall, roosting and foraging during breadfruit season between 2010 and 2013 (Quitugua 2022).

During surveys in 1992 USFWS recorded nine species of coral on the inner reef flat at the proposed project site. NMFS (2023a) surveys of the Action Area found that coral colonization was scattered and limited, with 12 individual colonies recorded 50m from shore, and none of them were *Acropora globiceps*.

Although Green Sea Turtles (*Chelonia mydas*) nest on Guam beaches, and a portion of the project area is designated critical habitat, nesting normally occurs at relatively isolated locations far away from the Action Area (USFWS 1992). Green Sea Turtles have previously been observed foraging in the water and on the beach in East Hagatna Bay, but they have not been observed to nest on East Hagatna Bay beaches (Flores 2022). A NMFS sea turtle tagging project from 2014 through 2019 did not tag or observe any hawksbill or Green Sea Turtles in East Hagatna Bay (Gaos et al. 2021). Given the above, it is unlikely that the Green Sea Turtle will enter the Action Area.

Table 5: ESA-Listed Species Potentially Affected by the Proposed Action

Common Name	Scientific Name	Status	Critical Habitat	Jurisdiction	Observed in Action Area	Effects Determination
Marine Invertebrates						
Giant Clam	<i>Tridacna derasa</i> <i>Tridacna squamosa</i> <i>Tridacna gigas</i> <i>Hippopus hippopus</i>	Proposed for Listing in 2024	No	NMFS	No	No Effect
small-polyp stony coral	<i>Acropora globiceps</i> **	Threatened	Proposed 11/27/2020 85 FR 76262	NMFS	No	NLAA
Sea Turtles						
Green sea turtle, Central South Pacific Distinct Population Segment (DPS)	<i>Chelonia mydas</i>	Endangered	Proposed 07/19/2023 88 FR 46572	NMFS in ocean USFWS on land	No	NLAA
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	No	NMFS in ocean USFWS on land	No	NLAA
Slevin's Skink	<i>Emoia slevini</i>	Endangered	No	USFWS	No	No Effect
Terrestrial Invertebrates						
Humped tree snail, akaleha'	<i>Partula gibba</i>	Endangered	No	USFWS	No	NLAA
Guam tree snail, akaleha'	<i>Partula radiolata</i>	Endangered	No	USFWS	No	NLAA
Fragile tree snail, akaleha'	<i>Samoana fragilis</i>	Endangered	No	USFWS	No	NLAA
Terrestrial Mammals						
Mariana Fruit Bat	<i>Pteropus mariannus mariannus</i>	Threatened	Not in Action Area 10/28/2004 69 FR 62944	USFWS	No	No Effect
Birds						
Guam Kingfisher	<i>Todiramphus cinnamominus</i>	Endangered	Not in Action Area	USFWS		
Guam Rail	<i>Gallirallus owstoni</i>	Endangered	No	USFWS		
Short-tailed Albatross	<i>Phoebastria (=Diomedea) albatrus</i>	Endangered	No	USFWS		

Hawksbill Sea Turtles (*Eretmochelys imbricata*) have not been reported in the Bay. A NMFS sea turtle tagging project from 2014 through 2019 did not tag or observe any Hawksbill or Green Sea Turtles in East Hagatna Bay (Gaos et al. 2021). Given the above, it is unlikely that the Hawksbill Sea Turtle will enter the Action Area.

According to USFWS Guam Office, Slevin's Skink is only found on Cocos Island, well outside of the Proposed Action Area.

Tree snails prefer dense moist forests and are not expected to be found in the sparsely vegetated Action Area (Fiedler personal communication 2024), however individuals have been found in vegetation along roadsides and beaches since Typhoon Mawar and USFWS has requested site surveys before construction to ensure none are present (Appendix A-4, Attachment 2f). USFWS considers tree snail surveys to be good for 6 months or until the next high wind and heavy precipitation event, whichever is sooner, therefore surveys will occur just prior to construction.

Guam DAWR reported no sightings of Guam Kingfisher, Guam Rail, or Short-tailed albatross in the proposed action area. Guam Rail is only found on Cocos Island and in captivity. Guam kingfisher is only found in captivity. The short-tailed albatross does not breed on Guam and has not been reported along East Hagatna.

There are no State designated endangered species on Guam.

2.2.4 Essential Fish Habitat (EFH)

The proposed action area consists of Essential Fish Habitat (EFH) designated for the federally managed fisheries/species of the Marianas Bottomfish and Pelagic Fisheries (Table 6; NMFS 2021). EFH is defined in the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 USC § 1801 et seq.) as, "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity..." Textual descriptions of the fisheries, managed species and their designated EFH occurring within the proposed action area are published in the Fishery Ecosystem Plan (FEP) for the Mariana Archipelago and the Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region, respectively (WPRFMC 2009 a & b). These place-based FEPs replaced the former Fishery Management Plans.

The Marianas Archipelago Fishery includes the following Management Unit Species (MUS): Mariana Bottomfish MUS, listed in Table 6: Mariana bottom fish EFH management unit species (WPFMC 2018). FEP Amendment 5 (WPRFMC 2018) reclassified the Crustacean and Coral Reef MUS to Ecosystem Component Species (ECS).

Table 6: Mariana Bottom Fish EFH Management Unit Species (Wpfmc 2018)

Local name	English common name	Scientific name
lehi/maroobw	red snapper, silvermouth	<i>Aphareus rutilans</i>
tarakitu/etam	giant trevally, jack	<i>Caranx ignobilis</i>
tarakiton attelong, orong	black trevally, jack	<i>Caranx lugubris</i>
bueli, bwele	lunartail grouper	<i>Variola louti</i>
buninas agaga', falaghal, moroobw	red snapper	<i>Etelis carbunculus</i>

abuninas, taighulupegh	red snapper	<i>Etelis coruscans</i>
mafuti, atigh	redgill emperor	<i>Lethrinus rubrioperculatus</i>
funai, saas	blueline snapper	<i>Lutjanus kasmira</i>
buninas, falaghal-marooBW	yellowtail snapper	<i>Pristipomoides auricilla</i>
buninas, pakapaka, falaghal-marooBW, pakapaka	pink snapper	<i>Pristipomoides filamentosus</i>
buninas, falaghal-marooBW	yelloweye snapper	<i>Pristipomoides flavipinnis</i>
buninas, falaghal-marooBWmarooBW	pink snapper	<i>Pristipomoides seiboldii</i>
buninas rayao amariyu, falaghal-marooBW	flower snapper	<i>Pristipomoides zonatus</i>

The marine portion of the proposed action area is inclusive of the EFH action area, which includes the footprint of the existing seawall (as depicted in Figure 16) and 2.5 ft down to the limestone subgrade (Figure 15), and encompasses EFH designated for both Mariana Bottomfish and Pelagic MUS (Table 6; NMFS 2021). No Habitat Areas of Particular Concern (HAPC) are identified in the proposed action area (NMFS 2021). The nearshore region in east Hagatna is designated as level 1 essential fish habitat (i.e., based simply on the “geographic range of a species [or life stage]”; 50 CFR Part 600 Subpart J; WPRFMC, 2009, (NMFS 2023a).

EFH is designated for each of the above species, however, collectively, the combined EFH for Mariana Bottomfish MUS is the water column from the shoreline to the Exclusive Economic Zone (EEZ, 200 nautical miles from shore), from the surface to 1,000 meters in depth; and all bottom habitat from the shoreline to a depth of 400 meters. The combined EFH for the Pelagics MUS is the water column down to a depth of 200 meters from the shoreline to the outer limit of the EEZ for egg and larval life stage and the water column down to a depth of 1,000 meters for juvenile and adult pelagic fishery species.

Specific bottom habitats and ecosystems comprising EFH in the Mariana Archipelago are listed in Table 7. There are intertidal habitats, seagrass beds, coral and patch reefs and hard, artificial and soft substrates within the EFH action area. There are no mangrove forests, lagoons, estuaries, surge zones, deep reef slopes, banks or seamounts, deep ocean, or pelagic ecosystems within the EFH action area. These EFH habitats are not discussed or considered further in this analysis.

Table 7: Bottom Habitat and Ecosystems Comprising EFH Designations for the Marianas Bottomfish and Pelagic MUS Within EFH Action Area (WPRFMC 2005 a & b).

Bottom Habitat/Ecosystem	Present in EFH Action Area
Intertidal	Yes
Mangrove forest	No
Seagrass bed	No
Coral and Patch Reefs	No
Hard, Artificial, and Soft Substrates	Yes
Lagoon	No
Estuarine	No
Surge Zone	No

Bottom Habitat/Ecosystem	Present in EFH Action Area
Deep reef slopes, banks, and seamounts	No
Deep ocean and pelagic ecosystems	No

While Guam-based management unit species were not observed during NMFS surveys in 2022, regional use may occur by the various species and life-stages (NMFS 2023a, Attachment 1h Appendix A-3).

The habitat within the EFH Action Area is a narrow, highly variable intertidal strand of sand, coral rubble, gravel, and rock, supporting no obvious aquatic communities. NMFS surveys in November 2022 confirmed previous observations (USFWS 1992, NOAA 2005) that the intertidal region within 20 ft of the wall is predominantly sand and does not contain live coral, other macroinvertebrates, seagrasses or fish. Sparse seagrass, macroalgae and fish occur beyond 20 ft from the existing seawall where the depth reaches 3 ft. The depth is shallow, approximately 3 ft, for several hundred feet from the existing seawall (NMFS 2023).

The NMFS Pacific Islands Regional PIRO is the federal regulatory agency responsible for consultation under the MSA, including the EFH provision (Section 305(b)(2) as described by 50 CFR 600.920). The complete EFH consultations are Attachment 3 to Appendix A-3 Environmental.

2.2.5 Invasive Species

EO 13112 defines an “invasive species” as a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Invasive species of concern identified for Guam include African tulip tree (*Spathodea campanulate*), Coral Vine (*Antigonon leptopus*), Mile-a-minute Vine (*Mikania micrantha*), Cycad Aulacaspis Scale (*Aulacaspis yasumatsui*), Tångantångan (*Leucaena leucocephala*), Angel Hair Alga (*Chaetomorpha vieillardii*), cycad blue butterfly (*Chilades pandava*), cycad moth (*Erechthias sp.*), Little fire ant (*Wasmannia auropunctata*), Greater Banded Hornet (*Vespa tropica*), Giant African Land Snail (*Achatina fulica*), New Guinea flatworm (*Platydemus manokwari*), Coconut rhinoceros beetle (*Oryctes rhinoceros*), and Banana Bunchy Top Virus (*Babuvirus*) (University of Guam 2019). None of these species were observed in the proposed action area during the PDT site visit in January 2022 (USACE 2022a).

2.3 Built Environment

2.3.1 Navigation

Due to its shallow depth (3 ft or less; NMFS 2023a) and lack of developed entrance channel, navigation in East Hagatna Bay is limited to shallow draft personal watercraft such as jet skis and canoes. The closest federal navigation channel is in Agana Small Boat Harbor (Figures 6 and 7).

2.3.2 Land Use, Utilities, and Public Infrastructure

The proposed action area includes the Veteran's Sunset Beach Park and Trinchera Beach Park, operated by the Guam Department of Parks and Recreation. The 2021 Hagatna Master Plan defines the proposed action area as part of the Padre Jose Palomo Barrio containing the Cormoran Monument, Jose Bernardo Torres Palom Statue, and US Navy Fortification historic and cultural sites; the Eastern Waterfront Subarea of the Hagatna Waterfront District and has designated land use in the Proposed action area as Park and Open Space. The Eastern Waterfront Subarea is not one of the three focus areas for redevelopment within the Waterfront District. Park and Open Space land use focuses on enhancing recreational opportunities and providing links between Hagatna's parks and open spaces, providing park and open space to neighborhoods, surrounding historical and cultural sites, and along the shoreline. Only structures supporting the park / open space are permitted in this land use designation. The project proposed action area is owned by the Government of Guam (HRRA 2021).

Utilities include a 16-inch iron pipe water line on the landside; a 30-inch sewer line and manholes every 300 feet on the ocean side; a 24 strand, a 200 pair and a 300 pair underground telephone cable on the landside; a 100, 200-pair, and a 900-pair underground Navy telephone cable (manholes every 500 fee. No stormwater lines run parallel to the ocean along this stretch of highway, but there are 5 culverts that run under the highway to drain the landside.

On the seaward side of South Marine Corps Drive within the proposed action area there is insufficient fast land for commercial or residential development typical of adjacent areas to the east and west. The Veteran's Sunset Beach Park and Trinchera Beach Park include a picnic area, with two open pavilions, a parking lot, and stone steps down to the beach. Access to this public park is provided via South Marine Corps Drive. There is limited off road parking. The parks are used regularly by residents for social gatherings, usually picnics, and for cooperative reef flat fishing. Existing facilities include off-road parking, a low concrete-rubble-masonry seawall, three shelters, and numerous concrete tables and benches (see Figures 3-5).

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 USC §4601 et seq.) ensures that owners of real property to be acquired for Federal and federally assisted projects are treated fairly and consistently and that persons displaced as a direct result of such acquisition will not suffer disproportionate injuries because of projects designed for the benefit of the public as a whole. This Project does not involve real property acquisition and/or displacement of property owners or tenants. Therefore, this Act is not applicable.

No prime or unique farmland will be affected by implementation of this project; therefore, the Farmland Protection Policy Act of 1981 (7 USC §4201 et seq.) is not applicable.

2.3.3 Traffic and Circulation

South Marine Corps Drive is a major thoroughfare for central Guam, serving an estimated 54,828 vehicle trips a day. Loss of the road, even temporarily for repairs, would impact traffic.

2.4 Socio-Economic Environment

2.4.1 Socio-Economic Conditions

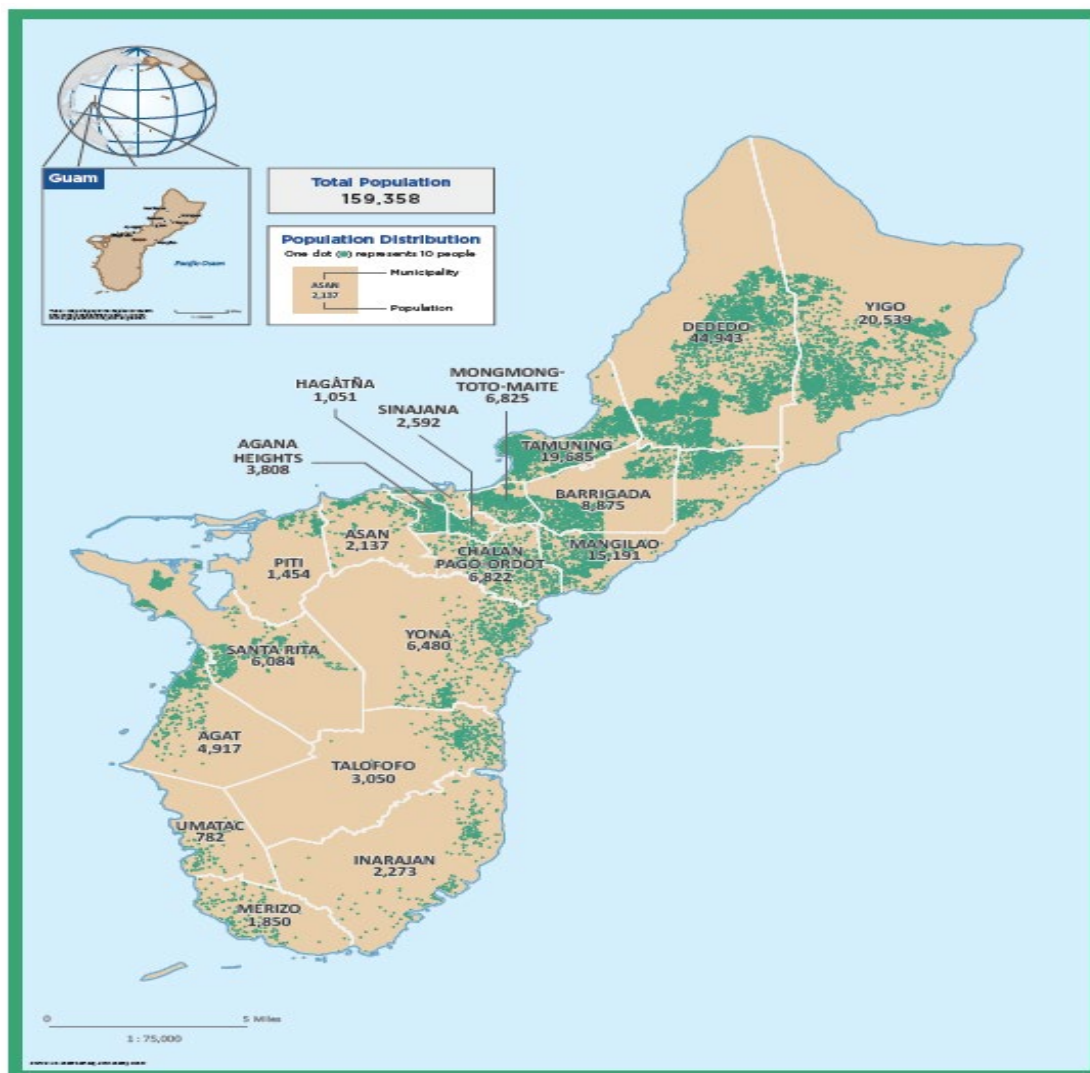


Figure 11: Population Distribution of Guam. Source: U.S. Census Bureau, 2010 Census: Understanding the Population of Guam

The 2020 Census estimates the census-designated place (CDP) Hagatna population as 943, a decrease of 3.5% from the previous decennial census estimates (Figure 11). However, since South Marine Corps Drive serves the broader population of the entire island, the unit of analysis for this section is the entire island of Guam. The 2020 Census estimates the population of Guam at approximately 154,000. The Northern portion of Guam, where the terrain lends itself more easily to development, sees population distributed generally across the landscape, whereas the more mountainous southern half of Guam sees population and development more concentrated near the coastlines.

Census data from the Guam Bureau of Statistics and Plans and the US Census Bureau indicate that the most prominent race or ethnicity in Guam is Native Hawaiian or Other Pacific Islander (49%), 75% of which are Chamorro. This group is followed by Asian (32%), multi-racial groups (9%), White (7%), Black (1%), and Hispanic or Latino (1%).

The economy of Guam is strongly tied to 2 sectors that predominately contribute to Guam's economic activity: Federal Government, including Military, and Tourism. The Bureau of Economic Analysis (BEA 2022), released the Gross Domestic Product (GDP) for Guam for 2021, showing an increase of 1.1% from 2020 after a decrease of 11.4% from 2019. There was a decrease in exports and consumer spending and increases in private fixed investment, federal government spending, and imports. Spending by tourists increased by 15.6% because of the increased number of Korean and Japanese tourists. Consumer spending increased on goods and services attributable to health care services and retail trade. Guam expected to see an increase in cruise ship activity that would bring ships onto the island to stimulate the economy because of the new Hotel Wharf rehabilitation project.

As of March 2019, there were 65,220 individuals that were employed according to the Current Employment Survey (CES) conducted by the Guam Department of Labor-Bureau of Labor Statistics (BLS 2019). There was also an increase in total employment from 2018 to 2019 of +0.52% and an unemployment rate of- 4.3%. The Government of Guam receives most of their revenue from taxes such as Income Tax, Gross Receipts or Business Privilege Tax, Federal Income Taxes, and other taxes. In 2019, there was a decrease in income tax revenue because of the Tax Cut and Jobs Act (UOG 2020). This policy reduced tax rates dramatically and therefore decreased the amount of revenue received by the Government of Guam.

The military presence in Guam is substantial with plans to further increase its population via relocation of Marines from the U.S. Marine Corps Futenma Air Station on Okinawa to Guam. This relocation is currently delayed due to higher-than-expected relocation costs. There are economic advantages and disadvantages that come with the relocation of the Marines. The advantages are that there may be a chance to create new jobs, new small businesses, new tax revenues, and an increase in spending. Disadvantages include possible social impacts that come with large population shifts such as sufficient housing and public utilities, infrastructure, and resources to facilitate the incoming population of about 35,000 people (GHURA 2009).

Table 8: Demographic Information by Census Tract Number

Census Tract	66010955900	66010953400
Population	3,699	1,051
Race / Ethnicity		
White	19%	6%
Black or African American	2%	0%
Asian	43%	22%
Native Hawaiian or Pacific Islander	30%	67%
Other	1%	0%
Hispanic or Latino	2%	1%
Identified as disadvantaged?	NO , this tract is not considered disadvantaged. It does not meet any burden thresholds OR at least	NO , this tract is not considered disadvantaged. It does not meet any burden thresholds OR at least

Census Tract	66010955900	66010953400
	one associated socioeconomic threshold.	one associated socioeconomic threshold.
Workforce Development		
Low median income , Comparison of median income in the tract to median incomes in the area	15th , not above 90 th percentile	87th , not above 90 th percentile
Unemployment , Number of unemployed people as a part of the labor force	39th , not above 90 th percentile	77th , not above 90 th percentile
Poverty , Share of people in households where income is at or below 100% of the Federal poverty level	56th , not above 90 th percentile	89th , not above 90 th percentile
High school education , Percent of people ages 25 years or older whose high school education is less than a high school diploma	22%, above 10% percent	33%, above 10% percent

9 out of 57 census tracts in Guam as economically disadvantaged, including two census tracts in close proximity to, but not actually in, the proposed action area. However, all US territories, including Guam, are considered economically disadvantaged by USACE (USACE 2023b). Therefore, the proposed action area is considered economically disadvantaged.

2.4.2 Cultural Traditions and Subsistence Activities

The proposed action area is an important local talaya (hand-net casting) fishery. Presently, the bay recreational areas (the beach, inner reef flat or moat, and the raised outer reef flat) are used regularly by residents for social gatherings, usually picnics, for talaya fishing, and for cooperative reef flat fishing. Fishing for the family table is an important cultural tradition in Guam, and subsistence fish species provide a culturally significant source of food at fiestas, funerals, marriages, and christenings. During the atulai and manahak fish runs, a hundred or more families camp for several days along East Hagatna Bay beach parks to be near to and enjoy the traditional cooperative fishing activity (USACE 1993).

East Hagatna Bay is heavily used by local fishermen during the manahak runs. Community members have indicated the importance of the proposed action area for subsistence use access throughout the year, especially for traditional talaya fishing which is conducted by walking along the shoreline.

2.4.3 Aesthetics

The view of the bay and ocean beyond the fringing reef is presently unobstructed along the reach of South Marine Corps Drive within the proposed action area. The coastal strand is landscaped with coconut palms and other ornamental coastal trees. Much of the area is grassed or covered with beach morning glory. The overall effect is a very pleasing visually aesthetic view. The public perception of the scenic value of this view plane was clearly demonstrated during the construction of the Alupang Beach Tower

Condominium on the eastern end of the proposed action area. A concrete seawall built along the 300 foot strip park, which was part of the project, blocked the view of the ocean from passing motorists. Public reaction was intense enough to cause the developer to shorten the height of the wall so that the view of the ocean would not be obstructed (USACE 1993). The current seawall is level with the ground of Trinchera Beach Park (see Figure 4), which is roughly level with the pavement of South Marine Corps Drive (see Figure 12).



Figure 12: Relative elevation of current seawall and South Marine Corps Drive at Trinchera Beach Park. Photo by USACE staff taken on January 14, 2022.

2.5 Historical and Archaeological Resources

The island of Guam was first occupied more than 3,500 years ago by ancestors of the Chamorro people. The history of Guam is broadly divided into six periods: Pre-Latte, Latte, Spanish, First American, Japanese Occupation, and Second American (see Table 8). The dominant archaeological site type associated with the Pre-Latte Period consists of subsurface cultural layers at coastal lowlands and elevated coastal terraces. The principal artifact type associated with these sites is a thin-walled, red-slipped ceramic referred to as Marianas Redware. The Latte Period is characterized by latte architecture; a configuration of two parallel rows of stone shafts (haligi) supporting bowl-shaped capstones (tasa). The foundation of these latte sets supported raised residential structures. Archaeological sites dating to this period are found in both coastal areas and

further inland. In addition to latte architecture, the principal artifact type associated with these sites is a thicker style of ceramic known as Marianas Plainware (Watanabe 1994; Hunter-Anderson et al. 2006; Amesbury et al. 2015).

Table 9: General Chronological Historic Context of Guam.

Date Range	GHPI Cultural Periods	Broad Periods
1500 – 1000 BCE	Early Pre-Latte Period	Pre-Latte Period
1000 – 500 BCE	Middle Pre-Latte Period	
500 BCE – 500 CE	Late Pre-Latte Period	
500 – 800 CE	Transitional Period	
800 – 1100 CE	Early Latte Period	Latte Period
1100 – 1350 CE	Middle Latte Period	
1350 – 1521 CE	Late Latte Period	
1521 – 1668 CE	Pre-Colonial European Trade Period	Spanish Period
1668 – 1700 CE	Spanish Missionization Period	
1700 – 1898 CE	Spanish Colonial Period	
1898 – 1941 CE	First American Territorial Period	First American Period
1941 – 1944 CE	WWII Japanese Military Occupation	Japanese Occupation Period
1944 – 1950 CE	Second American Territorial Period	Second American Period
1950 CE – Present	Organic Act / Home Rule Period	

The Spanish Period began with the arrival and departure of Ferdinand Magellan at Guam in 1521 Common Era (CE), although Spain did not formally take possession of Guam until 1565 and did not establish a military or religious presence on the island until the late 1660s. An important cultural event during this period was the immigration of people from the Caroline Islands to the Mariana Islands in the 1800s. The First American Period began when the U. S. acquired Guam from Spain through the terms of the Treaty of Paris in 1898 and ended with the surrender of the American governor to invading Imperial Japanese armed forces on December 10, 1941. The Japanese Occupation Period spans most of World War II, terminating with the cessation of organized Imperial Japanese armed forces resistance on August 15, 1944. The Second American Period began with the reoccupation of Guam by American armed forces and continues to present day. Guam residents were declared citizens of the United States of America in the Organic Act of 1950, and a civilian government was established. In the 1970s, Federal historic preservation laws were found to be applicable to Guam (Watanabe 1994; Hunter-Anderson et al. 2006; Amesbury et al. 2015).

When the Spanish first anchored in East Hagatna Bay in 1668, Hagatna was one of the principal villages on Guam. Although the Spanish missionaries were initially welcomed by the Chamorro and given land on which to build their church, this relationship did not last. The island's first foreign military installation, thought to have been constructed near the beach in Hagatna, was completed in 1683 (Walth et al. 2016). During the Spanish-Chamorro Wars, the Chamorro built a stone wall from the cliff edge to the water in the vicinity of Trinchera Beach. However, by the early 1700s the East Hagatna Bay area had been abandoned due to population reduction (Moore et al. 1988; Davis 1990). In the early 1800s, immigrant Carolinians were allowed to settle in the area. Occupation of this new community, referred to as Tamuning, began in 1816. In 1884, the Spanish created a settlement in Tamuning called Maria Cristina where they consolidated all the Carolinians dispersed across the island. In 1901, the Carolinians were expelled from Guam by the Americans (Moore et al. 1988).

During the Japanese invasion of Guam in World War II, the Japanese Special Naval Landing Force boarded six landing craft in Hagatna Bay to come ashore at Dungcas Beach on December 10, 1941. Guam was the first American territory captured during the war. The Japanese created a roadblock at the narrowest point of the beach road between Dungcas Beach and Agana, likely near Trinchera Beach. Agana was recaptured by the U.S. military on July 31, 1944, as they pushed northward to the Tiyan Airfield (Denfeld 1997).

Previous archaeological investigations in the general vicinity of the proposed action area, including the excavations conducted in the 1920s by Hans Hornbostel on behalf of the Bernice P. Bishop Museum of Hawai'i, have recovered evidence of extensive occupation during the Latte Period. Cultural materials dating to the Pre-Latte Period have also been identified (Hunter-Anderson et al. 2006; Amesbury et al. 2015). Walth et al. (2016:215) reviewed radiocarbon dates collected from multiple archaeological investigations and determined that 14% of the archaeological sites in East Hagatna Bay date to the Pre-Latte Period, 62% date to the Latte Period, and 24% date to the Spanish/First American Period.

Most of the archaeological investigations conducted in the area were undertaken in association with construction projects, including road work (Moore et al. 1988; Amesbury et al. 1991; Walth et al. 2016) and building developments (Brown and Haun 1989; Amesbury et al. 1990; Davis 1990; Haun et al. 1990; Olmo 1997, 1999; Beardsley 2003; Hunter-Anderson et al. 2006; Amesbury et al. 2015). USACE has previously conducted limited archaeological investigations in association with feasibility studies in both the general area (Pangelinan and Price 1986; Cordy and Allen 1988) and along Trinchera Beach (Watanable 1994). More recent archaeological investigations, for which reports have not yet been finalized, include sewer line installations and cell phone tower installations; burials were identified at multiple locations (J. M. Joseph, pers. comm. 2022).

3 PLAN FORMULATION

This chapter presents results of the third step of the six-step planning process: Formulation of alternative plans. This section will outline the evolution of the screening process from identification of management measures to development of an initial array of alternatives, through the initial screening process, and then to the refinement of a final array of alternatives.

3.1 Planning Framework

Plan formulation is the process of building alternative plans that meet planning objectives and avoid planning constraints to the extent practicable. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. Alternatives were developed in consideration of proposed action area problems and opportunities as well as study objectives and constraints.

3.2 Management Measures and Screening

3.2.1 Management Measures

As part of the planning process, the PDT, in coordination with the NFS and interested stakeholders, developed a series of measures to consider as potential elements of the study solution. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. Measures may be structural or non-structural.

The PDT identified structural measures that would either decrease the level of shoreline erosion or reduce coastal risks associated with wave damage and flooding. Traditional shoreline protection and coastal storm risk reduction structural measures include levees, storm surge barrier gates, seawalls, revetments, groins, and nearshore breakwaters. The PDT also identified nonstructural measures that would reduce the consequences of coastal erosion to the threatened facility (South Marine Corps Drive) rather than trying to reduce the probability that facilities are threatened by coastal erosion. Traditional non-structural measures that address shoreline erosion and coastal storm risk at coastal beach fronts include piles, relocation, and acquisition.

Natural and nature-based features (NNBF) are measures that mimic the characteristics of natural features but are created by human design, engineering, and construction. Examples of NNBF that provide coastal risk reduction include dunes and beaches, vegetated offshore islands, oyster and coral reefs, barrier islands, and maritime forests.

The PDT reviewed the above traditionally applied measures and identified the following structural, non-structural and NNBF measures that were most likely to meet the study objectives. Measures consisting of new in-water construction such as breakwaters and groins were not included in the initial list of measures due to the high costs (permitting, design and construction) and substantially greater environmental impacts typically associated with new in-water construction.

Structural Measures:

- Rock revetment – generally consists of a graded slope protected by an underlayer of medium-sized stones and a top layer of heavier armor stones.
- Tri-bar revetment- constructed similarly to the rock revetment but comprised of engineered concrete armor units rather than armor stones. These structures are often considered when locally sourced armor stones are not available.
- Concrete seawall – consists of vertical precast concrete panels set onto bedrock and backfilled.
- Concrete Rubble Masonry (CRM) Wall – involves constructing a concrete rubble masonry wall on top of an engineered foundation
- Secant pile wall - involves drilling overlapping concrete columns to form a barrier.
- Permeation grouting- consists of injecting a flowable grout into granulated soils conditions to fill cracks or voids and form a solid cemented mass.

Non-Structural Measures

- Relocation of South Marine Corps Drive – involves the relocation or retreat of South Marine Corps Drive and buried utilities inland to avoid coastal storm damages.

NNBF Measures

- Beach fill – consists of introducing locally sourced or imported beach sand material to engineer and build up the existing beach to dissipate wave energy. This measure would require periodic beach renourishment to mitigate ongoing erosion and other natural processes.

3.2.2 Screening Management Measures

Screening is the process of eliminating those measures that will not be carried forward for consideration. To meet study objectives, each of the structural and non-structural measures were individually evaluated based on a qualitative assessment of the following criteria:

- Is the measure likely to be effective at providing shoreline protection over the 50-year period of analysis?
- Is the measure likely to be the least cost in comparison to other measures with similar effectiveness?
- Is the measure likely to be environmentally acceptable based on available information?
- Is the measure technically feasible?

Parametric cost estimates and initial agency feedback were used to assist with the screening process. Table 9 lists the initial array of alternatives and summarizes the screening of management measures.

Table 10: Screening of Management Measures

Management Measure	Carried Forward (Y/N)	Reason Not Carried Forward
Structural Measures		
Rock Revetment	Y	N/A
Tribar Revetment	Y	N/A
Concrete Seawall	Y	N/A
CRM Wall	Y	N/A
Secant pile wall	Y	N/A
Permeation Grouting	Y	N/A
Natural and Nature-Based Measures		
Beach Fill	N	Renourishment needed for measure performance not feasible under CAP Section 14
Nonstructural Measures		
Relocation of South Marine Corps Drive	N*	Costs too high; *Retained as a reference for plan formulation and selection.

All measures except for road relocation and beach fill were carried forward to the initial array of alternatives. For those measures not carried forward, a summary of the measure's performance under the screening criteria is included below:

- Relocation of South Marine Corps Drive – There is insufficient land area to the east of South Marine Corps Drive to relocate the roadway and associated buried utilities inland to avoid coastal storm damages. The construction contract costs to relocate a 4-lane highway (South Marine Corps Drive) inland is approximately \$13.2 million per mile for an anticipated 5-mile road. This cost was derived by taking the cost estimate for road relocation from the 2019 East Hagatna Emergency Shoreline Protection FID report of \$9.6 million per mile and escalating to FY24 price levels. The 2019 FID estimate was derived using bid data from the Route 33 improvement project in Guam. This cost does not include the additional land acquisition and utility relocation costs. Relocating the road would likely have a higher environmental impact on terrestrial resources due to construction of the new roadway. In addition, relocation would not be considered an acceptable alternative. The non-federal sponsor has indicated that relocation of the road is not a feasible option due to the importance of the highway to not only the locals, but also to the military (see Section 1.6.1). For these reasons, relocation of South Marine Corps Drive was screened out from further evaluation. The estimated cost for road relocation will be used as a point of comparison to identify the least cost alternative and TSP.
- Beach fill – From an engineering standpoint, due to the level of storm surge and wave heights in the proposed action area as well as the topography of the existing bay, beach fill as a stand-alone is considered inadequate and would be considered a temporary fix. Beach fill has the potential to be effective in combination with other structural measures. However, local availability of suitable beach fill material is limited, so this measure would be extremely costly to implement and maintain. More importantly, renourishment is not covered under the Section 14 authority, therefore, regular renourishment to maintain the

effectiveness of the structure would be a non-Federal responsibility. For these reasons, beach fill was screened from further consideration.

3.3 Initial Array of Alternatives

Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. An initial array of alternative plans was formulated by combining retained management measures. The initial array of alternatives includes the following:

- Alt 1: No Action
- Alt 2: Revetment (rock or tribar)
- Alt 3: Precast Concrete Seawall
- Alt 4: Concrete Rubble Masonry (CRM) Wall
- Alt 5: Secant Pile Wall
- Alt 6: Permeation Grouting

The initial array of alternatives was screened using the following criteria:

- Is the alternative likely to be cost effective in providing shoreline protection?
- Does the alternative require special equipment, material, or expertise that is not available in Guam?
- Does the alternative meet USACE design life requirements, including the consideration of 100 years of sea level change?
- Is the alternative likely to be environmentally acceptable?

Table 10 summarizes the screening of the initial array of alternative plans. Parametric cost estimates and concept designs were used to screen the initial array of alternatives.

Table 11: Screening of Initial Array of Alternatives

Alternative	Likely to be Cost Effective?	Special Equipment Required?	Meets USACE Design Requirements?	Likely to be Environmentally Acceptable?	Carried Forward
Alternative 1: No Action	N/A	N/A	N/A	N/A	Yes
Alternative 2: Revetment (rock or tribar)	Yes	No	Yes	Yes	Yes
Alternative 3: Precast Concrete Seawall	Yes	No	Yes	Yes	Yes
Alternative 4: Concrete Rubble Masonry (CRM) Wall	Yes	No	Yes	Yes	Yes
Alt 5: Secant Pile Wall	No	Yes	Yes	Yes	No

Alternative	Likely to be Cost Effective?	Special Equipment Required?	Meets USACE Design Requirements?	Likely to be Environmentally Acceptable?	Carried Forward
Alt 6: Permeation Grouting	Yes	Yes	No	Yes	No

Alternative 2 consists of either a rock or tribar revetment. Both measures have similar function and environmental impacts. At this stage in the planning process due to the cost variability, both were carried forward for further analysis. Material sourcing and availability will play a major factor in refinement of cost estimates. Tribar allows for the use of concrete armor units as an optimization if locally sourced armor stone is unavailable or too expensive to meet project budget requirements. Should an optimization be needed based on armor stone availability or cost, it would likely be incorporated during the D&I phase.

The vertical seawall alternatives include Alternative 3: Precast Concrete Seawall, Alternative 4: Concrete Masonry Rubble (CRM) Wall, and Alternative 5: Secant Pile Wall. All three have a similar effectiveness in providing coastal erosion protection. All three also have a similar real estate footprint and wave reflection for environmental considerations. Out of the three alternatives, the secant pile wall was assessed to have the highest costs because mobilization of specialized equipment and labor are required for the alternative. For this reason, the secant pile wall was screened out from further evaluation.

Alternative 6: Permeation Grouting functions to supplement the existing seawall, so the general footprint is similar to the other vertical wall options. However, from an engineering standpoint, this alternative is not as effective as the other vertical wall alternatives. Permeation grouting includes injecting chemical grout under pressure to harden granular soils both underneath and behind the existing seawall. For this, specialized equipment and material need to be mobilized, therefore increasing the costs for this alternative. In addition, permeation grouting is typically implemented to provide temporary support, so it has a low likelihood of meeting the USACE 50-year design life requirement. For these reasons, Alternative 6 was screened from further consideration.

3.4 Final Array of Alternatives

Based on the rationale and findings noted in Section 3.3, the Final Array of Alternatives were developed. The final array of alternatives include:

- Alternative 1: No Action Alternative
- Alternative 2: Revetment
- Alternative 3: Precast Concrete Seawall
- Alternative 4: Concrete Rubble Masonry (CRM) Wall

All alternatives in the final array, except for the No Action Alternative, include removing 1,630 lf of the existing seawall from (east end) 13.480339N, 144.768446E to (west end) 13.478478N, 144.762843E along South Marine Corps Drive and replacing it with a hardened shoreline structure that ties into the limestone shelf.

3.4.1 No Action Alternative

Under Alternative 1, no federal actions for emergency shoreline protection would be implemented. Conditions in the proposed action area are anticipated to develop as described in the FWOP condition (Section 2). More frequent and severe tropical storms in combination with relative sea level rise would exacerbate shoreline erosion and leave South Marine Corps Drive exposed to severe damage. Without federal intervention, the Government of Guam will be forced to undertake protection of South Marine Corps Drive itself or risk imminent damage to the roadway and associated public utilities. Without protection, South Marine Corps Drive would eventually need to be relocated or closed at a severe economic cost to the local sponsor.

3.4.2 Alternative 2 Revetment

Alternative 2 would replace the removed section of the seawall with a revetment. Engineered revetments reduce the erosive power of the waves by dissipating wave energy through the interstices of the stones or armor units. The base of the revetment extends 17.25 ft toward the ocean from the existing seawall toe. The temporary construction footprint of the revetment is approximately 40 to 50 ft wide to accommodate for construction means and methods. The slope of the structure was kept to 1V:1.5H, to minimize the footprint of the structure. This alternative has the largest footprint of the alternatives included in the final array. Based on current hydrological and site control data, the revetment may be inundated under each tidal datum as illustrated in Figure 14.

Revetment designs utilizing both rock and concrete armor units were considered for the design, with the final selection being concrete armor units, specifically tribar (Figure 12), due to the unavailability of appropriately sized rock (1.2 ton) and the high associated costs of importing rock. The revetment would be constructed parallel to the shoreline and built from the toe trenched into the limestone, approximately -3.5 ft MSL, up to the crest elevation, approximately +8.9 ft MSL, which matches the approximate height of the existing seawall. It was assumed the tribar units would be placed in a single layer, uniformly, as is typical for this type of design. The tribar units have fixed dimensions and are placed directly on top of each other in sloped rows. Underneath the tribar units atop geotextile fabric are two layers of underlayer stone. The toe tribar unit would be cemented at the toe, and grout filled geotextile bags would serve to seal the crest. A splash apron composed of formed concrete over a gravel fill behind the crest of the structure is included to provide scour protection and tie the structure to the existing ground. The 8.9-ft crest elevation design meets the 50-year design requirement for sea level rise (SLR) and is adaptable to the 100-year SLR under the intermediate scenario through the addition of another layer of concrete armor units. A cross section of the revetment design is shown in Figure 15.

Table 12: Preliminary Armor Unit Sizing

Description	Tribar arm diameter (ft)	Tribar unit diameter (ft)	Layer Thickness (ft)
Tribar 1 ton unit	1.3	4.1	2.7

Table 11 summarizes the armor and under layer design criteria as well as the tribar design criteria. The expected design life of this system (assuming proper installation and routine maintenance) is on the order of 50 years.

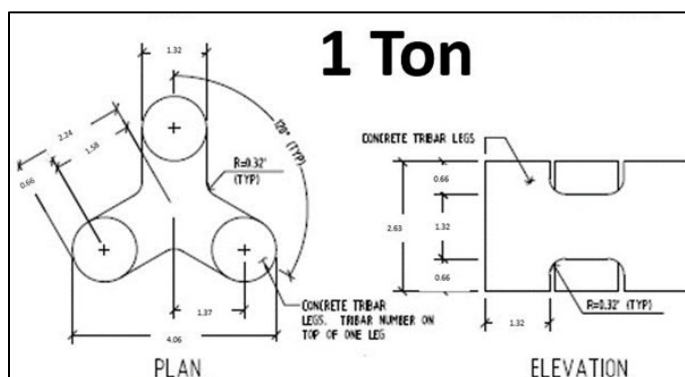


Figure 13: Example of a typical tribar unit

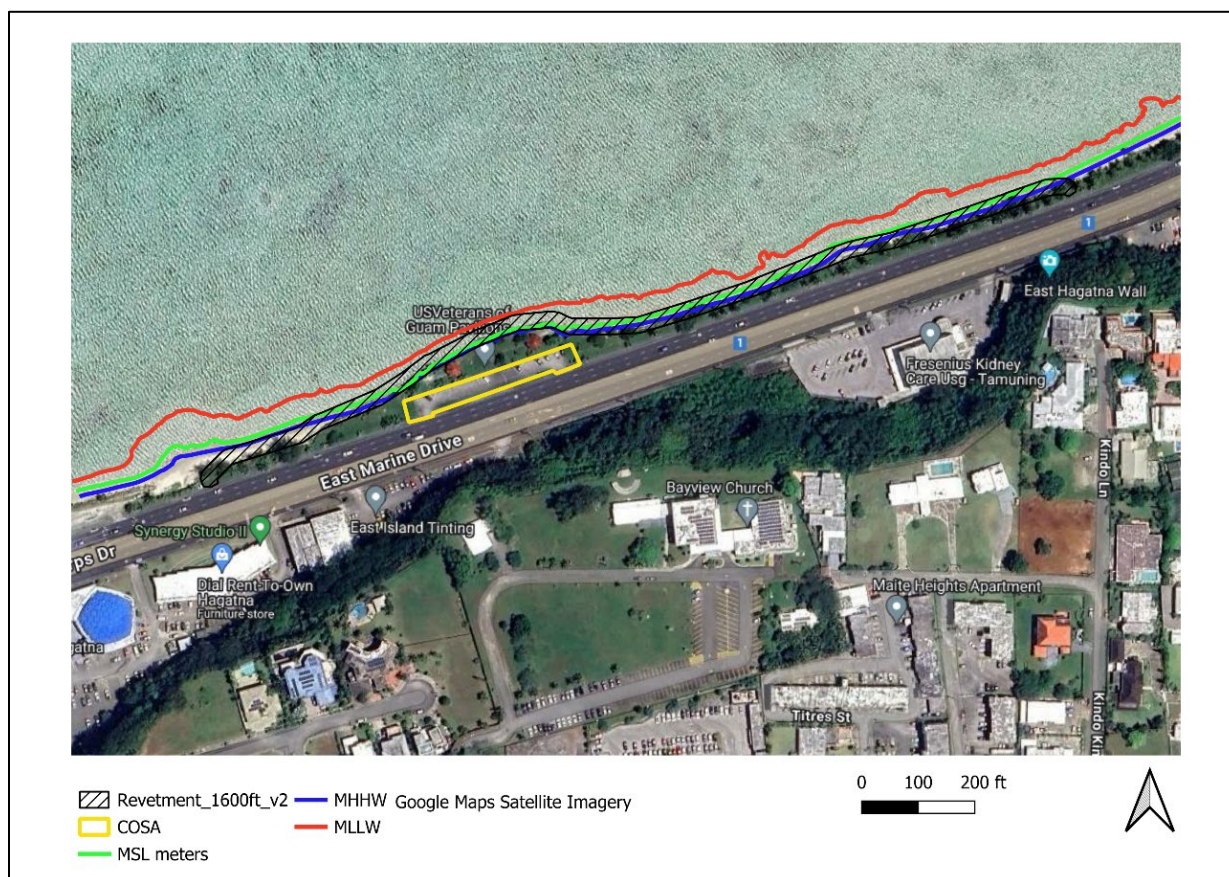


Figure 14: Temporary staging area and revetment extent.

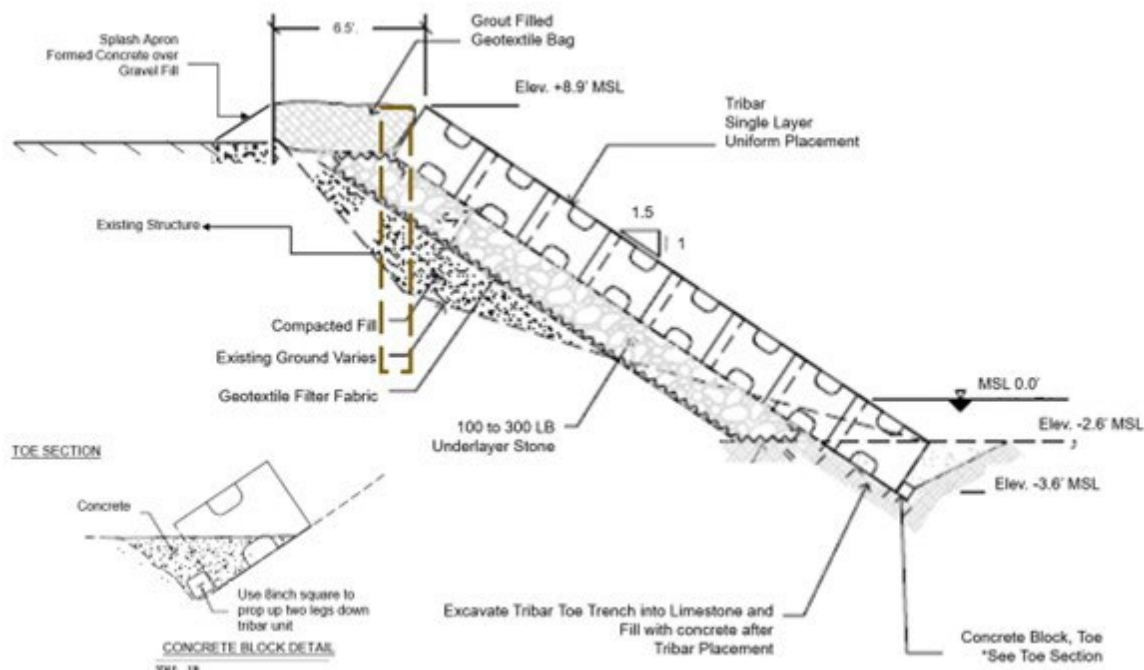


Figure 15. Preliminary schematic of concrete armor unit revetment

Using the Hudson equation, a less than 1-ton weight was designed for (0.3 tons) however a design for 1-ton was chosen for the area, due to fragility concerns of smaller than 1-ton tribar units, and because 1-ton is the more common and consequently more available size form. The 1-ton tribar unit has an individual arm diameter of 1.3 ft, a unit diameter of 4.1 ft, and an average layer thickness of 2.7 ft. The underlayer stone would be approximately 10% the size of the tribar, to prevent the material from escaping through the openings.

3.4.3 Alternative 3 Precast Concrete Seawall

Alternative 3 would replace the removed section of the seawall with a precast concrete seawall which acts as a cantilever retaining wall. This design utilizes the weight of the backfill to provide resistance to the lateral earth pressures (Figure 16). 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. This design has a top elevation of 8.9-ft above MSL, a crest width of 1-ft 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. A splash apron composed of formed concrete over a gravel fill behind the crest of the structure is included to provide scour protection and tie the structure to the existing ground. This alternative meets the USACE coastal engineering criteria for expected design life and adaptability to sea level change (SLC). Figure 17 illustrates the general footprint of the precast concrete seawall alternative.

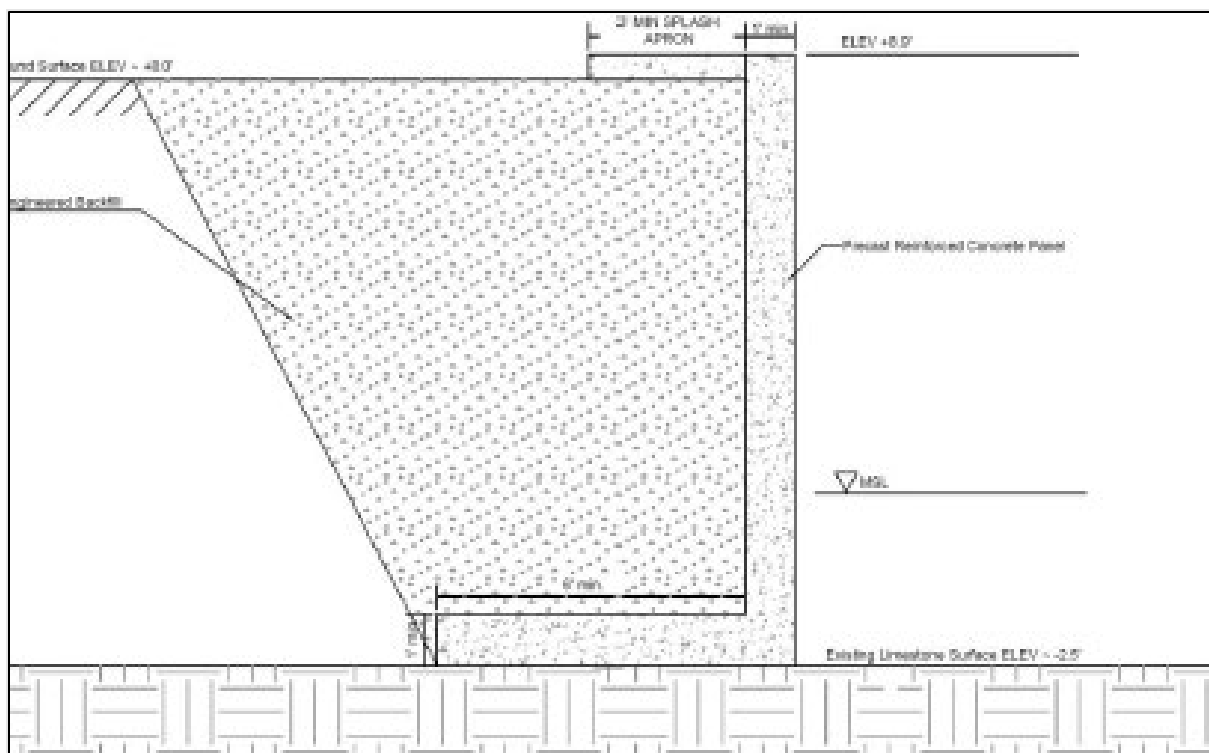


Figure 16: Cross section of a precast concrete wall

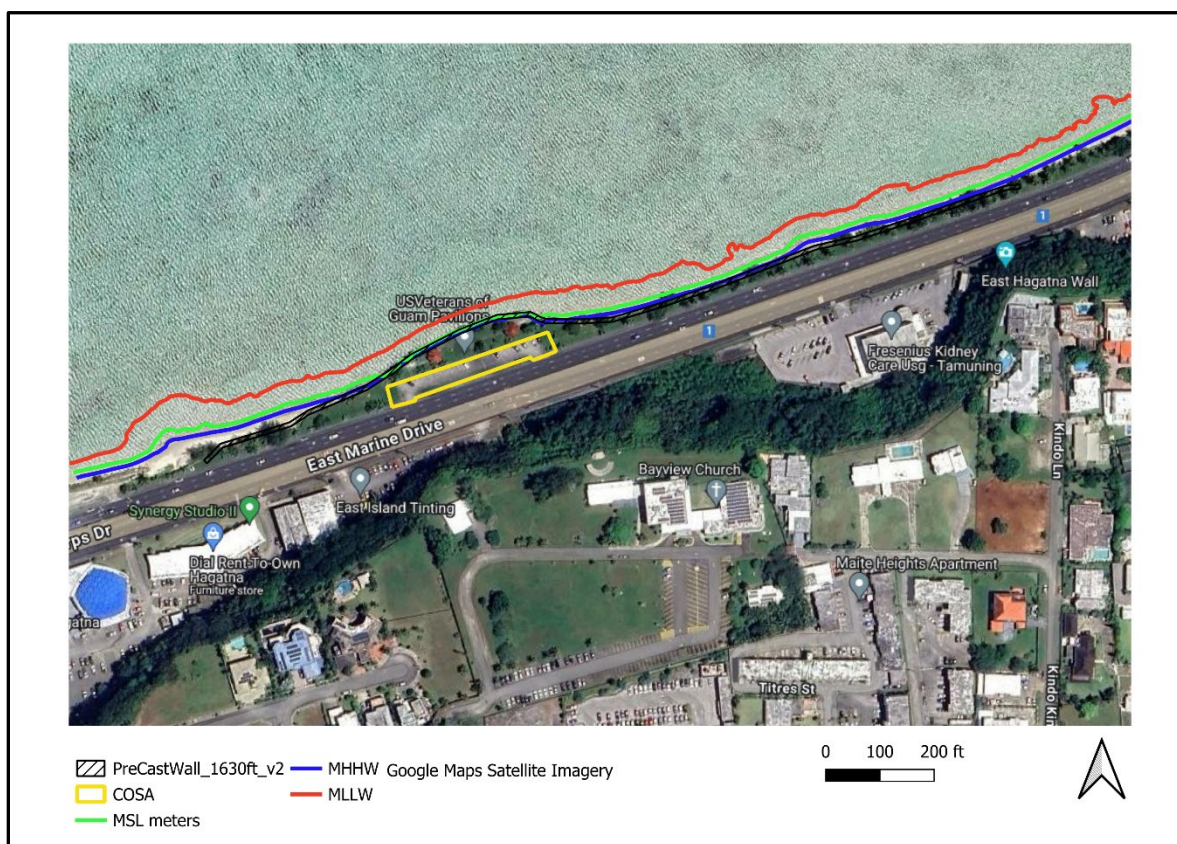


Figure 17: Precast concrete seawall footprint

3.4.4 Alternative 4 CRM Seawall

Alternative 4 includes removal of 1,630 linear ft of existing seawall and construction of a CRM seawall in its place. Figure 18 illustrates the lateral extent of the CRM seawall. The design consists of a precast concrete base secured to the limestone shelf and a CRM seawall constructed on top of the concrete foundation (Figure 19). Construction of the CRM wall would consist of excavating the existing soils to the limestone shelf, and then installing the CRM wall. After construction, the excavated area would be regraded to the elevation of the existing ground surface. This design has a total elevation of 8.9-ft above MSL, a crest width of 2-ft and a base that is 9-ft wide, with the total disturbed area being approximately 20-feet due to excavation and backfill of the existing soils. A splash apron composed of formed concrete over a gravel fill behind the crest of the structure is included to provide scour protection and tie the structure to the existing ground. This alternative meets the USACE coastal engineering criteria for expected design life and adaptability.

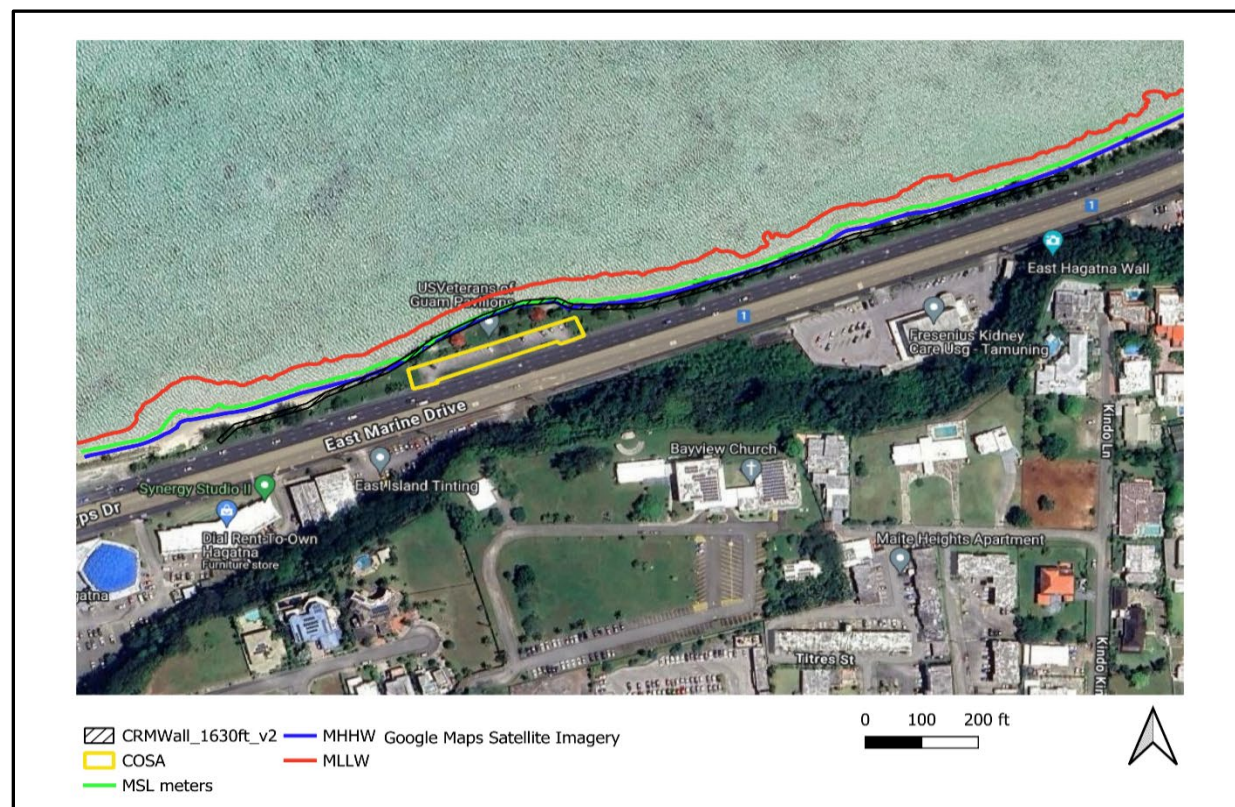


Figure 18: Footprint of concrete rubble masonry wall.

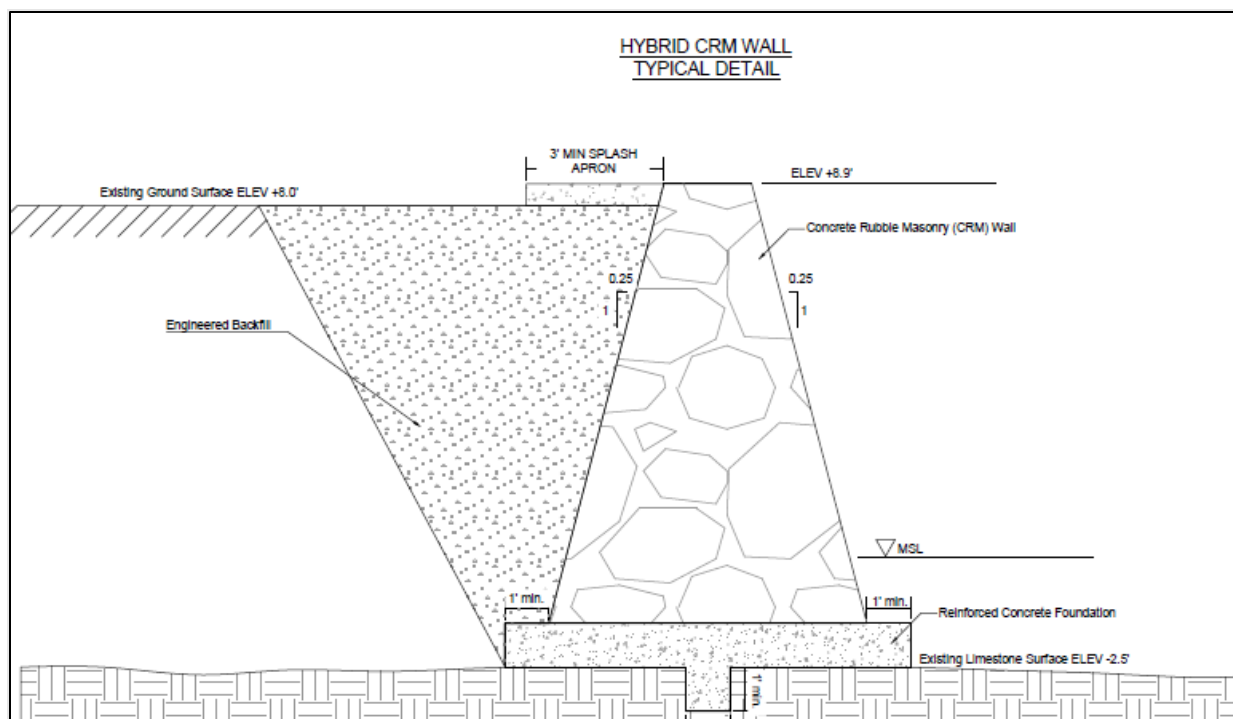


Figure 19: Cross section of concrete rubble masonry wall

4 ENVIRONMENTAL EFFECTS AND CONSEQUENCES

This section provides an analysis of environmental effects and consequences (40 CFR 1502.16) for the resources described in Section 2 that are present in the proposed action area based on a comparison of the effects (or impacts) of each alternative plan as formulated through the alternative analysis process (Section 3) relative to the No Action (FWOP) conditions. The general setting, natural, physical, and built environments as described in Section 2 are expected to change under the FWOP condition due to the changes described in Section 2.

Project impacts may be permanent or temporary, adverse, or beneficial, and include both direct and indirect effects (Table 12). Impacts from the proposed construction will be permanent and temporary in nature. Permanent impacts are those that cause a permanent alteration of the physical, chemical, or biological properties of an area. Temporary impacts occur when fill and/or cut impacts occur that are restored to pre-construction contours or condition when construction activities are complete. (e.g., staging or stockpile area, temporary access construction easements, temporary access routes).

Direct effects are caused by the action and occur at the same time and place; indirect effects are caused by the action and are later in time or farther removed in a spatial context (distance from the source of the effect) but are still reasonably foreseeable. The CEQ defines 5 types of mitigation at 40 CFR 1508.1(S): (a) avoidance, avoid the impact altogether by not taking a certain action or parts of an action; (b) minimization, minimizing impacts by limiting the degree or magnitude of the action and its

implementation; (c) rectification, rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reduction, reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensation; compensating for the impact by replacing or providing substitute resources or environments. Best management practices (BMPs) are used to avoid or minimize direct and indirect impacts. BMPs are policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects resulting from construction activities. All mitigation for this project, including BMPs, are detailed in Attachment 8 of Appendix A-3 and will be included in construction plans and specifications.

Table 13: Habitat Area Affected by Each Alternative

Impact	Alternative 1: No Action	Alternative 2: Revetment	Alternative 3: Precast Concrete Seawall	Alternative 4: CRM Wall
Temporary: Upland Staging area (parking lot) (acres)	NA	0.20	0.20	0.20
Temporary: Upland Construction Area (acres)	NA	1.10	0.73	0.73
Permanent: Upland (acres)	NA	0	0.04	0.07
Permanent: Beach/Intertidal (acres)	NA	0.63	0	0
Total Impacts	NA	1.93	0.97	1.00
Construction NPDES required	NA	>1 acre Yes	<1 acre No	>1 acre Yes
Slope	0	1.5H/1V	0	0.25H/1V

Temporary impacted habitat areas include 0.20 acres of upland staging area for construction located in the paved parking lot of Veteran's Sunset Beach Park (Figures 12, 16, and 17) and are the same across alternatives. The permanently impacted habitat area is the area that would be disturbed by the placement of each of the alternative plans in the final array (Figures 11, 15, and 16). Alternatives 2 and 4 are an acre or greater and would require a construction stormwater NPDES permit. Alternative 3 is less than an acre and would not require a construction stormwater NPDES permit. Construction is anticipated to occur from land at low tide as much as practicable in order to avoid in water work. It is not feasible to calculate the extent of erosion under the No Action Alternative within the constraints of this Feasibility Study.

Criteria based on the definitions of significance and 40 CFR 1508.1 were identified for each resource to assist with evaluation of the potential for significant adverse effects (Table 13):

- Beneficial. This effect would provide benefit to the environment as defined for that resource.
- No Effect. This effect would cause no discernible change in the environment as measured by the applicable significance criteria; therefore, no mitigation would

be required.

- Less than Significant. This effect would cause no substantial adverse change in the environment as measured by the applicable significance criteria; no mitigation would be required, though BMPs may be used to meet other regulatory requirements.
- Significant. This effect would cause a substantial adverse change in the physical conditions of the environment or as otherwise defined based on the significance criteria. Significant effects can be categorized as: (1) those for which there is feasible mitigation available that would avoid or reduce the environmental effects to less-than-significant levels, and (2) those for which there is either no feasible mitigation available or for which, even with implementation of feasible mitigation measures, would remain a significant adverse effect on the environment (significant and unavoidable effects).

Table 14: Summary of Chapter 4 Potential Effects.

Resource	Alternative 1 No Action	Alternative 2 Revetment	Alternative 3 Precast Concrete Seawall	Alternative 4 CRM Seawall
Air Quality*	N	L	L	L
Geology	S	L	L	L
Hydrology	S	L	L	L
Water Resources and Quality*	S	L	L	L
Hazardous, Toxic & Radioactive Wastes	N	N	N	N
Noise*	N	L	L	L
Terrestrial Habitats and Species*	S	L	L	L
Marine Habitats and Species*	S	L	L	L
Threatened/Endangered Species/Critical Habitat	L	L	L	L
Essential Fish Habitat*	L	L	L	L
Special Aquatic Sites*	L	L	L	L
Invasive species*	N	L	L	L
Land use*	S	L	L	L
Public infrastructure*	S	L	L	L
Socioeconomics	S	B	B	B
Historic and Archaeological Resources	S	L	L	L
Other cultural resources*	S	L	L	L
Aesthetics	S	B	B	B
*Effect would cause substantial adverse change in the environment; however, use of standard BMPs would avoid or reduce the environmental effects to less-than-significant or beneficial levels.				
S = Significant, L = Less than Significant, N= No Effect, B = Benefit				

4.1 Physical Environment

4.1.1 Weather

A qualitative assessment (literature review) was conducted for this study to determine broad trends and projected trends in temperature and precipitation that could affect

shoreline protection and coastal flood risk management alternatives. Within the 50-year study period (2026 to 2076) tropical storms are expected to increase in severity but decrease slightly in frequency, while sea level will increase and combined these conditions will increase the frequency of high-water events and coastal erosion (East West Center 2020).

Since the shoreline in the proposed action area is receding landward, the threat of storm damage will become more extreme and frequent over time. South Marine Corps Drive and utilities within the project proposed action area will sustain significant damage from damaging waves due to long-term sea level rise and elevated sea levels during storm events (Appendix A-1).

Projected sea level rise within the 50-year study period (2026 to 2076) will be approximately 1.28 ft (Figure 8 Appendix A-1 Engineering). The design water level, based on short-term, storm-driven water level changes superimposed on the astronomical tides (Figure 9 Appendix A-1 Engineering) is approximately 1.4 ft (0.42 m) relative to MHHW or 2.3 ft (0.71 m) relative to MSL, with an additional 5 ft. (1.5m) of ponding and setup from the 50-year wave event breaking on the reef.

Without replacement of the wall with a structure having a more stable base, more frequent and severe tropical storms in combination with relative sea level rise would exacerbate shoreline erosion and leave South Marine Corps Drive exposed to severe damage. Without federal intervention, the Government of Guam will be forced to undertake protection of South Marine Corps Drive itself or risk imminent damage to the roadway and associated public utilities. Without protection, South Marine Corps Drive would eventually need to be relocated or closed at a severe economic cost to the local sponsor. For these reasons, USACE has determined the FWOP will experience significant impacts to the shoreline from changes in temperature and precipitation, and sea level rise, however the alternatives would have no effect temperature, precipitation, or sea level.

4.1.2 Air Quality

Under the Clean Air Act of 1972 (CAA; 42 USC §7401 et seq.) Hagatna and Tamuning are not designated as nonattainment or maintenance areas for any criteria pollutant; therefore, USEPA's General Conformity Rule to implement Section 176(c) of the CAA does not apply. No air quality permits, nor a conformity determination are required for this project. The project complies with the Act.

Effects on air quality were considered significant if implementation of an alternative plan would result in any of the following:

- Exceedance of federal or Territorial air quality standards established for criteria pollutants, and/or
- Generation of greenhouse gas emissions that would significantly contribute to air quality, precipitation, and/or temperature change(s). There are currently no Federal thresholds of significance established for greenhouse gas emissions, and so it is the responsibility of the NEPA lead agency to decide how significant

effects will be determined. To this end, significance for greenhouse gas emissions was determined by comparing the greenhouse gas emissions produced for each project alternative to governmental greenhouse gas reduction goals, while not formally adopting the greenhouse gas reduction goal per se.

Table 15: Construction & Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) Emissions in Metric Tons

Pollutant	Alternative 1 - No Action Alternative	Alternative 2: Concrete Armor Revetment	Alternative 3: Precast Concrete Seawall	Alternative 4: CRM Wall
Reactive Organic Gases aka Volatile Organic Compounds (ROG/VOC)	0	-1	-1	-1
Carbon Monoxide (CO)	0	-4	-4	-4
Sulfur Oxides (SOx)	0	0	0	0
Nitrous Oxides (NOx)	0	-7	-7	-7
Particulate Matter - 2.5 micron (PM2.5)	0	0	1	0
Particulate Matter - 10 micron (PM10)	0	0	0	0
Carbon Dioxide (CO2)	0	-280	-368	-372
Methane (CH4)	0	0	0	0

* Net total is equivalent to (with action gross) subtracted by (no action gross)

4.1.2.1 Alternative 1 No Action

Under the No Action Alternative, no federal actions for emergency shoreline protection would be implemented. It is expected that the FWOP air quality conditions would be the same as existing conditions. Air pollution sources within the proposed action area would not be expected to change substantially over the period of analysis. With continuing trade wind patterns, air quality levels are expected to remain relatively constant and would continue to comply with federal and Territory standards. For these reasons, USACE has determined the No Action Alternative would result in no effects to air quality resources.

The No Action Alternative would result in recurring repair needs for the shoreline, highway, utilities and parks and eventually the collapse of the seawall and erosion of the surrounding land. Loss of the road would result in additional travel time and distance incurred as a result of highway closures. In 1990 USACE calculated the average daily vehicle count along this stretch of South Marine Corps Drive is 54,828. Increased development of Guam over the past several decades will have increased average daily use of Marine Corps Drive. If this highway is closed, traffic must detour around the Naval Air Station and commercial airport. It is estimated that of the total traffic along this corridor that half comes from (goes to) the Tamuning area immediately to the east of this coastal area, and half comes from (goes to) the northeastern end of the island. For the Tamuning traffic, the detour will be 8.9 miles while the rest of the traffic will need to detour only 2.0 miles. This is because the Tamuning traffic has to backtrack on Marine Drive to get around the airfield while the other traffic merely jogs slightly to the east to clear the airfield (USACE 1990).

Under the No Action Alternative, no construction would occur, however annual repairs to the highway, utilities, and/or park would occur every year at a CO₂ emissions rate of 1610 metric tons (Appendix 4, Attachment 8, Table 8-11). Assuming the repairs take 6 weeks, over 50 years the longer alternative commuter routes would contribute 187,860 metric tons and once the road failed, contribute 37,572 more metric tons annually. The No Action Alternative would not significantly impact air quality or greenhouse gas emissions.

4.1.2.2 Alternatives 2-4

Alternatives 2-4 have the same potential temporary insignificant effects on air quality. Gases from construction equipment may cause a temporary reduction in air quality at the project site during construction. There may be some temporary generation of dust near the construction area resulting from transport and handling of construction materials. No long-term degradation of air quality would result from implementation of the project. Construction activities involving heavy equipment are minimal and will cease once construction is completed; significant impacts to ambient air quality are not expected and will likely be immeasurable. For these reasons, USACE has determined the alternatives would cause less than significant impacts to air quality.

Direct emissions from a 2-year construction period and long-term indirect emissions from operations and maintenance over the 50-year lifespan of the project were quantified for each alternative in the final alternatives array. The same equipment would be used for Alternatives 2-4 resulting in similar effects.

Alternatives 2-4 would result in one GHG output for construction (Appendix 4, Attachment 8, Table 8-9), though they would differ based on differences in construction, and two (required every 20 years) for maintenance (Appendix 4, Attachment 8, Table 8-10) within the 50-year design lifespan of the project, significantly less than that produced by the No Action Alternative (for full analysis see Attachment 8 of Appendix A-4). All alternatives have net negative emissions total, indicating they would all produce less emissions over the 50-year project lifespan (Table 15). Effects from the alternatives would be beneficial.

4.1.3 Geomorphology, Hydrology, Hydraulics

Effects on hydrology, hydraulics, and geomorphology (including geology, seismicity, and soil conditions) are significant if implementation of an alternative would result in any of the following:

- Significantly change drainage patterns within the watershed;
- Substantially increase the extent, frequency, or duration of flooding;
- Create or contribute to runoff that would exceed the capacity of existing or planned stormwater drainage system;
- Substantially alter an important natural geologic feature;
- Cause substantial soil erosion;
- Increase exposure of people or structures to seismic-related hazards;
- Substantially contribute to an increased potential for (or otherwise be affected by) an onsite or offsite landslide/debris flow, subsidence, liquefaction, or collapse

4.1.3.1 Alternative 1 No Action

Under Alternative 1, no federal action for emergency shoreline protection would be implemented. Conditions in the proposed action area would be expected to equate with the current onsite conditions. The No Action Alternative would result in collapse of the seawall and erosion of the surrounding land, changing the geology and topography, and shifting the intertidal zone inland. The No Action Alternative would result in changes to hydrology from the collapse of the seawall and erosion of the shoreline. For this reason, USACE has determined the No Action Alternative would cause significant impacts to hydrology.

For these reasons, USACE has determined the No Action Alternative would cause significant impacts to geomorphology, hydrology, hydraulics.

4.1.3.2 Alternatives 2-4

Construction of the Alternatives would not be expected to alter local coastal hydrologic or hydraulic conditions (e.g., wave patterns, currents) or affect local drainage patterns or hydrologic conditions within Hagatna Bay (e.g., affect peak water velocities, flow discharges during flood events, obstruct or change the course of any waterway, modify an existing floodplain). There would be no placement of fill material (e.g., compacted fill) within any stream channel, waterway, or floodplain.

Alternatives 2-4 have slightly different footprints and slopes which would result in minimal changes to the geology and topography of the proposed action area. They all would have the positive effect of protecting the floodplain.

Alternatives 2-4 all have the same temporary less than significant effects on soils. All require the removal of 1630 ft of the existing stonewall requiring excavation and subsequent backfill of 20 to 30 ft inland of the wall resulting in a temporarily disturbed area of 1.1 acres for Alternative 2 and 0.73 acres for Alternatives 3 and 4.

Alternatives 2-4 would maintain the existing shoreline and protect the existing hydrology. Seawalls are known to disrupt longshore sediment transport, causing erosion

and accretion elsewhere. USACE proposes to replace the existing seawall i.e., hardened shoreline, with an engineered structure in the same footprint. Accordingly, the anticipated impacts to longshore sediment transport post-construction would be similar to existing. USACE has determined the proposed action would cause less than significant impact to nearshore hydrology, currents, tide, and circulation.

USACE anticipates the beneficial effects to hydrology, hydraulics, or geomorphology of the shoreline and accordingly preliminarily determined the alternatives would have a less than significant impact on hydrology, hydraulics, or geomorphology in the proposed action area.

Effects are positive for the resource; therefore, no environmental commitments are required.

4.1.4 Water Resources and Quality

The CWA 404(b)(1) evaluation is included as Attachment 4c of Appendix A-3. The 404(b)(1) analysis demonstrates that both construction and OMRR&R comply with Section 404. So long as the non-federal sponsor (Guam Department of Public Works, GDPW) conducts OMRR&R operations within the scope of activities characterized in the environmental assessment, it would comply with Section 404. The project will comply with this Act.

The USEPA and GEPA were informed about the preferred plan during Cooperating Agency Workshops on 8 and 14 June 2022 (HST). GEPA confirmed by letter dated 21 August 2023 that USACE may request Section 401 Water Quality Certification prior to construction of the project when at least 75% design is available. USACE would be responsible for compliance during construction while the GDPW would need to comply separately with Section 401 for OMRR&R. Coordination with the USEPA and GEPA will continue during the feasibility phase draft IFR/EA public review period and through the construction phase for this project.

Effects on water quality were considered to be significant if implementation of an alternative plan would result in any of the following:

- Substantially degrade surface water quality such that it would violate water quality standards, contribute to exceedance of aquatic life guidelines, or otherwise impair beneficial uses;
- Substantially increase contaminant levels in the groundwater.

4.1.4.1 Alternative 1 No Action

Under Alternative 1, no federal actions for emergency shoreline protection would be implemented. It is expected that the FWOP conditions would be relatively commensurate with existing conditions. The No Action Alternative would result in increased sediment and pollution load in the Bay due to collapse of the seawall and erosion of the surrounding land. For these reasons, USACE has determined the No Action Alternative would cause significant impacts to surface water quality.

4.1.4.2 Alternatives 2-4

The only excavation in water is the excavation of the existing seawall. Upland disposal or reuse of demo material from the existing wall would occur. Therefore Section 103 of the Marine Protection, Research, and Sanctuaries Act (33 USC §1401 et seq.) does not apply. There may be some localized, transient increases in turbidity created by excavation and setting of stones under all Alternatives, the use of BMPS as described in Attachment 8 of Appendix A-3 will mitigate these impacts. No long-term effects on water quality are anticipated under alternatives 2 through 4. For these reasons, USACE has determined in a 404(b)(1) evaluation (included as Attachment 4 of Appendix 3) that the alternatives would cause less than significant impacts to surface water quality with the use of appropriate BMPs as described in Attachment 8 of Appendix A-3. Based on the analysis in the IFR/EA, USACE concludes that the Recommended Plan will not result in harm to people, property, and floodplain values, in fact would protect the floodplain, will not induce development in the floodplain, and the Project is in the public interest. The project complies with the EO11988.

4.1.5 Hazardous, Toxic, and Radioactive Wastes

There are no known contaminants in the area and the project would not introduce contaminants to the environment, therefore the alternatives are anticipated to have no effect on hazardous, toxic, and radioactive wastes. If HTRW were discovered during construction, the non-federal sponsor is responsible for the costs of HTRW cleanup and response.

4.1.6 Noise

Effects related to noise were significant if implementation of an alternative plan would result in any of the following:

- Exceedance of maximum permissible levels established by local noise ordinances
- Long-term exposure of noise-sensitive receptor(s) to a substantial increase in noise levels over the ambient condition

4.1.6.1 Alternative 1 No Action

Under the No Action Alternative, no federal actions for emergency shoreline protection would be implemented and no increase in ambient noise levels would occur. Land uses under the future without-project condition are expected to be reasonably consistent with the existing land uses and be relatively commensurate with existing conditions in terms of noise generated by vehicles using the highway and typical social activities conducted at the park. Given that the types of noise and maximum permissible noise levels are linked to the various land use types, the general range of ambient noise levels across the proposed action area is not expected to measurably change over the period of analysis. The No Action Alternative would have no effect on noise.

4.1.6.2 Alternatives 2-4

Construction of all Alternatives would require operation of the same heavy equipment for various activities, including clearing, site preparation, excavation, grading, and installation of the structure. Construction activity would generally occur between the hours of 7:00 a.m. and 5:00 p.m. Monday through Friday, though some work outside those times may be necessary. Typical sound levels produced by construction equipment are listed in Table 16. These sound levels are based on an inventory of equipment noise emissions that were compiled by the Federal Highways Administration as part of their Construction Noise Handbook (USDOT 2006).

Table 16: Example of Typical Sound Levels Emitted from Construction Equipment

Type of Equipment ^a	L _{max} at 50 feet (dBA, slow) ^b	Type of Equipment ^a	L _{max} at 50 feet (dBA, slow) ^b
Backhoe	80	Excavator	85
Compactor (ground)	80	Flatbed truck	84
Concrete saw	90	Front end loader	80
Drill rig truck	84	Grader	85
Dozer	85	Pick-up truck	55
Dump Truck	84	Tractor	84

Notes:

^a This is an abbreviated list for example purposes; a more complete list of construction-related equipment is available at the above-referenced source.

^b The sound levels shown are specification limits for each piece of equipment expressed as a maximum sound level (L_{max}) in dBA “slow” at a reference distance of 50 foot from the loudest side of the equipment.

dBA = A-weighted decibels

During active construction, it is not expected that construction noise levels would be significantly higher than ambient noise levels for sensitive noise receptors. Regardless, due to the short duration and temporary nature of the construction activities, advance notice and coordination with residents, and implementation of noise-reduction measures, construction-related noise impacts would be reduced to a less-than-significant level.

Over the long-term, OMRR&R of the constructed feature is not expected to substantially affect ambient noise levels. There would be some noise generated during OMRR&R activities (e.g., maintenance vehicles and debris removal equipment), but these would be very short-term increases that occur on a periodic basis (e.g., once per year), such that the impact on noise levels is expected to be insignificant. With the incorporation of appropriate noise reduction BMPs, these Alternatives have less than significant effects to sensitive noise receptors.

There may be some localized, transient increases in noise created by construction activities under Alternatives 2-4, the use of BMPS as described in Attachment 8 of Appendix A-3 will mitigate these impacts. No long-term effects on noise are anticipated

under alternatives 2 through 4. For these reasons, USACE has determined the alternatives would cause less than significant impacts to noise.

4.2 Natural environment

4.2.1 Terrestrial Habitats and Species

Currently none of the migratory bird species found on Guam nest in the project area, therefore vegetation clearing during nesting season does not need to be avoided. If that should change, USACE will include standard migratory bird protection measures as described in Attachment 7: Migratory Bird Consultation in the project plans and specifications and will require the Contractor to abide by those requirements. The Project is being coordinated with USFWS and will comply with these Acts.

Effects on terrestrial habitats or species were considered significant if implementation of an alternative plan would result in any of the following:

- Substantial loss of native species
- Reduced habitat availability or degradation of habitat suitability of a magnitude and/or duration that could substantially affect a native species population
- Substantial interference with the movement of migratory species
- Introduction or contribution to the substantial spread of an invasive species

4.2.1.1 Alternative 1 No Action

Under the No Action Alternative, no federal actions for emergency shoreline protection would be implemented. In the absence of coastal erosion reduction measures, it is anticipated that areas adjacent to the coastline within the proposed action area would continue to be subject to periodic erosion and the eventual loss of some or all of the terrestrial environment between South Marine Corps Drive and East Hagatna Bay, and its associated species as the existing seawall collapses, the shoreline erodes, and sea level rises. Resources in the action area will continue to be vulnerable to inundation and wave damages from elevated sea levels during storm events. Since the shoreline in the proposed action area is generally receding landward, the threat of coastal inundation and storm damage will become more extreme and frequent over time (USACE 2015). For these reasons, USACE has determined the No Action Alternative would cause significant impacts to terrestrial habitat and species.

4.2.1.2 Alternatives 2-4

Alternatives 2-4 all have the same temporary less than significant effects on terrestrial habitats. All require the removal of 1630 ft of the existing stonewall requiring excavation and subsequent backfill of 20 to 30 ft inland of the wall resulting in a temporarily disturbed area of 0.73 acres for Alternatives 3 and 4, and 1.1 acres for Alternative 2.

It is estimated that 20 trees would be removed during construction and replaced after construction with appropriate and desirable native species and all bare ground would be revegetated. Impacts to terrestrial animals would be temporary during construction and less than significant due to implementation of BMPs as described in Attachment 8 of Appendix A-3. Construction of the alternatives would beneficially protect existing and

restored terrestrial habitat between the wall and the road. Construction may make more nesting sites for Sali to disburse and use (Duenas 2022). There are no effects from the staging area, which would be located in an existing parking lot at Veteran's Sunset beach Park.

For these reasons, USACE has determined Alternatives 2-4 would cause less than significant impacts to terrestrial habitats and species.

4.2.2 Marine Habitats and Species

Construction of Alternatives 2, 3, and 4 is anticipated to occur from land at low tide as much as practicable in order to avoid work within the water. Ocean disposal is not a component of this Project; therefore, the Marine Protection, Research, and Sanctuaries Act (33 USC §1401 ET SEQ.) is not applicable.

The Fish and Wildlife Coordination Act (FWCA) of 1934 (16 USC 661 et seq.) requires federal agencies to coordinate with the USFWS and local state/territorial agencies when any stream or body of water is proposed to be impounded, diverted, or otherwise modified. USACE consulted USFWS and NMFS on the effect of the recommended alternative (Alternative 3) on fish and wildlife resources as documented in Appendix 3, Attachment 1. A Planning Aid Letter was received from NMFS and USFWS on 14 July 2023. In the Planning Aid Letter, the Services recommended measures to conserve fish and wildlife resources which are included in the Appendix A-3 Attachment 8 Environmental Commitments. USACE will adopt these recommendations, to the extent that the measure is applicable, commensurate and practical, as enforceable conditions i.e. specifications, of any construction contract. The Project complies with this Act.

Effects on marine habitats and species were considered significant if implementation of an alternative plan would result in any of the following:

- Substantial loss of native species;
- Reduction of habitat availability or degradation of habitat suitability of a magnitude; and/or duration that could substantially affect a native species population;
- Substantially interference with the movement of migratory species;
- Introduction of or contribution to the substantial spread of an invasive species.

4.2.2.1 Alternative 1 No Action

Under Alternative 1, no federal actions for emergency shoreline protection would be implemented. The No Action Alternative would result in increased sediment and pollution load in the Bay due to collapse of the seawall and erosion of the surrounding land contributing material to the bay. Beach and intertidal habitat would be lost. For these reasons, USACE has determined the No Action Alternative would cause significant impacts to marine habitats and species.

4.2.2.2 Alternative 2 Revetment

With a conservatively estimated permanent footprint of 1.1 acres, the revetment would replace the greatest area of existing sandy rocky shoreline with concrete armor units.

During construction, excavation of beach material and some limestone along the shoreline will be necessary prior to installation of the toe and armor units of the revetment. Benthic invertebrates residing within this zone would be destroyed in the process and are expected to readily re-colonize remaining nearby sandy bottom. The beach and intertidal areas which serve as foraging and loafing habitat for shore birds would be disrupted during construction. After completion of the project the beach would be expected to reestablish and stabilize along the seaward edge of the revetment, followed by the colonization of the supratidal and intertidal zones with organisms typically associated with them. There will be no loss of open water, only intertidal area and beach (*Figure 13*). For these reasons, USACE has determined Alternative 2 would cause less than significant impacts to marine habitat and species.

4.2.2.3 Alternative 3 Precast Concrete Seawall

The Precast Concrete Seawall has the same permanent footprint as the existing seawall and would not create any additional permanent changes to the shoreline or adjacent marine habitat. Temporary, less than significant impacts, to habitat and fish and wildlife such as increased human presence, elevated noise levels, and elevated turbidity would occur during construction, however adverse impacts would be avoided and/or minimized to the greatest extent practicable through implementation of BMPs as described in Attachment 8 of Appendix A-3. For these reasons, USACE has determined Alternative 3 would cause less than significant impacts to marine habitats and species.

4.2.2.4 Alternative 4 CRM Seawall

The CRM seawall would replace 0.34 acres of the existing sandy rocky shoreline with coarser rock. During construction, excavation of beach material and coral reef rock along the shoreline will be necessary prior to installation of the toe and armor stones of the seawall. Sand bottom invertebrates residing within this zone would be destroyed in the process and are expected to readily re-colonize remaining nearby sandy bottom. Beach and intertidal areas which serve as foraging and loafing habitat for shore birds would be disrupted during construction of the shore protection structure. With completion of the project, the beach is expected to reestablish and stabilize along the seaward edge of the seawall, minimizing any long-term effects on shore bird habitat. For these reasons, USACE has determined Alternative 4 would cause less than significant impacts to marine habitats and species.

4.2.3 Federal Threatened and Endangered Species

Pursuant to Section 7 of the Endangered Species Act, USACE evaluated the potential effects to T&E species that may be affected by implementation of the Recommended Plan. USACE determined the federal action may affect but is not likely to adversely affect corals, turtles; and the Mariana fruit bat. Based on current observations, giant clams and tree snails do not occur in the action area and there would be no effect. Green sea turtle, Hawksbill sea turtle, Acropora globiceps, and Mariana Fruit bat would not occur in the proposed action area during the project. Therefore, the proposed alternatives may affect but are not likely to adversely affect threatened or endangered

species. The detailed biological assessment can be found as Attachment 2h to Appendix A-3.

The USACE will continue to coordinate with the USFWS, NMFS, and the DAWR as part of the public review of this Draft IFR/NEPA document and throughout the feasibility phase. The project will comply with the Act.

Effects on threatened and endangered species were considered significant if implementation of an alternative plan would result in any of the following:

- Substantial loss of a threatened and endangered species
- Reduction of habitat availability or degradation of habitat suitability of a magnitude and/or duration that could substantially affect a threatened and endangered species population
- Substantial interference with the movement of any migratory threatened and endangered species
- Introduction of or contribution to the substantial spread of an invasive species that would threaten a threatened and endangered species.

4.2.3.1 Alternative 1 No Action

The No Action Alternative would result in the eventual loss of some or all of the terrestrial environment between South Marine Corps Drive and East Hagatna Bay, and its associated species as the existing seawall collapses and the shoreline erodes. Erosion releases terrigenous sediments and pollution into the bay. Beach and intertidal habitat for resting and feeding by sea turtles would be lost. Erosion over time would contribute a chronic input of landside pollutants into the bay which is likely to adversely affect *A. globiceps*, an ESA-listed coral. For these reasons, USACE has determined the No Action Alternative would cause less than significant impacts to, and is likely to adversely affect, federal threatened and endangered species and their habitat.

4.2.3.2 Alternatives 2 -4

The Revetment, Precast Concrete Seawall, and Concrete Rubble Masonry Wall all have the same temporary less than significant effects on green sea turtle foraging in the project area and the less than significant effects on habitat quality of the bay, which would be mitigated with BMPs as detailed in Attachment 8 of Appendix A-3. Given the existing conditions as previously described in Section 2 and in the absence of any shoreline protection measure, the amount of sandy shore habitat that would permanently be lost under the footprint of Alternatives 2 and 4 is still expected to be less than would be lost to natural forces under the No Action Alternative. Construction activities would convert an estimated 1.1 acres of beach sand to revetment for Alternative 2 and 0.34 acres of beach sand to CRM wall for Alternative 4 and could result in a loss of habitat that may affect Central West Pacific green sea turtles, hawksbill sea turtles, and *A. globiceps*. Alternative 3 is a replacement of the existing seawall and has no additional beach footprint.

The sandy beach between the existing seawall and the ocean is a narrow, highly variable intertidal strand of sand, coral rubble, gravel, and rock that varies in size between zero and 15 ft in width (USACE 2022). NMFS surveys in November 2023

confirmed previous observations (USFWS 1992) that the intertidal region within 20 ft of the wall contains no live coral. No other threatened or endangered species were seen during the surveys at or near the proposed project site (NMFS 2023a). Sea turtles use the nearby reef habitat immediately offshore in Hagatna Bay for foraging and resting behaviors (USFWS 2023).

Given the relatively small impact area, the lack of ESA-listed corals, and the availability of similar habitat nearby for foraging and resting behaviors for sea turtles, NMFS concurred effects on Central West Pacific green sea turtles, hawksbill sea turtles, and *A. globiceps*, a loss of habitat will not reach the scale where harm or harassment occurs, and therefore are insignificant (NMFS 2023b; Appendix 3 Attachment 2b).

Limited impact on the proposed coral critical habitat for *A. globiceps* may occur during the construction of the revetment. The current habitat consists of sand, coral rubble, gravel, and rock and lacks live coral. The intertidal area is unlikely to support coral reproduction, recruitment, growth, and maturation. Therefore, NMFS are reasonably certain the effects of the loss of habitat will not measurably reduce the essential features of the proposed coral critical habitat for *A. globiceps* and are therefore insignificant (NMFS 2023b; Appendix 3 Attachment 2b).

Limited impact on the Central West Pacific green sea turtle's proposed critical habitat may occur during the construction of the revetment. Due to its intertidal nature, this area lacks underwater refugia and food resources of sufficient condition, distribution, diversity, abundance, and density necessary to support sea turtles' survival, development, growth, and reproduction. Based on the poor quality of the habitat for foraging, NMFS are reasonably certain the effects of this loss of habitat will not measurably reduce the conservation value of the physical or biological features of critical habitat for the Central West Pacific green sea turtle and are therefore insignificant (NMFS 2023b; Appendix 3 Attachment 2b).

Mariana Fruit Bat may pass through on their way to foraging areas, but none of their roosting tree species were observed in the proposed action area and they have not been observed foraging on the coconut in the area.

For these reasons, USACE has determined Alternatives 2-4 may affect but are not likely to adversely affect federal threatened and endangered species and their habitat and that effect is expected to be less than significant with implementation of BMPs in Attachment 8 of Appendix A-3.

4.2.4 Essential Fish Habitat

USACE initiated consultation with NMFS during the 8 and 14 June 2022 cooperating agency workshops. Consultation is ongoing. The Project complies with the Act.

Effects on EFH were considered significant if implementation of an alternative plan would result in any of the following:

- Substantial direct or indirect physical, chemical, or biological alterations of the waters or substrate
- Substantial loss of, or injury to, benthic organisms and prey species

- Reduction of habitat availability or quality of a magnitude and/or duration that could substantially affect EFH species
- Substantial loss of MUS;
- Reduction of habitat availability or degradation of habitat suitability of a magnitude; and/or duration that could substantially affect a MUS population;
- Substantial interference with the movement of MUS;
- Introduction of or contribution to the substantial spread of an invasive species

Based on current observations, Guam-based management unit (MSA MUS) species would not occur in the proposed action area during the project. Therefore, the proposed alternatives do not have the potential to cause substantial adverse effects on EFH. Effects on the resource will be less than significant with implementation of BMPs in Attachment 8. The detailed EFH assessment can be found as Attachment 3d in Appendix A-3. USACE submitted a revised EFH Assessment to NMFS on April 24, 2024

4.2.5 Special Aquatic Sites

The only Special Aquatic Sites present in East Hagatna Bay are Coral Reefs, which occur 100 yards away from the proposed action area. However, no corals or hardbottom habitats exist within the Proposed action area, therefore E.O. 13089 Coral Reef Protection is not applicable to the project.

4.2.5.1 Alternative 1 No Action

The No Action Alternative would result in increased sediment and pollution load in the Bay due to collapse of the seawall and erosion of the surrounding land contributing material to the bay. Depending on the volume, duration, and composition of terrigenous and anthropogenic pollutants into the bay, water quality may be degraded and adversely impact distant corals over time. For these reasons, USACE has determined the No Action alternative would cause less than significant impacts to coral reefs.

4.2.5.2 Alternatives 2 -4

The Revetment, Precast Concrete Seawall, and Concrete Rubble Masonry Wall all have the same temporary less than significant effects on the habitat quality of the bay due to construction within the intertidal zone at low tide during daylight hours, which would be mitigated with BMPs as detailed in Attachment 8 of Appendix A-3. Construction of each of these alternatives would occur at low tide from land and not require in water work. Construction activities will occur at a far enough distance from known coral reefs that no direct impacts are anticipated. As detailed in Attachment 8 of Appendix A-3, industry-standard BMPs will be employed to curtail spread of construction-generated turbidity that could degrade water quality and indirectly impact distant coral reefs. Such impacts would be avoided and minimized to the greatest extent practicable and would occur only during the duration of in-water construction. Because of the spatial distance preventing direct impacts and the implementation of BMPs to minimize degradation of water quality and the discrete, temporary in-water construction period, USACE anticipates less than significant impacts to coral reefs.

4.3 Built Environment

4.3.1 Navigation

Under the Rivers and Harbors Act of 1899, Section 10 (33 USC §403 et seq.) the proposed work would not affect navigable waters of the U.S. The proposed action will be subjected to the public notice and other evaluations normally conducted for activities subject to the Act. The proposed work will not obstruct navigable waters of the U.S. The Project complies with the Act.

4.3.2 Land Use, Utilities, and Public Infrastructure

The principles of the Federal Water Project Recreation Act (16 USC §460I-12 et. seq.) require USACE to give full consideration to any opportunity for the Project to add or improve outdoor recreation and/or fish and wildlife enhancement. The Preferred Alternative does not have any anticipated long-term impacts to recreation; therefore, the project complies with this Act.

Effects on land use, utilities and public services were considered to be significant if implementation of an alternative plan would result in any of the following:

- Substantial interference with, or increase in the response time of police, fire, or emergency medical services
- Permanently disrupt or decrease in the level of service for any public utility
- Significant burden to any public service or utility, including the water, wastewater, or storm water drainage system

Congress enacted the Coastal Zone Management Act (CZMA) of 1972 (16 USC § 1451 et seq.) to protect the coastal environment from growing demands associated with residential, recreational, commercial, and industrial uses (such as state and federal offshore oil and gas development). Coastal states with an approved Coastal Zone Management Plan, which defines permissible land and water use within a state or territory's coastal zone, can review federal actions (such as deployment/construction and operation of a proposed project action) for federal consistency. Federal consistency is the requirement that a proposed action likely to affect any land/water use or natural resources of the coastal zone be consistent with the enforceable policies of a state or territory's program.

In Guam, federal consistency determinations under the Coastal Zone Management Act (CZMA) are administered by the GBSP through the Guam Coastal Management Program (GCMP). The GCMP was approved in 1979. A Federal Consistency Determination (FCD) evaluation is included as Attachment 5 in this Appendix. Pursuant to the CZMA, an FCD for the 2100 ft revetment was submitted to GBSP on 13 July 2023. Guam BSP conditionally concurred with USACE determination on 8 September 2023. The conditional BMPs were incorporated into the Environmental Commitments and will be included in construction plans and specifications (Appendix A-3, Attachment 8). USACE determined that the current Recommended Plan is consistent with the GCMP, submitted a revised FCD to GBSP on 12 September 2024, and anticipates receiving concurrence. The project will comply with this Act.

4.3.2.1 Alternative 1 No Action

The No Action Alternative would result in collapse of the seawall, erosion of the surrounding land, and loss of the current land use and existing utilities and other public infrastructure. In 1993 USACE calculated the damage to utilities by storm event:

Table 17: Utility Damage by Storm Event (USACE 1993)

Utility	15-year storm	25-year storm	50-year storm	100-year storm
Sanitary sewer	280 feet of sewer line and 1 manhole	420 feet of sewer line and 1 manhole	805 feet of sewer line and 2 manholes	945 feet of sewer line and 3 manholes
Underground power conduit	16 feet	24 feet	46 feet	54 feet

For these reasons, USACE has determined the No Action Alternative would cause significant impacts to land use, public infrastructure, and utilities.

4.3.2.2 Alternatives 2-4

Alternatives 2-4 would result in temporary less than significant impacts to land use during construction. The long-term effect of the alternatives is the protection of the park and recreational land use, public infrastructure and utilities, which supports Hagatna Master Plan Goal PB-4 to have safe and secure public facilities (HRRRA 2021).

Effects will be temporary, based on inaccessibility of the site during construction. Construction will be phased to allow public access to as much of the proposed action area as possible throughout construction. For these reasons, USACE has determined Alternatives 2-4 would cause less than significant impacts to land use, public infrastructure and utilities.

4.3.3 Traffic and Circulation

Effects on traffic and circulation were considered to be significant if implementation of an alternative plan would result in any of the following:

- Substantial increase in vehicle travel times due to increased congestion, delays in traffic movement and circulation, and/or reduced roadway capacity
- Substantial reduction in availability, quality and/or safety of roadways or other transportation resources (e.g., sidewalks, bicycle lanes, etc.)
- Substantial decrease in access to businesses, residences, or public facilities; or
- Substantial displacement of parking and/or other significant changes in parking supply

Because there were no significant potential effects to traffic or circulation identified that could result from implementation of any of the action alternatives, no compensatory mitigation is required.

4.3.3.1 Alternative 1: No Action

Under Alternative 1, no federal actions for emergency shoreline protection would be implemented. It is expected that the FWOP conditions would be relatively commensurate with existing conditions in terms of traffic and circulation. Under the FWOP condition, the infrastructure would remain vulnerable to coastal erosion, exacerbated by changes in temperature, precipitation, and sea level, which could cause more frequent closures of South Marine Corps Drive for repairs and maintenance of the roadway and other infrastructure impacted by the effects of more frequent flooding and storms.

In 1990 USACE calculated the average daily vehicle count along this stretch of South Marine Corps Drive is 54,828. If this highway is closed, traffic must detour around the Naval Air Station and commercial airport. It is estimated that of the total traffic along this corridor that half comes from (goes to) the Tamuning area immediately to the east of this coastal area, and half comes from (goes to) the northeastern end of the island. For the Tamuning traffic, the detour will be 8.9 miles while the rest of the traffic will need to detour only 2.0 miles. This is because the Tamuning traffic has to backtrack on Marine Drive to get around the airfield while the other traffic merely jogs slightly to the east to clear the airfield (USACE 1990). For these reasons, USACE has determined the No Action Alternative would cause significant impacts to traffic and circulation.

4.3.3.2 Alternatives 2-4

Construction of Alternatives 2-4 would use the same parking lot construction staging area (COSA; yellow polygon on Figures 13, 16, and 18) and while temporary loss of some parking would occur during construction, the alternatives are not expected to significantly increase travel times or affect other transportation resources. Construction would require the delivery of construction equipment and materials, as well as the transportation of construction workers to the project location; however, these impacts would be limited to construction, such that they would be temporary in nature. In addition, the contractor would be required to coordinate with the relevant agencies to limit any impacts to traffic along South Marine Corps Drive. With this coordination, it is anticipated that impacts to traffic and transportation resources would be reduced to a less-than-significant level. Once constructed, the structure would not permanently displace any transportation facilities, including roadways, bicycle lanes, pedestrian pathways and/or parking. The project would function to substantially reduce the extent of coastal erosion and would effectively protect South Marine Corps Drive. By decreasing the potential for loss of this roadway, the project would provide important benefits, including more reliable access during storm conditions.

During non-storm conditions, OMRR&R of the proposed structure would require the use of trucks and other vehicles (e.g., to remove and dispose of debris, etc.). It is expected to be similar to traffic levels associated with similar types of maintenance operations for other projects at the park. Access to the site is along an existing roadway, so long-term effects would be minimal. In addition, only a minimal number of vehicles would be required, and activities would occur on a periodic basis, such that traffic and transportation resources are not expected to be significantly affected on a long-term

basis. With appropriate coordination, effects to traffic and circulation expected under these Alternatives would be less than significant.

4.4 Socio-Economic Environment

4.4.1 Socio-Economic Conditions

Effects related to socioeconomics were significant if implementation of an alternative plan would result in any of the following:

- Inducement of substantial population growth (either directly or indirectly)
- Displacement of substantial numbers of existing people or housing
- Substantial reduction of employment opportunities or income levels in the area
- Significantly affect the social connectedness of the community.

4.4.1.1 Alternative 1 No Action

The No Action Alternative would result in impacts to socioeconomic conditions from the loss of land, infrastructure, and potentially the road. For these reasons, USACE has determined the No Action Alternative would cause significant impacts to socio-economic conditions.

4.4.1.2 Alternatives 2-4

Alternatives 2-4 would result in short term positive impacts to the socio-economic conditions with employment for construction and purchase of local supplies and services.

Effects are positive for the resource; therefore, no environmental commitments are required. For these reasons, USACE has determined Alternatives 2-4 would cause beneficial impacts to socio-economic conditions.

4.4.2 Cultural Traditions and Subsistence Activities

Effects on cultural and subsistence activities were considered significant if implementation of an alternative plan would result in any of the following:

- Substantial disruption of activities that occur at an institutionally recognized facility; or
- Substantial reduction in availability of and access to designated communal or open space areas.

4.4.2.1 Alternative 1 No Action

The No Action Alternative would result in collapse of the seawall, erosion of the surrounding land, and potential loss of public access for traditional fishing practices. For these reasons, USACE has determined the No Action Alternative would cause significant impacts to other cultural resources and subsistence activities.

4.4.2.2 Alternatives 2–4

Alternatives 2–4 would temporarily impact access to the water for traditional fishing while construction was active. All three alternatives include the current public access via steps to the beach. The Revetment would replace 1.1 acres of existing sandy rocky shoreline with coarser rock and create a 1.5H/1V slope which is walkable for water access and would have the positive effect of protecting the shoreline and maintain a wadable depth. The Precast Concrete Seawall has the same permanent footprint as the existing seawall and would not change the slope, width, or depth of the beach. While the upland would be protected, the beach in front of the wall could still erode, which may adversely impact subsistence activities from the shore. The CRM seawall would replace 0.34 acres of the existing sandy rocky shoreline with and would have the positive effect of protecting the shoreline. While the upland would be protected, the beach in front of the wall could still erode, which may adversely impact subsistence activities from the shore.

While East Hagatna Bay meets the definition of a navigable water of the U.S. and the Rivers and Harbors Act of 1899, Section 10 does apply, none of the proposed alternatives would obstruct navigation within East Hagatna Bay.

The proposed action area is absent of Tribal Trust Resources as there are no federally recognized tribes in Guam. Accordingly, the resource is unaffected by the action, therefore no environmental commitments are required. Effects will be temporary, based on inaccessibility of the site during construction. Construction will be phased to allow public access to as much of the proposed action area as possible throughout construction.

For these reasons, USACE has determined Alternatives 2-4 would cause less than significant impacts to other cultural resources and subsistence activities.

4.4.3 Aesthetics

Effects on aesthetics and visual resources were considered significant if implementation of an alternative plan would result in any of the following:

- Development that substantially conflicts with the surrounding landscape (i.e., a form, line, color, or texture that contrasts with the visual setting);
- Obstruction of established viewshed, significant view corridor, or other public views of important environmental resources and/or landscapes; or
- Substantial reduction of the views or aesthetic values associated with a historic property, scenic byway, or other important landmark

4.4.3.1 Alternative 1 No Action

The No Action Alternative would result in collapse of the seawall, erosion of the surrounding land, and potential loss of public access for appreciating the visual aesthetics of East Hagatna Bay. For these reasons, USACE has determined the No Action Alternative would cause significant impacts to aesthetics.

4.4.3.2 Alternatives 2–4

Alternatives 2–4 would add approximately 0.5 ft of height above the existing wall and would be graded to ground height on the park side of the wall, which would not affect views from South Marine Corps Drive or the beach parks. The crest elevation of structural improvements would not obstruct the panoramic view of the bay, though the water at the immediate foot of the structure would not be visible. Looking toward the shore from Hagatna bay, the appearance of the shoreline protection structure would change in appearance of the wall and less of the road and park infrastructure along it would be visible. The Revetment would add 17 horizontal ft of rock similar in appearance to the rock already present in the seawall along the shoreline, blending with the current aesthetics. The Precast Concrete Seawall would take the place of the existing seawall face and include architectural treatment of the exposed faces to match the natural stone color and texture. The CRM seawall would resemble the current seawall.

In the long-term aesthetics would benefit from the structures because the park and its infrastructure will be preserved and not collapse into a mound of rubble in the water with the road slowly eroding. For these reasons, USACE has determined Alternative 2 would cause minimal impacts to aesthetics and Alternatives 3 and 4 would have no impact on current aesthetics.

4.5 Cultural Resources

4.5.1 Historical and Archaeological Resources

The goal of the National Historic Preservation Act (NHPA) of 1966 (54 USC § 306101), as amended is to empower federal agencies to act as responsible stewards of cultural resources when agency actions affect historic properties. The NHPA established the Advisory Council on Historic Preservation, an independent federal agency that promotes the preservation, enhancement, and productive use of our nation's historic resources, and advises the President and Congress on national historic preservation policy. The NHPA also authorizes the Secretary of the Interior to expand and maintain a National Register of Historic Places composed of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture.

Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. In carrying out their responsibilities under Section 106, the NHPA requires that federal agencies consult with Federally-Recognized Tribes and Native Hawaiian Organizations that attach traditional religious and/or cultural significance to eligible or listed historic properties that could potentially be affected by the agency's actions. The intent of the consultation is to identify historic properties potentially affected by the undertaking and to seek ways to avoid, minimize, or mitigate any adverse effects on those properties.

The NHPA details a four-step process for Section 106 consultation that requires each federal agency to: 1) initiate a review process to evaluate the potential of a proposed

federal undertaking to cause an effect; 2) identify historic properties with the federal undertaking's Area of Potential Effect (APE); 3) assess whether the undertaking will have an adverse effect on historic properties that are within the APE, and 4) if avoidance or minimization of an adverse effect is not possible, work with consulting parties to identify mitigation that will resolve the adverse effect.

Pursuant to Section 106 of the NHPA, USACE notified the Guam State Historic Preservation Officer (GSHPO), the Guam Preservation Trust, and the Guam Department of Chamorro Affairs of this undertaking on February 25, 2022. In consultation with these consulting parties, USACE has determined the proposed undertaking's APE, reviewed existing information on cultural resources and historic properties within and in the general vicinity of the APE, and made a reasonable and good faith effort to identify historic properties in the APE. On March 29, 2024, in accordance with 36 CFR § 800.4(d)(1), USACE determined that the recommended plan (Alternative 3) will result in no historic properties affected conditional on an archaeologist who meets the *Secretary of the Interior's Historic Preservation Professional Qualification Standards* (SOI-qualified; 36 CFR § 61; 62 FR 33708) monitoring all ground-disturbing construction activities within the APE. The GSHPO concurred with this determination on April 17, 2024.

4.5.1.1 Alternative 1 No Action

The No Action Alternative would result in collapse of the seawall and erosion of the surrounding land. USACE has determined the No Action Alternative would not impact any known historical and archaeological resources.

4.5.1.2 Alternatives 2–4

In accordance with 36 CFR § 800.4(a)(1), USACE has determined that the APE is similar for Alternatives 2–4 (Figure 20). A review of published literature, grey literature, historical aerial imagery, and other documentation provided to USACE by the Guam Historic Resources Division in response to Requests for Assistance identified 14 known cultural resources in the general vicinity of the APE. No known historic properties have formally been reported within the APE at this time. In January 2022, a SOI-qualified USACE archaeologist conducted a non-invasive pedestrian survey of the APE; no cultural resources were identified.



Figure 20. Area of potential effect (yellow polygon) and approximate locations of known cultural resources (red points and red polygon)

Although the pedestrian survey and review of available published and grey literature did not identify any known cultural resources within the APE, personal communications with the former Guam State Archaeologist, Mr. John Mark Joseph, have indicated the existence of cultural resources near the APE that will be described in forthcoming reports. There are no records that the Government of Guam uncovered any subsurface cultural materials during construction of the existing seawall during the 1990s.

However, to minimize or mitigate any impacts associated with unexpected post-review discoveries of human burials or subsurface archaeological features that may be eligible for listing in the National Register of Historic Places, USACE will provide for an SOI-qualified archaeological monitor to be present during all ground-disturbing construction activities within the APE. The Archaeological Monitoring Plan will include an appropriate and respectful Human Remains Recovery Plan that meets the requirements of Guam Territorial Executive Order No. 89-24 and adheres to the Guam Department of Parks and Recreation's 2010 Section IV Reburial Guidelines Amendments. Archaeological monitoring during construction will ensure less than significant impacts to any discovered historical and archaeological resources.

4.6 Mitigation

NEPA describes 5 types of mitigation: avoidance, minimization, rectification, reduction, and compensation. USACE has determined that compensatory mitigation is not necessary for the preferred alternative since significant impacts will be avoided through other types of mitigation as described in Appendix A-3, Attachment 8, primarily avoidance, minimization, rectification, and reduction. The majority of the BMPs detailed in Attachment 8 are avoidance and minimization measures. Rectification will include

backfilling and replanting with native trees and with grass. Reduction will be relocating any endangered tree snails if found during surveys between Design and Construction.

4.7 Reasonable and Foreseeable Impacts

Cumulative effects are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The potential for cumulative impacts to the environment from the proposed action was evaluated by reviewing other projects and activities in the vicinity of the East Hagatna seawall that could directly or secondarily affect the same environmental resources as the proposed action. The analysis generally includes actions that were recently completed, are currently underway, or are programmed to occur in the foreseeable future, and are directly related to coastal shoreline protection, are located within or proximate to the proposed measure sites and/or would directly or secondarily affect resources in East Hagatna Bay. Based on a review of the related actions, this analysis incorporates the following past projects and activities:

4.7.1 Agana (Hagatna) River Flood Control Project.

This project was terminated in 2022 and will not contribute net effects.

4.7.2 Agana Small Boat Harbor (SBH) OMRR&R breakwater repair

The Harbor was last surveyed in 2017, at which time barely 1200 cubic yards of material had accumulated in shoals that were not endangering the safety of navigation. There is insufficient material to require dredging. Current plans are for maintenance repairs of the breakwater and revetted mole structures with minimal temporary impacts to water due to placement of stones just below the water line.

Construction is planned for later in calendar year 2024. This repair of existing structures does not increase the area of hardened shoreline and therefore contributes no net effects.

4.7.3 Agat SBH OMRR&R Dredging

This project may include beneficial reuse such as beach replenishment at Agat Mayor’s Complex or Nimitz Beach. The 2021 survey found 8000 cubic yards are shoaling up in areas that are more impactful to safe navigation than the shoaling areas at Agana. The material is predominantly sand and would benefit the island, which is losing sand.

This project is currently in Design. Construction is anticipated in 2025. This project may result in beneficial reuse of the dredge material and ecosystem restoration, a net beneficial impact.

4.7.4 Agat Mayor's Complex CAP 14 Emergency Shoreline Protection Feasibility Study

The proposed action area is located on the west central coast of Guam in the village of Agat and is authorized by Section 14 of the Flood Control Act of 1946, as amended. This authority allows for the planning and construction of emergency stream bank and shoreline protection projects for public facilities in imminent danger of failing. The Non-Federal Sponsor is the Government of Guam.

USACE is investigating alternatives to protect the municipal government headquarters of Agat which is under threat of coastal erosion. This collection of buildings located along approximately 450 feet of shoreline includes the mayor's office, emergency shelter and evacuation facility, post office, and community gathering space. A Feasibility Cost Share Agreement (FCSA) was executed in February 2023. This project is in the scoping phase; however structural options are similar to those of the East Hagatna study and include the non-structural measure of beach replenishment from Agat SBH OMRR&R.

Construction is anticipated in 2027. This project replaces existing shoreline protections, does not increase the area of hardened shoreline, and therefore has no net effect.

4.7.5 Merizo Flood Risk Management CAP Section 205 Feasibility Study

The proposed action area is located on the southern coast of Guam in the village of Merizo and is authorized by Section 205 of the Flood Control Act of 1948, as amended. This authority allows for study, design, and construction of small flood risk management projects in partnership with non-federal government agencies. The Non-Federal Sponsor is the Government of Guam.

USACE is investigating alternatives to reduce flood risk in the area caused by the Nelansa (Manell) and Guess Rivers. A Federal Cost Share Agreement (FCSA) was executed in May 2023.

The effects of these actions were considered in combination with the degree and timing of the potential adverse and beneficial effects of the proposed alternatives to determine the types and significance of potential cumulative effects on ESA listed species. For this analysis, implementation of the project is considered cumulatively significant if, in concert with other past, present, or reasonably foreseeable future actions, it would exacerbate the declining status of an identified resource (a resource that is already adversely affected) or create a condition in which an effect is initially minor but is part of an irreversible declining trend.

Construction is anticipated in 2028. This project should provide ecosystem restoration benefits in reduction of flood derived sediment to the bay, decreased flood derived erosion in the water shed, and increased retention of water within the watershed. There should be no net negative effect from this project.

In conclusion, cumulative effects are not expected from planned USACE projects.

5 PLAN COMPARISON AND SELECTION

5.1 Plan Evaluation

5.1.1 Federal Objective

In accordance with EP 1105-2-58, “*Continuing Authorities Program*,” plan formulation and evaluation for CAP Section 14 projects focuses on the least cost alternative. The least cost alternative is considered justified if the total costs of the alternative is less than the costs to relocate the threatened facility.

5.1.2 Contribution to Objectives and Avoidance of Constraints

This section evaluates the alternatives considering the study’s objectives (to reduce erosion risks to critical infrastructure in the proposed action area). The following conclusions were drawn from the hydrology and hydraulics analyses and a limited economic analysis:

- All alternatives carried forward to the final array are effective in protecting South Marine Corps Drive from erosion due to storm surge and big wave events, compared to FWOP conditions in Alternative 1: No Action.
- All alternatives conform with USACE requirements for consideration of sea level change over the 50-year period of analysis and are adaptable to 100-year sea level change.
- All alternatives carried forward to the final array have estimated total first costs that are less than the estimated cost of relocating South Marine Corps Drive. The cost of relocating South Marine Corps Drive, without accounting for real estate acquisitions, is estimated at \$13.2 million per mile for a 5-mile length of road, a total cost of \$67.8 million, as described in Section 3.2.2.

5.1.3 PR&G Criteria – Completeness, Effectiveness, Efficiency, and Acceptability

Completeness, effectiveness, efficiency, and acceptability are the four evaluation criteria specified in the PR&G in the evaluation and screening of alternative plans (USACE ER 1105-2-100). Alternatives considered in any planning study should meet minimum subjective standards of these criteria to qualify for further consideration and comparison with other plans.

Completeness is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. It does not necessarily mean that alternative actions need to be large in scope or scale.

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.

Efficiency is the extent to which an alternative plan is a cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the nation’s environment.

Acceptability is the viability and appropriateness of an alternative from the perspective of the Nation’s general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.

Table 18: PR&G Criteria Evaluation of Alternatives

Alternative	Completeness	Effectiveness	Efficiency	Acceptability
Alternative 1: No Action	Low	Low	Low	Low
Alternative 2: Revetment	High	High	Med	Low
Alternative 3: Precast Concrete Seawall	High	High	High	High
Alternative 4: Concrete Rubble Masonry (CRM) Wall	High	High	Med	High

Completeness. The No Action alternative has a low rating on completeness, as another project would be required to meet the study objective of providing coastal erosion protection. The three structural alternatives are complete and do not require additional investments or actions to meet the study objectives.

Effectiveness. The No Action alternative rates low on effectiveness since it provides no protection from shoreline erosion. All three structural alternatives are highly effective in protecting South Marine Corps Drive against coastal erosion risks.

Efficiency. The No Action alternative rates low on efficiency because although the alternative would not require immediate funds, it has zero effectiveness in alleviating the specified problems and realizing the specified opportunities. The revetment and CRM seawall have higher costs than the precast concrete seawall, giving these two shoreline protection alternatives a medium rating in efficiency.

Acceptability. The No Action alternative rates low on acceptability as the local government needs immediate assistance of protecting South Marine Corps Drive, which is considered critical to the local economy as well as to national security. The Revetment alternative is rated low because the relatively wide footprint is likely to reduce the amount available beach for recreational use by locals. The Precast Concrete Seawall and CRM Seawall alternatives are rated high in acceptability as they most closely resemble the existing seawall in terms of aesthetics and general footprint.

5.2 Plan Comparison

The following sections summarize the fifth step in the six-step planning process: comparison of alternative plans. The initial array of alternatives described in Section 3.3 were either screened out or carried forward to the final array of alternatives (Section 3.4). For CAP Section 14 feasibility studies, the TSP is the least cost alternative that is environmentally acceptable, technically feasible, and meets study objectives. In this section, the final array of alternatives will be compared against each other for environmental considerations and cost of implementation.

An evaluation of potential environmental impacts by resource category for each of the alternatives in the final array is included in Section 4. For all resource categories, the effect determination for the final array of proposed alternatives falls under one of the following: (1) Beneficial; (2) No Effect; (3) Less than Significant; or (4) Significant. Table

18 provides an assessment of environmental acceptability for each proposed alternative included in the final array.

Table 19: Assessment of Environmental Acceptability

Alternative	Significantly Affected Resources	Environmentally Acceptable?
Alternative 1: No Action	Geology, Hydrology, Water Quality, Fish and Wildlife Habitat, Threatened and Endangered Species, Special aquatic sites, Invasive species, Land use, Public infrastructure, Socio-economics, Historical and archaeological resources, Other cultural resources, Aesthetics	No
Alternative 2: Revetment	None	Yes
Alternative 3: Precast Concrete Seawall	None	Yes
Alternative 4: Concrete Rubble Masonry (CRM) Wall	None	Yes

Alternative 1 is expected to cause significant impacts to the resources listed above. Accordingly, USACE has determined Alternative 1 is not environmentally acceptable. Alternatives 2-4 which propose both measures for shoreline protection and implementation of standard BMPs listed in Attachment 8 of Appendix A-3 that would avoid or minimize environmental effects would result in less than significant or beneficial impacts to the resources considered under Section 4.0. Accordingly, USACE has determined that Alternatives 2, 3 and 4 are all environmentally acceptable. Additionally, Alternative 3 is the least environmentally damaging practicable alternative (LEDPA, CWA Section 404; see Table 14, Section 4).

5.3 Identification of the Least Cost Alternative

Under the CAP Section 14 authority, the least cost, environmentally acceptable alternative that meets study objectives is selected as the TSP. The cost to protect must be less than the cost to relocate the threatened facility. Table 20 compares the estimated Project First Costs at FY25 price levels for each of the final array of alternatives.

Table 20: Project First Costs of Each of the Alternative Plans

Alternative	Project First Cost (FY25 Price Level, \$1000's)	Cost Ranking (Ascending)
Road Relocation	\$67,891	N/A
Alt. 1 No Action	\$0	N/A
Alt. 2 Revetment	\$21,539	3
Alt. 3 Precast Concrete Seawall	\$16,200	1
Alt. 4 Concrete Rubble Masonry (CRM) Seawall	\$20,624	2

The No Action Alternative has the lowest cost estimate of \$0, but since this alternative does not provide any protection to South Marine Corps Drive, it does not meet the study objectives. Alternative 2 has the highest estimated construction costs of the three structural alternatives with estimated costs of \$21.54 million. Alternative 3 is the least-

cost alternative with estimated costs of \$16.20 million. Alternative 4 is the second-lowest cost alternative with estimated costs of \$20.62 million.

5.4 Plan Selection

Based on the environmental and economic assessment of the final array of alternatives, Alternative 3 is selected as the TSP. Alternative 3 was assessed as environmentally acceptable (Table 19) and least environmentally damaging practicable alternative (LEDPA) and is the least cost alternative (Table 20) that meets study objectives. Alternative 3 is more cost effective than relocating South Marine Corps Drive.

6 THE TENTATIVELY SELECTED PLAN

6.1 Plan Components

The selected plan includes the following components:

- Demolition of approximately 1,630 linear ft of existing seawall
- Excavation of soils to the limestone shelf
- Placement of cantilever concrete panels to form a seawall to replace failing sections of the existing seawall
- Regrading excavated areas to the elevation of the existing ground surface
- The precast concrete seawall consists of the following components:
 - Precast concrete cantilever wall panels
 - Splash apron composed of formed concrete over gravel fill
 - Concrete stairs to allow for beach access

6.2 Plan Accomplishments

The construction of a precast concrete seawall to replace critically damaged sections of the existing seawall will protect South Marine Corps Drive and associated public utilities from continued and imminent damage due to coastal erosion. The continued viability of South Marine Corps Drive as a major thoroughfare on the western coast of Guam will facilitate continued commercial activity and the provision of public and emergency services and allow the US military to maintain strategic readiness. At the FY25 discount rate of 3%, the total construction first cost of the TSP is approximately \$16.2 million dollars. The TSP accomplishes the project objectives while meeting USACE engineering standards.

6.3 Cost Estimate

The total project first cost of the TSP (Alternative 3) is \$16.2 million. In accordance with the cost share provisions of Section 14 of the Water Resources Development Act (WRDA) of 1986, as amended (33 USC 2213), the federal share of the total project first cost is estimated to be \$10.53 million, and the non-federal share is estimated to be \$5.67 million.

Table 21 provides the cost breakdown for the total project first cost. Detailed information on project costs can be found in the Cost Engineering Appendix. Note that, for the

purposes of cost estimating, cultural mitigation costs are the costs of implementing BMPs to reduce insignificant cultural resource impacts. These costs are calculated using the upland and in-water footprints for each alternative. A detailed description of how these costs were derived is included in the Cost Engineering Appendix.

Table 21: Total Project First Cost

Construction Item Cost	Project First Costs (FY25 Price Level; \$1000s)
Construction	\$10,991
LERRDs	\$200
Section 106 NHPA Mitigation	\$612
Preconstruction Engineering & Design	\$2,748
Construction Management	\$1,649
Total Project First Cost (\$1000s)	\$16,200

6.4 Lands, Easements, Rights-of-Way, Relocations, and Disposal

The estimated real estate cost associated with the Tentatively Selected Plan is approximately \$200,400 including all recommended lands, easements, rights-of-way, relocations, and disposals (LERRDs), utility and facility relocations, and administrative costs to be carried out by the NFS and Government.

Required estates for the proposed Project include flood protection levee easements totaling 0.3 acres and temporary work area easements totaling 0.95 acres for one (1) year during project construction. Further information is available in the real estate appendix of this report.

6.5 Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R):

Per EP 1105-2-58 (USACE 2019), OMRR&R is a 100% non-Federal responsibility. OMRR&R costs for the TSP are estimated at \$1.62 million (10% of project first costs), 20 years following construction.

6.6 Project Risks

The TSP, a precast concrete seawall, will provide protection to South Marine Corps Drive from imminent failure due to coastal erosion. The following high-risk items were identified during the plan formulation process:

The history of bombardment in Guam means that there is a high risk of encountering Unexploded Ordnance (UXO) in the proposed action area. Encountering UXOs could lead to project delays during construction and increased cost for monitoring and mitigation. A literature review has been conducted to find FUDS sites in the proposed action area. Further research into the likelihood of UXOs in the proposed action area will occur during preconstruction, engineering, and design (PED). The non-Federal sponsor is responsible for providing a clear and safe proposed action area.

Historic properties and human burials may be found in the project area. There is a documented history of burials in sandy beach areas in the Pacific and known historic properties and burials in the immediate vicinity of the project APE. Encountering

previously unknown archaeological or burial sites during construction could lead to project delays and increased project costs associated with cultural resources mitigation to resolve adverse effects in accordance with Section 106 of the National Historic Preservation Act (NHPA). Archaeological monitoring and cultural resources mitigation are included in the project first-cost estimate as a construction cost.

Estimated costs are subject to inflation and supply chain risks. Comprehensive documentation of cost-related risks is included in the Cost and Schedule Risk Analysis (CSRA) in Appendix 2.

Residual risk: For the high sea level rise scenario projected for 50 and 100 years into the future, and the intermediate sea level rise scenario projected for 100 years in the future under storm conditions for a 10-year wave event or greater, water elevations are expected to exceed both the ground elevation (+7 ft MSL) and the crest of the proposed precast concrete wall (the TSP) (+8.9 ft MSL). While raising the wall height could mitigate this risk, it would negatively impact the viewshed and usability of the property as a community park and main roadway.

To stabilize the backshore during high overtopping and/or inundation events, a paved promenade is included in the design. However, it is acknowledged that the project will not completely prevent inundation under future design conditions. The risk of overtopping, in terms of both frequency and magnitude, will increase with future sea level rise, as indicated by the calculated overtopping rates in the engineering appendix.

As the design of the precast concrete wall progresses into the PED phase, it must account for the anticipated future inundation and overtopping to ensure structural stability. This residual risk was determined to be acceptable for this project since the shore protection structure will provide increased stability to the eroding shoreline. To further mitigate against coastal hazard inundation, a more comprehensive study should be completed but such considerations are beyond this project's authority.

Residual Risk: Based on the project authority, i.e., emergency shoreline protection, the proposed project is appropriately limited in scope. Shoreline erosion is likely to impact unprotected shoreline areas, such as the seawall sections not being replaced. While there is currently no erosion occurring in these areas, it is reasonable to assume that erosion will occur under future conditions. Consequently, Marine Corps Drive may continue to be vulnerable to erosion, depending on the extent of the impacts.

This residual risk is considered acceptable for this project because the Recommended Plan will provide shoreline protection in the most urgent area where shoreline erosion threatens both the US Veterans of Guam Pavilions Park and Marine Corps Drive.

6.7 Cost Sharing

Projects implemented under the Section 14 authority are generally cost shared 65/35 Federal to non-Federal, or as described by the terms of the Project Partnership Agreement (PPA). Model PPAs can be found online at https://www.usace.army.mil/Missions/Civil-Works/Project-Partnership-Agreements/model_cap/. Per the terms of the PPA, the non-Federal sponsor is

responsible to contribute a minimum of 35 percent, up to a maximum of 50 percent, of construction costs.

In accordance with Section 1156 of WRDA 1986, as amended (33 USC 2310), territories such as Guam are afforded an additional reduction of both feasibility and D&I costs through a waiver that is adjusted annually based on current inflation rates. In FY21 when the FCSA was executed, the Section 1156 waiver value was \$511,000. Estimated feasibility study costs totaled \$826,000, and after application of the waiver, the remaining \$315,000 was cost shared 50/50 Federal to non-Federal. The D&I phase estimate totals \$16,200,000. The minimum 35% non-Federal cost share requirement results in a cost share, prior to any waivers, of \$10,530,000 Federal to \$5,670,000 non-Federal. Following application of the Section 1156 waiver, D&I estimates are adjusted to \$11,118,000 Federal and \$5,012,000 non-Federal.

Federal participation for projects executed under CAP Section 14 is limited to \$15 million, including federal expenditures during feasibility and design and implementation. Therefore, the non-Federal Sponsor must pay all project costs above \$15 million federal.

Table 22 summarizes the breakdown between the Federal and non-Federal cost share estimated for the Feasibility and D&I phases.

Table 22: Cost Share Breakdown

Alt 3: Precast Concrete Seawall			
	Fed	Non-Fed	Total
Feasibility Phase			
FID	\$100,000	\$0	\$100,000
Feasibility Study	\$668,500	\$157,500	\$826,000
Total Feasibility Phase	\$768,500	\$157,500	\$926,000
D&I Phase			
Construction (Incl. PED/S&A)	\$16,000,000	\$0	\$16,000,000
LERRD		\$200,000	\$200,000
	\$16,000,000	\$200,000	\$16,200,000
<i>Adjustments</i>			
5% Min Cash Contribution	(\$810,000)	\$810,000	\$0
Additional Cash Contribution	(\$4,660,000)	\$4,660,000	\$0
Total Before Waiver	\$10,530,000	\$5,670,000	\$16,200,000
	65%	35%	
Sec 1156 Waiver (FY25)	\$658,000	(\$658,000)	\$0
Total D&I Phase	\$11,188,000	\$5,012,000	\$16,200,000
Feasibility & D&I Phases			
Feasibility Phase	\$768,500	\$157,500	\$926,000
D&I Phase	\$11,188,000	\$5,012,000	\$16,200,000
Total Cost Apportionment	\$11,956,500	\$5,169,500	\$17,126,000

**Totals may not add due to rounding (nearest (\$1000))*

6.8 Design and Construction

Expected estimated construction quantities are shown in Table 23 below. Additional detailed design will be conducted during the D&I below. Additional detailed design will be conducted during the PED phase of the project and quantities are subject to change based on a refined design post-TSP.

Table 23: Estimated Quantities of the TSP

TSP Components:	Quantity	Unit
Existing CRM Wall Demo	711	CY
Construct Precast Wall	1,630	LF
Reseeding	3,555	SY
Tree Removal	20	EA
Culverts	3	EA
Concrete Stairs	3	EA

The precast concrete seawall design would involve the use of individual cantilever concrete panels to replace failing sections of the 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. This design has a top elevation of 8.9-ft above MSL, a crest width of 1-ft 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. A splash apron composed of formed concrete over a gravel fill behind the crest of the structure is included to provide scour protection and tie the structure to the existing ground. A detailed description of the alternative design can be found in Section 3.4.3.

6.8.1 Design Considerations

The lidar determined topography elevations, the Annual Exceedance Probability (AEP) curves, SLC curves, and results of the wave modeling were used to inform the crest elevations of the revetment and the other proposed structural alternatives based on computed runup and overtopping. With this information, it can be concluded that a new crest elevation of +9 ft MSL or a one-ft increase in elevation from the existing seawall elevation, is sufficient to reduce the risk of overtopping from all but the 2% AEP +2072 SLC high curve water condition.

Considering 100-yr SLR, it is expected that the low curve will still function under the current design criteria, however the intermediate and high curves will likely require additional modification of the structure height. A detailed account of engineering design considerations is included in the Engineering Appendix.

6.8.2 Construction

Construction of the precast concrete seawall would occur using conventional land-based earth moving equipment and will consist of excavating approximately two to three feet of coastal soils and placing the individual precast wall panels on the limestone shelf. The precast concrete panel units would either be cast on-site or off-site and transported to the site. Following the construction of the precast concrete panel wall, the area should be regraded to the elevation of the existing ground surface. It is anticipated that precast concrete panel wall would be installed within the same footprint of the existing wall. The final footprint would be approximately 7 feet at its widest (with 6 ft buried under ground as shown in 8). The total disturbed area is estimated at approximately 20 feet due to excavation and backfill of the existing soils. In addition to the approximately 20 feet of disturbed area, a minimal additional 30 feet will be needed landward of the disturbed area for the working platform of the construction equipment. Construction of the precast concrete seawall is expected to begin in 2026 and take approximately 12 months.

6.9 Environmental Commitments*

The environmental commitments listed in Attachment 8 of Appendix A-3 Environmental include avoidance, reduction, minimization measures, and BMPs that would be implemented during the design and construction of the Recommended Plan to ensure that potential design and construction-related effects are minimized and/or reduced to a less than significant level.

6.10 Environmental Operating Principles (EOP)

The TSP is consistent with the USACE Environmental Operating Principles (EOP) that were developed to ensure USACE's missions include totally integrated and sound environmental practices:

- Foster a culture of sustainability throughout the organization
- Proactively consider environmental consequences of all USACE activities, and act accordingly
- Create mutually supporting economic and environmental solutions
- Continue to meet corporate responsibility and accountability under the law for activities undertaken by USACE, which may impact human and natural environments
- Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities

The EOPs were considered in the following ways:

- Both environmental and economic considerations were considered in the development of the TSP. Benefits or costs were accounted for in terms of appropriate monetary and non-monetary metrics. These considerations will be carried through the

project planning, design, construction, operation, and maintenance phases of the project.

- The study team has, to the maximum extent practicable, attempted to make effective use of transparency in scoping and planning actions in order to elicit new insights from individuals and diverse stakeholder groups. The study team has coordinated with partners and stakeholders early in the process and has made a concerted effort engage the resource agencies.
- The TSP incorporates lessons learned from similar actions (e.g., other Flood Risk Management studies conducted in the region) to ensure activities avoid adverse environmental consequences.
- The study team has identified potential environmental concerns at the conceptual stage and has engaged subject matter experts within the USACE, as appropriate. Outreach to the centers of expertise was conducted (e.g., USACE nonstructural working group, Engineering with Nature). The study team also sought technical assistance from state and federal resource agencies.
- The best available science, practices, analyses, and tools are being investigated and utilized whenever possible. Data and information are being leveraged with partner agencies.
- Development of the TSP (Alternative 3) considered areas of relevant risk and plans to implement mitigation where risks exist.

6.11 Views of the Non-Federal Sponsor

Alignment for the NFS's support was coordinated with the Governor of Guam. The Government of Guam expressed support for Alternative 3 as the TSP.

7 ENVIRONMENTAL COMPLIANCE*

7.1 Environmental Compliance Table

Details of environmental compliance are given by law, regulation, or policy in Section 2 of Appendix A-3.

Table 24: Status of Environmental Compliance

Law, Regulation, Policy	Status
National Environmental Policy Act	Will Comply
Clean Air Act	Compliant
Clean Water Act	Compliant
Rivers and Harbors Act	Compliant
Marine Protection, Research, and Sanctuaries Act	Not Applicable
Migratory Bird Treaty and Conservation Acts	Compliant
Marine Mammal Protection Act	Not Applicable
Anadromous Fish Conservation Act	Not Applicable
Fish and Wildlife Coordination Act	Compliant
Endangered Species Act	Will Comply
Magnuson-Stevens Fishery Conservation and Management Act	Will Comply
Coastal Zone Management Act	Will Comply
Uniform Relocation and Real Property Acquisition Act	Not Applicable
Farmland Protection Policy Act	Not Applicable
National Historic Preservation Act	Will Comply
Federal Water Project Recreation Act	Not Applicable
Wild and Scenic River Act	Not Applicable
Estuary Protection Act	Not Applicable
Coastal Barrier Act and Coastal Barrier Improvement Act	Not Applicable
EO 13751 Invasive Species (EO 13112)	Compliant
EO 13045 Protection of Children from Environmental Health Risks	Compliant
EO 11988 Floodplain Management	Compliant
EO 11990 Protection of Wetlands	Compliant

7.2 Public Involvement

7.2.1 Scoping

PDT Members Jeff Herzog, Troy Phan, Rachel Mesko, Chris Floyd, and Kelly Eldridge visited the project Site on January 10, 2022. Mr. Phan and Ms. Eldridge visited the site again on January 12, 2022.

Scoping with federal and state agencies was performed during the two agency coordination workshops held on 8 June and 14 June 2022. Agency coordination actions are detailed in Section 7.2.1 and the Environmental Appendix.

A Public Meeting on the availability of the Draft IFREA for Public Comment was held on 8 August 2023 Chamorro Time, 7 August 2023 Hawaii Time at the Sinajana Mayor's Office. Eight (8) members of the public, DPW Director Vince Arriola, BSP Deputy Director Matt Santos, and USACE PDT members Mike Terlaje, Cindy Acpal, Nick Emilio, Catie Dillon, and Jessica Podoski participated.

7.2.2 Agency Coordination

PDT members Kelly Eldridge, Chris Floyd, and Troy Phan met with Mr. John Mark Joseph and Dr. Megan Edwards Alvarez of the Guam Historic Resources Department-SHPO to informally discuss the project area on January 11, 2022. Formal NHPA Section 106 consultation was initiated on February 25, 2022. Early coordination and pre-consultation with NMFS and USFWS on threatened, and endangered species was conducted during a series of email conversation on March 16, 2022 (HST) and April 12, 2022 (HST). Coordination workshops were held with Guam SHPO; Guam Preservation Trust; Guam Coastal Management Program; Guam BSP; Socioeconomic Planning Program, and the National Marine Fisheries Service Pacific Islands Regional Office, Intergovernmental Coordination and Conservation Branch of the Protected Resources Division on 8 June 2022 (HST) and with National Marine Fisheries Service, United States Fish and Wildlife Service, United States Environmental Protection Agency; and Guam Division of Aquatic and Wildlife Resources on June 14, 2022 (HST). The purpose of these coordination workshops was to brief coordinating agencies on the preferred alternative for the project and gather their information and concerns regarding the project for incorporation into the IFR/EA.

The entire island of Guam has been designated a “coastal zone” in the context of the CZMA and all offshore islands in their entirety, including Cocos Island, under Section 923.31(a)(7) of the 306 regulations. Most of the submerged lands surrounding Guam to the Territorial Sea limit of three miles were conveyed to Guam in 1974 under Public Law 93-435. USACE evaluated the precast concrete seawall according to the enforceable policies of the Guam Coastal Management Program to make a consistency determination as detailed below and found that the described activities have a range of coastal effects, some of which may include reasonably foreseeable effects on coastal uses or resources or direct or indirect environmental benefits.

7.2.3 List of Statement Recipients

The agencies, organizations, and persons to whom USACE provided copies of the draft report for review are:

- U.S. Fish and Wildlife Service (USFWS), Pacific Islands Fish and Wildlife Office (PIFWO)
- NOAA National Marine Fisheries Service (NMFS), Pacific Islands Regional Office (PIRO), Protected Resources Division (PRD)
- NMFS, PIRO, Habitat Conservation Division (HCD)
- U.S. Environmental Protection Agency (USEPA)
- Guam Environmental Protection Agency (GEPA)
- Guam Division of Aquatic and Wildlife Resources (GDAWR)
- Guam State Historic Preservation Office (GSHPO)
- Guam Preservation Trust (GPT)
- Guam Department of Chamorro Affairs (GDCA)
- Guam Bureau of Statistics and Plans (BSP), Guam Coastal Management Program (GCMP)

7.2.4 Public Comments Received and Responses

The public comment period for the initial release of the Draft IFR/EA ran from July 25, 2023 – August 24, 2023. Comments received during this period are summarized in Table 25.

Table 25: Public Comment Matrix- Release with Revetment TSP

Commenter	Comment(s)	Response
M. Gawel via email	(1) Proposal to construct the revetment in East Hagatna Bay and create new fastland behind the revetment for the purposes of expanding Route 1 and/or underground utilities in the area (2) Proposal to dredge the Hagatna Bay channel and use the dredge material for beach replenishment along the project area (3) Proposal to plant native mangrove along the revetment for protection from waves, improving fish habitats and promoting settlement of sand (4) Proposal to phase construction around typhoons and storm waves (5) Proposal to use the federal infrastructure funding law and the Guam Coastal Management Program be planned to supplement the ACOE funding and plan for a widened land area to support infrastructure, such as buried power, sewer, water and communications lines and recreational improvements including parking and park restroom and shower facilities at the site	(1) Constructing the revetment in the Bay and creating new fastland is beyond the budget and scope of a CAP Section 14 Project. (2) Beach fill would require periodic renourishment to be effective over the 50-year period of analysis. There is insufficient beach fill material in Guam for this to be effective. Additionally, under CAP Section 14, the Government of Guam would be 100 percent responsible for renourishment after the implementation of a beach fill. For these reasons, beach fill was screened out as a management measure for this study. There is not sufficient material in the Agana Small Boat Harbor federal channel to support beach nourishment. (3) Under CAP Section 14, the PDT is obligated to identify and select the least-cost environmentally acceptable alternative that protects public infrastructure from failure due to coastal erosion over the 50-year period of analysis. Plantings along the revetment may be added by the non-Federal Sponsor but will not be considered as part of the cost-shared CAP Section 14 project. (4) This study is solely focused on a solution that provides protection from shoreline erosion to the existing infrastructure. Planning for expansion of Marine Corps Drive using federal and local funds is beyond the scope of this CAP Section 14 Emergency Shoreline Protection project.
M. Terlaje via email	Concern for public safety with a request for inclusion of a sidewalk/walkway/bicycle lane along the shoreline protection structure with improved lighting	Pedestrian infrastructure is outside the scope of the authorization for this CAP Section 14 Emergency Shoreline Protection Project.

Due to comments received after the initial release of the draft IFR/EA in July 2023, the TSP changed from a revetment to a precast concrete seawall. As a result, a revised Draft IFR/EA will be released in August 2025. A second public meeting will be held and comments will be documented in the Final IFR/EA.

8 DISTRICT ENGINEER RECOMMENDATIONS

I have considered all significant aspects of this project, including environmental, social, and economic effects and engineering feasibility. I support Alternative 3, the TSP, for the East Hagatna Emergency Shoreline Protection Study, as generally described in this report, be approved for implementation as a federal project after approval of the final report, with such modifications thereof as in the discretion of the Commander, USACE may be advisable. The estimated total project cost of the TSP is approximately \$16,200,000. The federal portion of the estimated total project cost is approximately \$11,118,000. The non-federal sponsors' portion of the estimated total project first costs is approximately \$5,012,000. All amounts are in FY25 price levels.

Federal implementation of the project for emergency shoreline protection includes, but is not limited to, the following required items of local cooperation to be undertaken by the non-federal sponsor in accordance with applicable federal laws, regulations, and policies:

- Provide a minimum of 35%, up to a maximum of 50%, of construction costs, as further specified below:
 - Provide, during design, 35% of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project.
 - Pay, during construction, a contribution of funds equal to 5% of construction costs.
 - Provide all real property interests, including placement area improvements, and perform all relocations determined by the Federal government to be required for the project.
 - Provide, during construction, any additional contribution necessary to make its total contribution equal to at least 35% of construction costs.
- Operate, maintain, repair, rehabilitate, and replace the project or functional portion thereof at no cost to the Federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal laws and regulations and any specific directions prescribed by the Federal government.
- Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-federal sponsor owns or controls for access to the project to inspect the project, and, if necessary, to undertake work necessary to the proper functioning of the project for its authorized purpose.
- Hold and save the Federal government free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the Federal government or its contractors.
- Perform, or ensure performance of, any investigations for HTRW that are determined necessary to identify the existence and extent of any HTRW regulated under CERCLA, 42 USC 9601-9675, and any other applicable law, that may exist in, on, or under real property interests that the Federal government determines to be necessary for construction, operation, and maintenance of the project.

- Agree, as between the Federal government and the non-federal sponsor, to be solely responsible for the performance and costs of cleanup and response of any HTRW regulated under applicable law that are located in, on, or under real property interests required for construction, operation, and maintenance of the project, including the costs of any studies and investigations necessary to determine an appropriate response to the contamination, without reimbursement or credit by the Federal government;
- Agree, as between the Federal government and the non-federal sponsor, that the non-federal sponsor shall be considered the owner and operator of the project for the purpose of CERCLA liability or other applicable law, and to the maximum extent practicable shall carry out its responsibilities in a manner that will not cause HTRW liability to arise under applicable law; and
- Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended, (42 USC 4630 and 4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring real property interests necessary for construction, operation, and maintenance of the project including those necessary for relocations, and placement area improvements; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

The recommendations contained herein reflect the information available at this time and current departmental policies governing the formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national civil works construction program or the perspective of higher levels within the executive branch. Consequently, the recommendations may be modified before they are approved for implementation funding. However, prior to approval, the Government of Guam, interested Federal agencies, and other parties will be advised of any significant modifications in the recommendations and will be afforded an opportunity to comment further.

If the IFR/EA identifies no significant impacts, the District Engineer will sign a Finding of No Significant Impact (FONSI) and recommend the TSP for implementation based on economic justification and environmental acceptability. There is insufficient information at this time to make a formal recommendation.

ADRIAN BIGGERSTAFF

LTC, EN

Commanding

9 PREPARERS OF THE ENVIRONMENTAL ASSESSMENT

The team members listed below provided substantial text to the East Hagatna Emergency Shoreline Protection Study IFR/EA.

Table 26: List of IFR/EA Preparers

Name	Contribution	Affiliation
Michael Terlaje	Project Management	CEPOH-PPC
Marian Dean	Environmental Resources	CEPOH-PPC
Christopher Floyd	Environmental Resources	CEPOA-PMC-E
Tyler Teese	Cultural Resources	CEPOA-PMC-E
Nickolas Emilio	Plan Formulation	CEPOH-PPC
Phillip Ohnstad	Cost Engineering	CENWW-ECE
Catie Dillon	Coastal Engineering	CEPOH-ECT
Jessica Podoski	Coastal Engineering	CEPOH-ECT
Christopher Kelly	Real Estate	CEPOH-RE
Brendon Hayashi	Structural Engineering	CEPOH-ECE-G

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